Awareness of Risk Factors for Developing Colorectal Cancer and Effect of Intensive Individualised Dietary Counselling on Improving Nutritional Status and Quality of Life

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Dedication

This thesis is dedicated to my husband, Mohamad Rodi Ishak, my kids, Aimi Najla', Mohamad Mukhlas Danial and Mohamad Muaz Darimi, my late father, Hj Abu Zaid, my mother, Hajah Che Nah, both my sister, Zurita and Zuraida and also my late brother, Mohamad Zuhaili without those wholehearted sacrifice, unconditional love and constant prayers, this thesis would not have been possible. Thank you my loves.

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List of Abbreviations

α	Probability
$(\Delta)^2$	Difference to be detected
ADA	American Dietetic Association
ADA MNT	The American Dietetic Association Medical Nutrition Therapy
AI	Adequate Intake
AICR	Australian Institute for Cancer Research
AMDR	Acceptable Macronutrient Distribution Range
ANZCTR	The Australian New Zealand Clinical Trials Registry
APC	Adenomatous polyposis coli
ARIC	The Atherosclerosis Risk in Communities
ASPEN	The American Society for Parenteral and Enteral Nutrition
BMI	Body Mass Index
CG	Control group
CI	Confident interval
cm	centimetre
CRC	Colorectal cancer
CRP	C-reactive protein
CT	Computed Tomography
CUP	Continuous Update Project
D&L	Diet and lifestyle
DNA	deoxyribonucleic acid
DQES v2	Dietary Questionnaire for Epidemiological Studies version 2
DSM	Department of Statistics Malaysia
ECOG	Eastern Cooperative Oncology Group
EORTC	The European Organisation for Research and Treatment of Cancer
EORTC QLQ C-30	The European Organisation for Research and Treatment of

	Cancer Care Quality of Life Questionnaire Cancer-30
EORTC QLQ-CR29	The European Organisation for Research and Treatment of Cancer Care Quality of Life Questionnaire-Colorectal29
EORTC QLQ-CR38	The European Organisation for Research and Treatment of Cancer Care Quality of Life Questionnaire-Colorectal38
EPIC	The European Prospective Investigation into Cancer and Nutrition
FACT	Functional Assessment of Cancer Therapy
FAP	Familial Adenomatous Polyposis Syndrome
FFQ	Food Frequency Questionnaire
FMC	Flinders Medical Centre
FRGS	The Fundamental Research Grant Scheme
g	gram
GHS	Global health status
GLM	General Linear Model
GR	Group rehabilitation
HNPCC	Hereditary Non-Polyposis Colorectal Cancer
IBD	Inflammatory Bowel Disease
IBW	Ideal body weight
IDC	Individual dietary counselling
IG	Intervention group
IL-6	Interleukin-6
IPAQ	International Physical Activity Questionnaire
IQR	Inter-quartile range
IS	Nutritional support
ISRG	Nutritional support group rehabilitation
ITT	Intent-to-treat
Kcal	Kilocalorie
kg	Kilogram

KJ	Kilojoule
LSI	Godin's Leisure Score Index
m	metre
MET	Metabolic Equivalent
MAP	MYH-associated polyposis
Mg	milligram
MREC	The Medical Research Ethics Committee
MST	Malnutrition Screening Tool
µg	microgram
n	Sample size
NA	Non-applicable
NMRR	The National Medical Research Registry
NS	Not significant
NSAIDs	Non-steroidal anti-inflammatory drugs
NSR-2002	Nutritional Risk Screening-2002
NUTTAB95	Nutrient data Tables for use in Australia database
p	Significance
PASS	Power Analysis and Sample Size
PHC	Primary Health Centers
PSF	Portion size factors
QOL	Quality of life
r	Relationship
RCT	Randomised controlled trial
RDA	Recommended Dietary allowance
RDI	Recommended Dietary Intake
RM	Ringgit Malaysia
SAFUHREC	The Southern Adelaide Health Service/Flinders University Human Research Ethics Committee
SC	Standard care/Standard nutritional care

SCOOP	The Southern Co-Operative Program for the Prevention of Colorectal Cancer
SD	Standard deviation
SGA	Subjective Global Assessment
sig	significant
SPSS	Statistical Package for Social Sciences
T	Clinic visit and assessment session
TNF	Tumour Necrosis Factor
The scored PG-SGA	The Scored Patient-Generated Subjective Global Assessment
USA	United States of America
WCRF	The World Cancer Research Fund
WHO	World Health Organization
WHR	Waist-hip ratio
wt	Body weight
$Z\alpha$	Data for alpha
Zβ	Data for beta
β	Power

Abstract

Colorectal cancer (CRC) is a highly preventable and yet commonly occurring cancer throughout the world with the highest prevalence in developed countries, and is increasing rapidly in some developing countries such as Malaysia. Key diet and lifestyle (D&L) factors can modulate the risk of developing CRC. Obesity, abdominal fatness, high intakes of red and processed meat and smoking increase CRC risk, whereas higher physical activity (PA) participation and fibre-rich foods reduce the risk.

The aim of this thesis is to investigate the prevalence of D&L risk factors in CRC patients and those at higher risk of developing CRC.

We hypothesised that CRC patients would demonstrate better D&L behaviours and awareness of risk factors than those without CRC but identified elevated risk (inflammatory bowel disease, IBD). In our first study, CRC participants (*n* = 14) had a higher risk profile compared to IBD (*n* = 30) (e.g., 80 vs. 30% overweight/obese; 30 vs. 70% sufficiently active). Total knowledge of 15 risk factors was low (47% correct); 60% agreed they were important; and only 11% and 27% had made changes to PA and diet respectively in response to CRC risk. Those with IBD had greater awareness of the role of obesity and higher fibre diets than CRC participants and 50% of the total group (IBD and CRC) wanted more D&L information.

In a second study of 104 older participants (mean age 68 ± 11 years) presenting for bowel resection surgery (non-CRC, *n* = 23; CRC, *n* = 81) with a mean Body Mass Index (BMI) of 28.1 ± 5.4 kg/m^2, women had better dietary intakes than men but there were no consistent significant differences in dietary intakes according to BMI status or stage of cancer. Overall, 63% had high levels of PA participation but there were no consistent differences between gender, BMI status or stage of cancer.

Malnutrition is common among patients with cancer and it is also associated with negative health outcomes of the patients. Therefore, our third study involved an 8-week randomised controlled trial of intensive D&L counselling with an 8-week follow-up (Intervention group, IG, *n* = 22)

compared to usual practice (Control group, CG, *n* = 20) in CRC Malaysian participants embarking on their first chemotherapy. In this Malaysian clinic, 67% were malnourished at baseline. The IG showed significant improvements in nutritional status, quality of life, PA levels, some dietary factors and greater readiness to change than the CG. These improvements were sustained 8 weeks after the intervention.

These studies revealed that among CRC participants and those at high risk of CRC, the prevalence of D&L risk factors was high, knowledge was poor, and risk-mitigating behaviours not widely adopted. More information on D&L risk factors should be provided and tailored to different sub-groups, while intensive D&L counselling in CRC patients undergoing chemotherapy may deliver better nutritional outcomes and sustained behaviour changes.

Declaration

I certify that this thesis does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any university; and that to the best of my knowledge and belief it does not contain any material previously published or written by another person except where due reference is made in the text.

Zalina Abu Zaid

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In The Name of God; the Most Compassionate and the Most Merciful

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Conference Presentations

Conference abstracts:

1. **Abu Zaid, Z.,** Kandiah, M., Jackson, K. & Cobiac, L. (2015, May). *Nutritional status among patients with colorectal cancer*. Abstract presented at the 12th Asian Congress of Nutrition (ACN), Yokohama, Japan. (Oral presentation)

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3. **Abu Zaid, Z.,** Kandiah, M., Jackson, K. & Cobiac, L. (2014, May). *Nutritional status and quality of life among patients with colorectal cancer.* Poster session presented at the Dietitians Association of Australia 31st National Conference, Brisbane, Queensland, Australia. (Poster presentation) **Won a Highly Commended Poster**

4. **Abu Zaid, Z.,** Cobiac, L., Wilson, C., & Kandiah, M. (2013, June). *Nutritional status in patients with colorectal cancer undergoing chemotherapy*. Poster session presented at the Australia Society for Medical Research (ASMR), Adelaide, South Australia, Australia. (Poster presentation)

5. **Abu Zaid, Z.,** Cobiac, L., Wilson, C., & Kandiah, M. (2013, May). *Nutritional status and quality of life in patients with colorectal cancer undergoing chemotherapy*. Abstract presented at the 1st Higher Degree Symposium & Research Day, University of South Australia, South Australia, Australia. (Oral presentation)

6. **Abu Zaid, Z.,** Cobiac, L., Wilson, C., & Kandiah, M. (2012, July). *Intensive individualised diet counselling and lifestyle intervention improves nutritional status in patients with colorectal cancer undergoing Chemotherapy*. Abstract presented at the 2nd Malaysian Postgraduate Conference (MPC), Gold Coast, Queensland, Australia. (Oral.presentation)

Chapter 1. General Introduction

General introduction

Cancer is the leading cause of death in both developed and developing countries (Torre et al., 2015). The cancer burden is continually increasing due to population ageing and growth, and adopting cancer-associated lifestyle choices such as smoking, physically inactivity, inappropriate diets and, reproductive changes (including lower parity and later age at first birth) (Torre et al., 2015). Cancer can be prevented to a certain point by practicing existing cancer control knowledge-based advice and implementing tobacco control, vaccination (liver and cervical cancer), early detection and treatment as well as public health campaigns such as increasing physical activity level and promoting healthy dietary intake (Jemal et al., 2011).

Colorectal cancer (CRC) is the third most commonly diagnosed cancer in males and the second in females worldwide (Torre et al., 2015). Between 5 to 10% of CRC cases are a consequence of recognised hereditary conditions which includes familial adenomatous polyposis (FAP) and hereditary non-polyposis colorectal cancer (HNPCC) (Enholm et al., 2003). Another 15 to 20% of CRC cases occur in people who have a family history of CRC (H. T. Lynch & de la Chapelle, 2003). The remaining 70 to 80% of CRC can be attributed to the contribution of environmental and lifestyle factors (Franco, Sikalidis, & Solis Herruzo, 2005). Modifiable risk factors for CRC such as smoking, low physical activity levels, overweight and obesity, high intake of red and processed meat and excessive alcohol consumption can play a role in the prevention of CRC (T. Boyle, Fritschi, Platell, & Heyworth, 2013).

The influence of diet and lifestyle (D&L) factors on the risk of developing CRC has been established in epidemiologic and scientific studies (Chan et al., 2011; Magalhães, Peleteiro, & Lunet, 2012; Yusof, Isa, & Shah, 2012). Therefore, the 2011 Continuous Update Project CRC Report extended from the World Cancer Research Fund (WCRF) and the American Institute for Cancer Research provides comprehensive evidence on the link between diet- and lifestyle-related risk factors and CRC. The main (convincing level) factors identified by WCRF that increase risk of CRC are high body and abdomen fat, high intakes of red and processed meat, alcoholic drinks in men (more than about 30 gram per day ethanol) and adult attained height

while higher physical activity and foods containing fibre appear to protect against CRC. Consumption of garlic, milk, and calcium, are factors that (probably) decrease risk and higher intakes of alcoholic drinks in women (more than about 30 gram per day ethanol) probably increase risk (World Cancer Research Fund/American Institute for Cancer Research, 2011).

Therefore, by identifying and modifying these relevant factors it might be possible to prevent CRC incidence or delay the onset of the disease. Furthermore, individuals who are at higher risk of developing CRC should be the focus for education on modifiable risk factors. This may help mitigate their risk and may reduce the occurrence of CRC in higher risk groups. Studies have shown that CRC patients are highly motivated to seek information and are interested in making healthy lifestyle changes (Patterson et al., 2003; Satia et al., 2004). This desire to engage in healthy behaviours may be particularly salient if the patients are aware of the risk recurrence of the disease (N. Lewis et al., 2012). Providing access to resources and informing them in a meaningful way about the potential impact of D&L changes and increasing access to screening, may improve CRC rates in those with the highest burden. In addition, patients who proactively seek nutrition information that is tailored and relevant to them from various sources are most likely to have improved nutrition.

Relatively little is known regarding the current knowledge of, attitudes and behaviours to, dietary and lifestyle change in those at elevated risk for CRC and how this varies between sub-groups in this population. An in-depth investigation of understanding of what nutritional knowledge these high risk people do have (including their attitude and behavioural reactions towards dietary and lifestyle changes to reduce CRC) would enable healthcare providers to better define risk profiles, develop and design effective preventive strategies and target information dissemination. Therefore, on the basis on this context, we undertook two survey studies (i.e. Study 1 : Knowledge, attitudes and behaviours related to diet and lifestyle in a population at above average risk of developing CRC and CRC patients and Study 2: Prevalence of diet and lifestyle risk factors according to BMI status in the Newcastle Environmental Factors and Colon Cancer Study) to get a

better understanding of this population about their knowledge of, attitudes and behaviours to, dietary and lifestyle changes that might affect the risk of developing CRC. We looked at three different sub-groups— those with long-term inflammatory bowel disease (IBD), those with CRC/or family history of CRC on an ongoing surveillance register, and those with an initial diagnosis of CRC prior to presenting for gastrointestinal surgery. We also explored whether the risk profile differed between those with different BMI status. With these outcomes, others in the future would be able to develop preventive management strategies for CRC for this population.

Currently, cancer patients are often malnourished. Malnutrition is associated with longer hospital stays (J. Bauer, Capra, & Ferguson, 2002), reduced responses to and increased complications from therapies, increased health-care costs (Correia & Waitzberg, 2003), and thus, poorer quality of life (QOL) and lower survival rate (Paccagnella et al., 2010). Moreover, therapies used for cancer treatment may also negatively influence patients' nutritional status (Gupta, Vashi, Lammersfeld, & Braun, 2011). Hence, maintenance and improvement in nutritional status of cancer patients is important to improve the effects of anticancer therapy, sustain the ability to confront stress, and minimise the side effects of treatment (Wie et al., 2010). A good nutritional status should be maintained for patients through nutritional intervention during cancer treatment (van den Berg et al., 2010) and it is a common challenge amongst oncology patients (Heredia, Canales, Sáez, & Testillano, 2008).

Several studies have suggested that early nutrition assessment and intensive individualised nutrition intervention are beneficial to patients at risk of malnutrition and are most effective if implemented at the first onset of nutritional problems in oncology patients (N Macdonald, 2003; Ravasco, Monteiro-Grillo, Vidal, & Camilo, 2005). If performed in a timely manner, nutritional assessment and intervention can prevent malnutrition, stabilise or improve nutritional status, minimise the side effects of chemotherapy treatment, maintain good quality of life, and improve their clinical outcomes (L. Brown, Capra, & Williams, 2008; Dintinjana, Guina, Krznaric, Radic, & Dintinjana, 2008).

A randomised controlled trial (J. M. Young et al.) to compare the effects of individualised dietary counselling compared to usual nutritional care is therefore the focus of our third study as early intervention is warranted in order to combat malnutrition in patients with CRC undergoing chemotherapy. Research in this area is urgently required as very little is known about this particular group (particularly in Malaysia where CRC is increasing) and the dietary counselling and lifestyle intervention implemented in the study will also serve as a reference in designing other intervention programs for the prevention and management of cancer in all clinical settings.

To the our knowledge, this is the first intervention study using dietary counselling and lifestyle intervention in patients with CRC undergoing chemotherapy. In addition, this is one of the few studies that investigate the relationship between self-efficacy and the maintenance of dietary/lifestyle changes in patients in order to prevent cancer recurrence. Even though intensive dietary counselling has been shown to improve nutritional status and QOL in patients with cancer, there has been no research published to date (to the authors' knowledge) on the sustainability of cognitive and behavioural changes in patients with cancer following dietary counselling intervention.

Chapter 2. Background and Literature Review

2.1 Cancer

In 2012, there were over 14.1 million new cancer (of any type) cases, 8.2 million cancer deaths and 32.6 million persons living with cancer worldwide (Ferlay et al., 2015). The overall incidence rate is nearly 25% higher in males than in females, with the rates of 205 and 165 per 100,000 patients, for men and women respectively (Ferlay et al., 2013). Cancer has become one of the leading causes of death worldwide with the total number of cases increasing globally (Peter & Bernard, 2008). The number of global cancer deaths is projected to rise by a further 11.5 million in 2030 (Strong, Mathers, Epping-Jordan, Resnikoff, & Ullrich, 2008).

In Australia there were 122,000 new cases of cancer (of any type) diagnosed and 43,400 cancer deaths in 2012. The age-standardised incidence and death rates are 323 and 96.4 per 100,000 respectively (Ferlay et al., 2013). Cancer is estimated to be the leading cause of the burden of disease in Australia (Australian Institute of Health and Welfare., 2012). The number of cases of cancer diagnosed in Australia is projected to increase over the decade for both males and females and is expected to reach about 150,000 in 2020 which is an increase of almost 40% from 2007. Evidence suggests that the increase in the number of incidence rates of cancer is due primarily to the ageing and increasing population and are expected to be most evident in elderly populations (Australian Institute of Health and Welfare., 2012). More than 42,844 people died from cancer in 2011, an average of 117 deaths every day (Australian Institute of Health and Welfare & Registries., 2012). This shows cancer is a leading cause of death in Australia.

There were a total of 37,400 new cases cancer (of any type) diagnosed among Malaysians in Malaysia and 21,700 cancer deaths in 2012 (Ferlay et al., 2013). By ethnicity, cancer seems to be more predominant among Chinese (34.0 per 100,000 population), followed by Malaysians (17.7 per 100,000 population) and Indians (17.1 per 100,000 population) (Zainal & Nor Saleha, 2011). It has been estimated that 1 in 7 males and 1 in 6 females in Malaysia will develop cancer of any sort in their lifetime (GCC Lim, Rampal, & Halimah, 2008).

Cancer can affect anyone regardless of age, sex and socio-economic status (Zalilah, Nabilah, Nurfaizah, & Sarina, 2011). The five most common cancers amongst the Malaysian population are breast (18.1%), colorectal (12.3%), lung (10.2%), nasopharynx (5.2%) and cervix (4.6%). For males, the five most common cancers are lung, colorectal, nasopharynx, prostate and lymphoma, while the five most frequent cancers in females are breast, colorectal, cervix, ovary and lung (Zainal & Nor Saleha, 2011).

The global burden of cancer continues to increase largely because of the ageing and growth of the world population and also due to an increasing adoption of cancer-causing behaviours, particularly cigarette smoking, within economically developing countries (Jemal et al., 2011). Apparently, the burden of cancer could be reduced by evidence-based strategies based on three major targets, namely primary prevention, identification of people with early stage preclinical malignancy, so as to increase the opportunities to treat and prevent progression of cancer (secondary prevention), and an adequate treatment of cancer in improving survival and functionality (tertiary prevention) (van der Aalst, van Klaveren, & de Koning, 2010).

2.2 Colorectal cancer

Colorectal cancer is one of the most common forms of gastrointestinal cancer in the world (Goh et al., 2005). Colorectal cancer is considered as a disease prevalent in developed countries and it is the fastest emerging gastrointestinal cancer in the Asia-Pacific region as the socio-economic development continues to progress (Goh et al., 2005). Colorectal cancer is the third most commonly occurring cancer worldwide among men (746,000 cases, 10% of the total) and the second in females (614,000 cases, 9.2% of the total) in 2012. Nearly 55% of the cases occur in the more developed regions (Ferlay et al., 2013). Globally CRC is the fourth most common cause of death amongst all cancers (World Cancer Research Fund/American Institute for Cancer Research, 2007).

Incidence rates vary ten-fold in both sexes worldwide, the highest incidence rate is found in Australia/New Zealand, Europe and Northern

America, whereas the lowest rate is found in Africa and South-Central Asia. Rates are substantially higher in males than in females (Torre et al., 2015). Even though the highest CRC incidence rates are observed among males in Europe, North America, and Oceania, select registries in Asia including Japan, Singapore, and Israel have reported high rates as well. The increasing incidence rate may reflect an increased prevalence of risk factors for developing CRC, including unhealthy diet, obesity, and smoking (Center, Jemal, & Ward, 2009).

In 2014, there were an estimated 16,980 new cases of CRC in Australia (9,250 new cases in men and 7,730 new cases in women). An estimated 19,960 are expected to be diagnosed in 2020 (Australian Institute of Health and Welfare., 2012). Colorectal cancer is the second most common cancer diagnosed in both Australian men (after prostate cancer) and women (after breast cancer). The age-standardised incidence rate of CRC was 73.7 cases per 100,000 men, compared with 51.1 cases per 100,000 women in 2010 (Australian Institute of Health and Welfare, 2015a). The average age of CRC diagnosis in Australia is 69.3 years (Australian Institute of Health and Welfare & Registries., 2012) and the risk of developing CRC increases with age (Australian Institute of Health and Welfare, 2015a). In addition, the risk of developing CRC before the age of 85 for people in Australia was 1 in 12 in 2010 (Australian Institute of Health and Welfare, 2015a).

Colorectal cancer is the third leading cause of cancer death in men and women in Australia (Australian Institute of Health and Welfare & Registries., 2012). There were 3,999 deaths from CRC (2,219 men and 1,780 women), accounting for 9.3 per cent of all cancer deaths in 2011 (Australian Institute of Health and Welfare, 2015a, 2015b). On the other hand, the age-standardised mortality rate for CRC was higher for men in which there were 19.7 deaths per 100,000 men compared to 12.7 deaths per 100,000 women in 2011 (Australian Institute of Health and Welfare, 2015a).

In Malaysia, CRC was the second most common cancer among Malaysian males and females and after breast cancer in 2007. A total of 2,246 cases were diagnosed in 2007 and registered with the National Cancer Registry, Malaysia. The incidence rate of CRC in Malaysia has risen over the

years with the overall incidence rates of 7.8% among males and 5.6% among females in 2002, which doubled in 2007 for both males and females (Figure 2.1). Colorectal cancer is in fact the most common gastrointestinal cancer in Malaysia. The incidence of CRC has also increased with the ageing population of Malaysia (Zainal & Nor Saleha, 2011). Colorectal cancer is the third highest cause of cancer-related mortality in Malaysia.

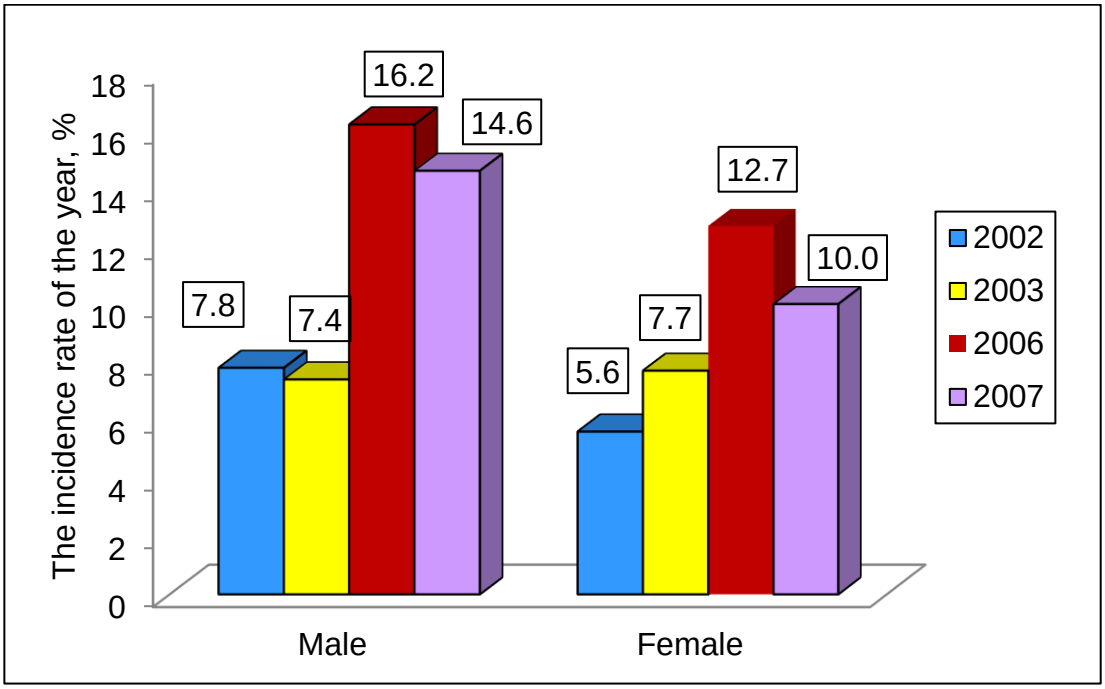

Figure 2.1. The incidence rate of colorectal cancer (CRC) in Malaysia in Year 2001, 2003, 2006, and 2007. Sources: National Cancer Registry, Malaysia (GCC. Lim & Halimah, 2004; GCC Lim et al., 2008; Zainal & Nor Saleha, 2011; Zainal, Zainudin, & Nor Saleha, 2006).

As CRC is a significant burden of disease globally, increasing in developing countries such as Malaysia, there is a need to understand to trajectory of the disease, the prevalence of risk factors and whether risk factors are modifiable or not. Details on modifiable and non-modifiable risk factors of developing CRC are reviewed in Sections 2.5 and 2.6.

2.3 Aetiology of colorectal cancer

The colon and rectum are parts of the digestive system, which is the gastrointestinal system (Figure 2.2). The first part of the digestive system is to process food for energy, including the stomach and small intestine. The colon is the large intestine, and the rectum is part of the large intestine, which is closest to the anus and absorbs fluid to form solid waste (faecal or stool).

The colon has four sections; the first is the ascending colon. It starts with a small pouch (the cecum) where the small bowel attaches to the colon and extends upward on the right side of the abdomen. Next, the transverse colon goes across the body from the right to the left side in the upper abdomen. The colon continues downward on the left side called the descending colon. The last section is known as the sigmoid colon as its 'S' or sigmoid shape. The proximal colon includes the ascending colon, the cecum and the transverse colon.

Colorectal cancer is cancer of the colon or rectum. It develops over a period of several years and nearly always develops from benign non-cancerous polyps on the inner lining of the colon or rectum (Bond, 2000). The progress of development of a small polyp on the inner lining of the bowel to development of cancer, termed 'dwell time' is extremely variable and may take from five to ten years (G. Young, Rozen, & Levin, 2002). Additionally, dwell time appears to vary with the location of the cancer. It is longer in the distal colon than in the proximal colon, and it is the shortest in the rectosigmoid segment (Rudy & Zdon, 2000).

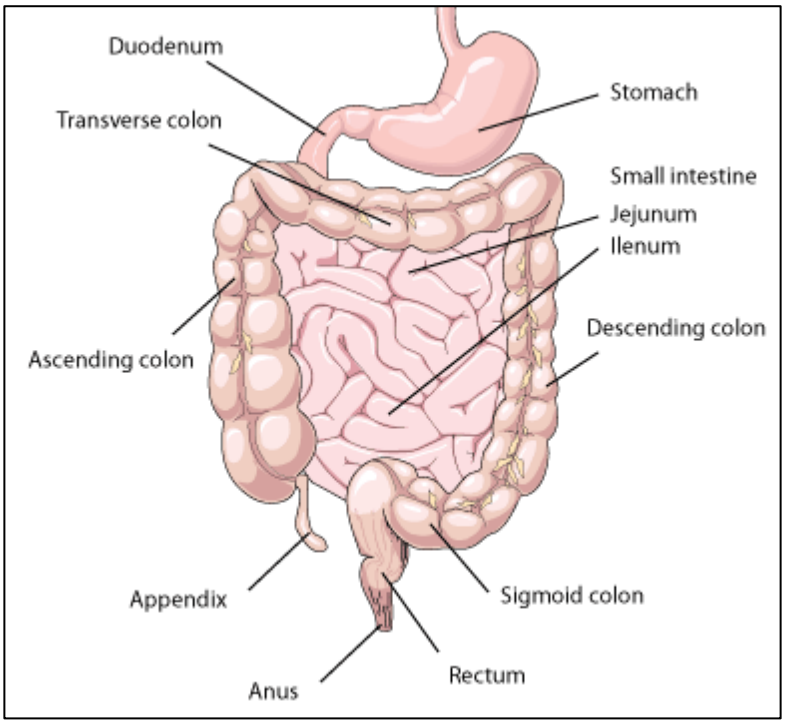

Figure 2.2. The digestive system. Sources: https://www.pinterest.com

Most CRCs develop from polyps in glandular tissue of the intestinal lining (M. R. B. Keighley, 2003). These polyps are benign growths that protrude from the inner walls of the colon and rectum and are relatively common in people over the age of 50. It is estimated that an average 60 year old without special risk factors for polyps has a 25% chance of having a polyp (Rudy & Zdon, 2000). Figure 2.3 shows the development from polyps to cancer. There are two common types of polyp: hyperplastic polyp and adenoma. The hyperplastic polyp is not at risk of developing into cancer, whereas the adenoma is known to be precancerous (Summers, 2010). The size of polyps correlates with the risk of developing cancer. Polyps which are less than 1 cm in size have a slightly greater than 1% chance of becoming cancer, but those which are 2 cm or greater have 40% chance of transforming into cancer (American Society for Gastrointestinal Endoscopy, 2006).

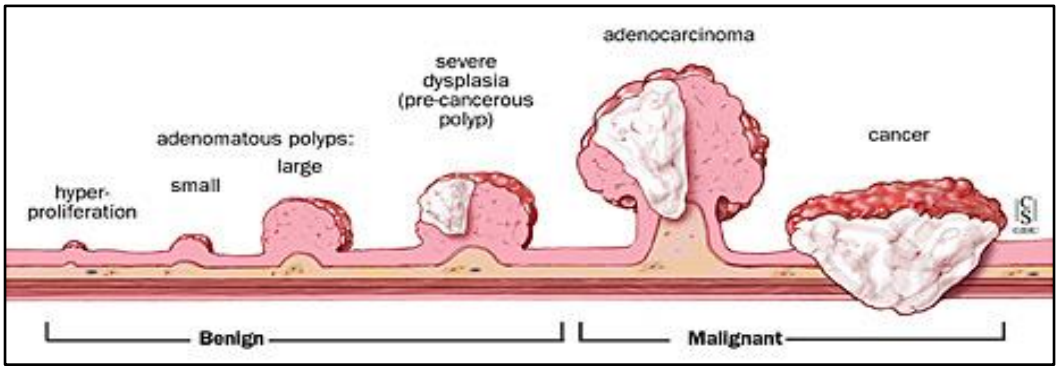

Figure 2.3. From polyps to cancer.
Source: www.hopkinscoloncancercenter.org

2.4 Risk factors of colorectal cancer

Many risk factors are associated with the development of CRC. Approximately 5% of all CRC occurrences are inherited syndromes like hereditary non-polyposis colorectal cancer (HNPCC), Lynch syndrome, familial adenomatous polyposis (FAP), and MYH-associated polyposis (MAP) (Burt, 1999; Enholm et al., 2003). In 10–15% of all CRC cases, combinations of genetic and environmental factors are the major risk factors of the disease. All remaining cases (85 to 90%) are probably mainly due to dietary and lifestyle factors (de Jong et al., 2005). Table 2.1 provides a list of risk factors for developing CRC.

Table 2.1. Risk factors that have been associated with modifying the risk of developing colorectal cancer (CRC)

Risk factors	Remarks
Age	Sharply increases the incidence of colon cancer after the age of 60
Inflammatory bowel disease (IBD)	Ulcerative colitis
	Crohn's disease
Genetics	Family history of CRC (parents, siblings, children; the younger the family member with CRC, the greater the risk of other family members to develop CRC)
	Autosomal dominant trait (familial adenomatous polyposis syndromes, FAP)
	Hereditary non-polyposis colon cancer (HNPCC)
Diet	High red and processed meat diet
	Low fibre diet
	Low intake of vegetables (including garlic) and fruits
	Low calcium and milk in diet
Lifestyle	Physical inactivity
	Tobacco used
	Alcohol consumption
	Overweight and/or obesity
	Abdominal fatness

Sources: Labianca et al. (2010); Lung, Trainer, Campbell, and Lipton (2015); McCormick, Kibbe, and Morgan (2002); Song et al. (2013); World Cancer Research Fund / American Institute for Cancer Research (2011); Young and Le Leu (2002)

2.4.1 Modifiable risk factors

Recently, the World Cancer Research Fund (WCRF) and the American Institute for Cancer Research (2011) provided an updated and comprehensive review of the evidence on the link between diet- and lifestyle-related risk factors and CRC. This was expanded from the 2007 second expert report on scientific literature on diet, physical activity and prevention of cancer (World Cancer Research Fund/American Institute for Cancer Research, 2007). The main (convincing level) factors identified by WCRF that increase the risk of CRC are high body and abdomen fat, high intakes of red

and processed meat and alcohol in men (more than about 30gram per day ethanol), while higher physical activity and foods containing fibre appear to protect against CRC. Garlic, milk, and calcium are factors that (probably) decrease the risk and alcoholic drinks in women probably increase the risk of CRC.

Of all types of cancer, CRC is considered as one of the most preventable. Up to 70% of CRC may be prevented by diet and physical activity alone (Ueland, Hornung, & Greenwald, 2006). The influence of D&L factors on the risk of developing CRC has been established in epidemiologic and scientific research (Giovannucci, 2002; Harriss et al., 2009; Huxley et al., 2009; Martínez, 2005). Studies have suggested that a "Western diet', characterised by high meat, fat and refined grains intake, is associated with a significantly increased risk of colon cancer, while a 'prudent diet', characterised by high fruit, vegetable and fish intake is non-significantly associated with a reduced risk of developing colon cancer (Fung, Hu, Fuchs, & et al., 2003; K. Wu et al., 2004). The Continuous Update Project (CUP) specifically for CRC has concluded that the evidence that foods containing high levels of folate, higher intakes of fish, and higher selenium intakes, is less consistent and was too limited to draw a conclusion that these dietary factors are linked to the risk of developing CRC (World Cancer Research Fund/American Institute for Cancer Research, 2011). In contrast, the evidence was rated as being convincing that increased consumption of foods containing dietary fibre was protective against CRC, while higher consumption of red and processed meat was deemed to increase the risk of CRC (World Cancer Research Fund/American Institute for Cancer Research, 2011).

The most important and possible risk factor of CRC and colorectal adenomas is the individual's diet (Ramadas & Kandiah, 2010). The role of diet in the aetiology of colorectal adenomas remains an area of active investigation, as the exact relationship between diet and colorectal adenomas remains unclear. Diet and lifestyle factors have been implicated in the development of the sporadic adenomatous polyps (Larsen, Grotmol, Almendingen, & Hoff, 2006; Wark et al., 2006). Results from several earlier

observational studies have suggested that three main dietary factors may or may not be protective against cancer of the large bowel, i.e. low fat intake, high fibre intake and high fruits and vegetables intake (Schatzkin et al., 2000). The role of fat as a dietary risk factor for CRC was not upheld in the more recent WCRF CUP.

A recent study showed that regular consumption of foods rich in dietary fibre could lower the risk of colon polyps and the risk could be decreased by 40% by eating brown rice at least once a week (Tárraga Lopez, Juan Solera, & Rodríguez-Montes, 2014). Substantially, eating legumes and dried fruits three or more times a week would lower the risk by 33% and 26% respectively (Tantamango, Knutsen, Beeson, Fraser, & Sabate, 2011).

A meta-analysis to understand the risk associated with body weight or obesity summarises the results of 23 cohort studies and 8 case–controlled studies on Body Mass Index (BMI) and the risk of CRC. The studies were compared amongst individuals with a BMI of > 30 kg/m^2 with those who have BMI = 20–25 kg/m^2. The results indicated that obesity has a direct and independent association with increased risk of CRC (Moghaddam, Woodward, & Huxley, 2007). The European Prospective Investigation into Cancer and Nutrition Study shows that a higher waist–hip index and waist circumference are indicators of abdominal obesity (abdominal fatness) and are associated with an increased risk of CRC in both genders (Tárraga Lopez et al., 2014). Another meta-analysis which included 41 prospective studies on BMI with a total of 85,935 cases and 13 prospective studies on waist circumference with a total of 6,546 cases showed that higher BMI and waist circumference were positively associated with CRC risk (Ma et al., 2013).

The presence of the metabolic syndrome (≥ 3 of the following components: high blood pressure, increased waist circumference, hypertriglyceridemia, low levels of high density lipoprotein cholesterol, or diabetes/hyperglycaemia) has been shown to have a modest, positive association with CRC incidence in the Atherosclerosis Risk in Communities (ARIC) cohort among men, but not among women, whereby there was a

dose-related response according to the number of components present (Robb, Miles, & Wardle, 2004). The author concluded that the metabolic syndrome might be a marker for a physiologic milieu of growth which encourages tumour initiation, promotion, and/or progression.

It has been well accepted that regular physical activity improves health and fitness. Lack of physical activity has been linked to increased risk for many health disorders. Both epidemiological investigations and prospective cohort studies have shown reduced risk of developing colon carcinoma in both men and women who engage regularly in physical activity (Harriss DJ, 2007; Inoue et al., 2008; Mai et al., 2007). In addition, physical activity has been shown consistently to reduce colon cancer incidence and mortality. Therefore, physical activity is one of the important aspects to focus on in managing cancer and preventing cancer in both a primary and secondary prevention sense.

Colorectal cancer is the most common cancer related to physical activity. A scientific report by CUP reported decreased risk of CRC with increased total physical activity (World Cancer Research Fund/American Institute for Cancer Research, 2011). A previous study showed that increased exercise has an effect on several functions of the human body that might influence cancer risk, such as immune, antioxidant defence, endogenous hormones and energy balance (Al-Otaibi, 2013; Batty & Thune, 2000). According to Haydon et al. (2006), physical activity may specifically influence CRC development through a reduction in abdominal fat mass (adiposity), which is particularly metabolically active and implicated in carcinogenesis (Haydon, MacInnis, English, & Giles, 2006). In addition, regular physical exercise has been shown to decrease the risk of CRC by 40% as reported in observational studies (IARC Working Group on the Evaluation of Cancer-Preventive Strategies, 2002).

Consumption of alcohol has been shown to have a positive association with an increased risk of CRC (Tárraga Lopez et al., 2014). A systematic review with meta-analysis was conducted to investigate the association and dose-response relationship of alcohol consumption with colorectal adenomas (Zhu et al., 2014). The study showed 17% increased

risk for colorectal adenomas in all drinkers as compared to non-drinkers or occasional alcohol drinkers. A recent systematic review concluded that moderate or heavy alcohol consumption significantly increase the risk of CRC (Y. M. Wang et al., 2015).

Early studies on smoking and CRC showed no association between them (Walter, Jansen, Hoffmeister, & Brenner, 2014). In later studies however, long term smokers have been found to have an elevated risk of CRC and consistently smoking has been positively associated with large colorectal adenomas, which are generally accepted as being precursor lesions for CRC (Haggar & Boushey, 2009). Thus exposure to tobacco constituents may be an initiating factor for colorectal carcinogenesis. An updated review is consistent with an induction period of 30 to 40 years between geno-toxic exposure and CRC diagnosis. In the United States of America (USA), it has been estimated that one in five CRCs may be potentially attributed to tobacco use (Hodge, Patterson, Brown, Ireland, & Giles, 2000).

A systematic review was conducted to determine the effect of non-steroidal anti-inflammatory drugs (NSAIDs) for the prevention or regression of colorectal adenomas and cancer (Asano & McLeod, 2004). The conclusion was that there is evidence from three randomised trials that aspirin significantly reduces the recurrences of sporadic adenomatous polyps. There was evidence from short-term trials to support regression, but not elimination or prevention, of colorectal polyps in familial adenomatous polyps (PM. Fayers et al., 2001). The active protection of NSAIDs suggests a significant inflammatory component in the progression and development of CRC.

Ulcerative colitis and Crohn's disease are forms of IBD which refers to a group of conditions characterised by inflammation in the intestinal tract (Morrison, Headon, & Gibson, 2009). Ulcerative colitis causes inflammation of the mucosa of the colon and rectum. Crohn's disease causes inflammation of the full thickness of the bowel wall and may involve any part of the digestive tract from the mouth to the anus. Polyps in IBD are usually inflammatory in nature, but adenomas may also be found. In general, patients with long-standing IBD, either ulcerative colitis or Crohn's disease

have six times greater risk of developing CRC compared to the general population (Mattar, Lough, Pishvaian, & Charabaty, 2011).

2.4.2 Non-modifiable risk factors

Risk factors of CRC for which an individual cannot control include age and hereditary factors. The likelihood of CRC diagnosis increases after the age of 40, increases progressively from age 40, and rises sharply after age 50 (World Cancer Research Fund/American Institute for Cancer Research, 2007). More than 90% of CRC cases occur in people aged 50 years or older. The incidence rate is more than 50 times higher in persons age between 60 to 79 years than in those younger than 40 years (Haggar & Boushey, 2009). However, CRC appears to be increasing among younger persons (Smith, King, Butow, & Olver, 2013).

About 20–30% of CRC diagnosis is associated with family history (Tárraga Lopez et al., 2014). It has been estimated that people who have first-degree relatives family history (one of the individual's parents, a brother, or a sister has had the disease) have 2.3 to 4.3 times higher risk of developing CRC than those without it (Butterworth, Higgins, & Pharoah, 2006; Zlot, Silvey, Newell, Coates, & Leman, 2012). The risk is greater for those with relatives who have early–onset CRC (diagnosed when young i.e. before age 50), than those with relatives diagnosed later in life (Church, 2005) and for those with more than one family member with the disease (Slattery et al., 2003). In addition, those who had personal medical history of other types of cancer, a history of colon polyps, or inflammatory diseases of the bowel (Zeller, Lynm, & Glass, 2008) have also been shown to have greater risk for CRC.

Genetic vulnerability to colon cancer has been attributed to either polyposis or non-polyposis syndromes. The main polyposis syndrome is familial adenomatous polyposis syndrome (FAP), which is associated with a mutation in the adenomatous polyposis coli (APC) gene. Non-polyposis is known as hereditary non-polyposis colorectal cancer (HNPCC) syndrome and is associated with gene mutation involved in the deoxyribonucleic acid (DNA) mismatch repair pathway (Labianca et al., 2010). These may also cause a condition known as Lynch syndrome which leads to the development

of multiple polyps (Burt, 2000) beginning early in life. Almost all persons with this syndrome will develop colon cancer by the age of 40 years (Rudy & Zdon, 2000).

Many deaths from CRC as well as other cancers can be prevented with early detection and treatment. Maintaining a healthy diet, avoiding obesity, exercising regularly, and lowering the amount of alcohol consumed and cigarette use can help to decrease an individual's chance of developing CRC and other health problems (Joshu, Parmigiani, Colditz, & Platz, 2012).

2.5 Awareness of dietary and lifestyle among a population at above average risk of colorectal cancer

Due to ageing population and population growth, it is expected that new CRC cases will increase in forthcoming years in most countries, with the greatest future burden on developing countries (Torre et al., 2015). Therefore, strategies on how to change modifiable risk factors (such as D&L) in the context of non-modifiable risk factors (such as age and family history) is highly important in lowering the risk for developing CRC. Thus, prevention and early detection has immense public health importance.

Indeed, overwhelming evidence indicates that a vast majority of these cases and associated deaths could be reduced if diagnosed early enough and prevented by existing primary and secondary intervention. At least 70% of CRC may be prevented by focusing on modifiable risk factors and making moderate changes in D&L (Giovannucci, 2002). Secondary prevention through D&L changes is also critically important to prevent recurrence of the disease and reduce mortality (Sessa, Abbate, Di Giuseppe, Marinelli, & Angelillo, 2008).

Increasing incidence of cancer suggests a growing need to implement a range of initiatives to raise the awareness of the problem and convince patients to adopt a healthy lifestyle that can positively influence health outcomes (Stubbings et al., 2009) and potentially prevent or delay the onset

of disease (Eyre, Kahn, & Robertson, 2004). However, the awareness regarding several lifestyle factors associated with CRC such as low physical activity, high intake of red and processed meat, high consumption of alcohol, and low intake of vegetable and fruit) is particularly poor. This has been found in previous studies (A. L. Hawkes et al., 2009; Power, Simon, Juszczyk, Hiom, & Wardle, 2011) and demonstrates that there is still improvement to be made in educating the general public about the association between healthy lifestyle and reduced cancer risk.

The diagnosis of cancer has been referred to as 'teachable moment' in which patients are likely to be motivated to make lifestyle changes to improve health outcomes (Wendy Demark-Wahnefried, Aziz, Rowland, & Pinto, 2005). Cancer diagnosis often results in an interest in dietary modification by patients for a number of reasons including the side effects of anticancer therapy; desire to optimise potential outcomes of treatment; and family, peer, or medical professional influence (Maskarinec, Murphy, Shumay, & Kakai, 2001; Salminen, Lagstrom, Heikkila, & Salminen, 2000).

Studies have previously shown that CRC patients are highly motivated to seek information beyond standard treatment options and are interested in making healthy lifestyle changes (Patterson et al., 2003; Satia et al., 2004). The study by Satia et al. (2004) suggested that persons diagnosed with cancer are very motivated to try different strategies that may improve their health (such as making healthy lifestyle changes) whereby the study found significant increases in physical activity, vegetable intake, and supplement usage two years after a colon cancer diagnosis. A recent qualitative study of CRC patients living in the United Kingdom suggested that successful lifestyle changes were often brought about by either a cancer diagnosis or other serious co-morbidities (Dowswell et al., 2012). It seems that there are opportunities for improvement in the lifestyle of people diagnosed with CRC.

Studies have found that cancer survivors have a strong interest in making positive changes in lifestyle and health-related behaviours, including diet, physical activity, and smoking (Chris M. Blanchard, Denniston, Baker, Ainsworth, & et al., 2003; W. Demark-Wahnefried, Peterson, McBride, Lipkus, & Clipp, 2000) to improve their response to treatment, speed

recovery, reduce risk of recurrence, and improve their quality of life (Doyle et al., 2006). For example, similarly to the study by Satia et al. Patterson et al. (2003) reported that two thirds of breast, colorectal, and prostate cancer patients reported making changes in diet, dietary supplement usage and, physical activity as much as two years post-diagnosis (Patterson et al., 2003). Demark-Wahnefried at al. (2000) also reported that 1,667 cancer survivors in North Carolina had strong interests in health promotion programs aimed at healthier diets, increasing exercise, and smoking cessation (W. Demark-Wahnefried et al., 2000).

Similar findings from a study by Isenring et al. (2010) among medical oncology patients receiving treatment at an Australian public hospital reported that 41% of patients altered their diet due to their cancer diagnosis (E. Isenring, Cross, Kellett, Koczwara, & Daniels, 2010). Almost 40% of patients expressed the desire for additional nutrition resources such as managing treatment side effects, and vitamin and mineral supplements and for these resources to be available in the patient resource room (E. Isenring et al., 2010). Even though the patients have access to information about the potential efficacy of these behaviours from various sources, including family, friends, the Internet, and other media, the credibility of this information is often questionable and frequently overstated beyond the available scientific evidence (Satia et al., 2004). Therefore, it is important that healthcare providers communicate with cancer patients to ensure that the health behaviours they may be adopting are beneficial for their overall health and quality of life (Satia et al., 2004).

Lifestyle represents an important target for preventive interventions as it is the most important modifiable cause of disease and premature death worldwide (Organization, 2009). Effective interventions to enable people to live longer and healthier lives, and to reduce inequalities have been strongly advocated by the scientific community. Whereas among ill people or among those at increased risk it may be easier to effect interventions that make positive changes in lifestyle and reducing or eliminating unhealthy behaviours (Senore, Giordano, Bellisario, Di Stefano, & Segnan, 2012). The ideal circumstance for a cancer-preventive model to be effective may be by

focusing attention on the ways teachable moments can be best utilised for promoting healthy lifestyles as they represent the time when patients are probably more inclined to consider a relationship between their own habits and their effects on health (Lawson & Flocke, 2009).

Evidence suggests that behavioural change programs, which target high-risk groups may be more effective than those targeting the population at large. In addition, it is likely that individuals who have had a recent health scare may be more motivated towards lifestyle changes. By targeting a screened population, it may be possible to benefit from raised perceptions of personal risk (Caswell, Anderson, & Steele, 2009). With improved survival rates from cancer, lifestyle risk behaviour such as smoking, poor diet, and sedentary behaviour among cancer patients requires attention from health promotion experts. There is a need to assess the relevance and prevalence of these behaviours so as to enhance recovery, improve quality of life, and possibly extend survival.

Greater awareness by those with CRC or survivors of CRC could also lead to increased healthy behaviours across the whole population and thus could go some way towards reducing the overall burden of ill-health on the population (Power et al., 2011). The development of evidence-based guidelines specifically for people with CRC or survivors of CRC would be a valuable undertaking (Dennis, Waring, Payeur, Cosby, & Daudt, 2013). The interest in the development of lifestyle intervention for cancer survivors is growing, as the number of cancers survivors is also increasing. Numerous health promotion interventions are also focusing on improving lifestyle in the general population (Parekh, Vandelanotte, King, & Boyle, 2012; Wright, Sherriff, Dhaliwal, & Mamo, 2011), and many of their recommendations are applicable to people with cancer, particularly after treatment completion. Indeed, the World Cancer Research Fund recommends for cancer survivors to follow the same dietary guidelines as used by people in the general population (World Cancer Research Fund/American Institute for Cancer Research, 2007). Randomised controlled trials suggest that diet and exercise interventions are safe and lead to improvements in diet, physical function,

body weight, and biomarkers for positive disease outcomes (Pekmezi & Demark-Wahnefried, 2011).

Several studies have shown that there was an obvious lack of knowledge about diet as a risk factor for CRC (Causey & Greenwald, 2011; McCaffery, Wardle, & Waller, 2003; Sessa et al., 2008). Understanding dietary habits effects on CRC risk is a vital aim for community education, public awareness and risk reduction (C. Wang, Miller, Egleston, Hay, & Weinberg, 2010). Although many studies assessed the knowledge of diet in relation to cancer in general, only few studies investigated human knowledge of dietary habits related to CRC risk reduction. Therefore, the data provided by our studies should help inform the future planning of interventional strategies and developing educational programs to maximise the knowledge of dietary habits related to CRC risk reduction (Nahas, Sarriff, & Othman, 2013).

2.6 Malnutrition in colorectal cancer patients

One of the most significant nutritional issues that can arise during cancer treatment is malnutrition (Mary M & Susan R, 2010) . Malnutrition is defined as 'a subacute or chronic state of nutrition in which a combination of varying degrees of over- or under-nutrition and inflammatory activity have led to a change in tissue/body composition and diminished function or clinical outcome' (Soeters et al., 2008).

Malnutrition is a common feature among cancer patients (Vergara, Montoya, Luna, Amparo, & Cristal-Luna, 2013) and may be due to a variety of mechanisms involving the tumour, the host response to the tumour, and anticancer therapies (L. Brown et al., 2008; von Meyenfeldt, 2005). It has been associated with increased morbidity, mortality, length of hospital stay, health-care costs, and decreased quality of life (Andreyev, Norman, Oates, & Cunningham, 1998; De Luis et al., 2006; von Meyenfeldt, 2005) and thus, lower survival rates (Gupta et al., 2006). Moreover, malnutrition worsens the responsiveness and the tolerance to treatment (such as surgery, chemotherapy and/or radiotherapy) and increases the susceptibility to

infection (D. L. a. Waitzberg & Correia, 2003). Therefore, it is essential that malnutrition is recognised early because it can lead to an increased risk of complications and decreased quality of life (Makhija & Baker, 2008).

The incidence of malnutrition in patients with cancer is reported to range from 40% to 84% (L. Brown et al., 2008), while studies on hospitalised cancer patients have reported that 56–76% of patients are either malnourished or suspected to be at risk of malnourishment (J. Bauer et al., 2002; J. A. Read, S. T. B. Choy, P. J. Beale, & S. J. Clarke, 2006) (Table 2.2). About 42.4% of patients receiving chemotherapy were malnourished or at risk of being malnourished (Heredia et al., 2008), 52% were found to be malnourished in stage III and IV CRC patients (Gupta et al., 2006), and 30% in outpatient CRC patients (Daudt, Cosby, Dennis, Payeur, & Nurullah, 2011). In addition, approximately 20% of patients with cancer have been reported to die from the effects of malnutrition or its complications rather than the cancer diagnosed (Laky, Janda, Cleghorn, & Obermair, 2008).

The prevalence of malnutrition in patients in cancer varied in different clinical settings (Daudt et al., 2011); depending on the use of different classifications of malnutrition and the malignancy itself, including tumour type, stage, location, and/or the anticancer treatment (Shike M, 1996). Capra and colleagues reported that weight loss and malnutrition were different according to the type of cancer and its location, ranging from 9% for breast cancer to 80% for oesophageal cancer (Capra, Ferguson, & Ried, 2001).

Table 2.2. The prevalence of malnutrition in cancer and colorectal cancer (CRC) patients

Authors	Patient data	Incidence of malnutrition	Country of studies
Bauer et al. (2002)	71 patients with cancer admitted to an acute care medical facility	76%	Australia
Read et al. (2006)	141 all types of cancer patients who attended the outpatient cancer care clinic	66%	Australia
Gupta et al. (2006)	58 Stage III and IV CRC patients	52%	America
Heredia et al. (2008)	33 CRC patients receiving chemotherapy	42.4%	Europe
Daudt et al. (2011)	252 outpatient CRC patients	30%	Canada

Patients with cancer of the lung, oesophagus, stomach, colon, rectum, liver, and pancreas are at greatest risk of weight loss and subsequent malnutrition, whereas patients with breast cancer, leukaemia, sarcoma, and lymphomas have a lower risk for weight loss (Dewys et al., 1980). Therefore, malnutrition is more prevalent in patients with solid tumours, the elderly, and those with advanced disease. Symptoms arising due to treatment include anorexia, taste changes, nausea, vomiting, diarrhoea and increased metabolic rate resulting in reduced dietary intake and weight loss (Bayram, Erbey, Celik, Nelson, & Tanyeli, 2009). Patients with malnutrition have more difficulties in overcoming the complications that may result from the treatments such as surgery, chemotherapy, and radiotherapy (Molassiotis, 2000). Untreated malnutrition has been associated with reduced responses to treatment (Marín Caro, Laviano, & Pichard, 2007), poor survival (Thoresen et al., 2012) and diminished quality of life (De Luis et al., 2006). Knowing this, prompt and substantiated interventions for treatment or prevention of malnutrition are needed for effective management of patients with cancer and undergoing treatment.

2.6.1 Pathophysiologic perspective of malnutrition or weight loss

Chronic and pathologic starvation caused by debilitating chronic illness or cancer alters healthy bodily functions. Patients with CRC experience unintentional weight loss for a number of reasons (Mattox, 2005; McCance, Forshee, & Shelby, 2006), including progressive tissue depletion caused by altered metabolism, the stress response caused by anxiety related to the illness (Mattox, 2005), increased resting energy expenditure resulting from tumour-induced changes (Siddiqui, Pandya, Harvey, & Zaloga, 2006), and decreased nutrient intake because of side effects of treatment including anorexia, nausea, and vomiting (Sanchez-Lara, Ugalde-Morales, Motola-Kuba, & Green, 2013). However, in this section only altered metabolism and effect of CRC treatments on malnutrition in patients with CRC are discussed in more detail.

2.6.2 Altered metabolism

Changes in energy, carbohydrate, protein, and lipid metabolism have also been cited as the causes of weight loss in patients with cancer (Siddiqui et al., 2006). Additionally, muscle wasting or a decrease in lean body mass occurs when body protein breakdown increases and body protein synthesis decreases (Trujillo E & Nebeling L, 2006). Research indicates that increased bioactivity of a key compound, known as proteolysis-inducing factor, is instrumental in the loss of skeletal muscle mass in patients with cancer (Siddiqui et al., 2006).

Abnormal elevation in Cori cycle activity causes alterations in carbohydrate metabolism including glucose intolerance and insulin resistance (Mary M & Susan R, 2010). Glucose intolerance has been noted to increase with increases in tumour burden, leading to increasing insulin resistance and weight loss (C. D. Young & Anderson, 2008). Increases in glucose utilisation combined with the additional energy demands of the tumour may subsequently increase the patient's energy needs, leading to depletion of protein and fat stores, which may manifest as anorexia, and alterations in taste that suppress oral intake (Bapuji & Sawatzky, 2010). Therefore, weight

loss in patients with CRC can occur as a consequence of abnormal Cori cycle activity, increased energy expenditure, and decreased dietary intake (Blum et al., 2011).

Similar to alterations in glucose metabolism, abnormalities in lipid metabolism are also thought to contribute to weight loss (loss of significant amount of adipose tissue) in patients with cancer. Body fat is lost when lipolysis and fatty acid oxidation increases and lipogenesis decreases. Researchers have found that the lipid-mobilising factor produced either by tumour or adipose tissue may induce lipolysis (Tisdale, 2000) by promoting an increased in cyclic adenosine monophosphate production (Guirao, 2002). Evidence to date suggests that the presence of a tumour in the body alters healthy cell processes, and the reduction in lipogenesis is thought to reflect the influence of cytokine production (Mary M & Susan R, 2010), thus contributing to the continuation of the malignancy process. In addition, pro-inflammatory cytokines such as tumour necrosis factor, interleukin-1, and interferon α contribute to alterations in healthy biologic responses, causing muscle wasting and loss of adipose tissues (Trujillo E & Nebeling L, 2006) and subsequently resulting in cancer cachexia.

2.6.3 Effects of colorectal cancer treatments on malnutrition or weight loss

Treatment of CRC is based on the size, location, extent of the tumour, and the patient's overall health status (McCormick et al., 2002). Treatments used for cancer include surgery, radiation and chemotherapy, either alone or in combination (Paccagnella et al., 2010). The main aim of cancer treatments is to remove the cancer cells, relieve pain and prevent further tumour growth (Arends et al., 2006). Treatment can produce adverse effects that may be negatively affected by progressive malnutrition (Bapuji & Sawatzky, 2010).

Surgery is the oldest form of cancer treatment and is an essential tool to diagnose and stage cancer. More than half of all patients with cancer (of any type) ultimately have cancer-related surgery (Charney & Cranganu, 2010). Surgery of the primary tumour is the mainstay of CRC treatment (Des

Guetz, Uzzan, Morere, Perret, & Nicolas, 2010) such that, approximately 70-80% of new cases of colon cancer undergo surgery for excision of the primary tumour (Burden, Hill, Shaffer, & Todd, 2010; Lombardi et al., 2010). In Malaysia, a similar percentage of newly diagnosed patients undergo potentially curative surgery (Selvaratnam, Kananathan, Manivannam, & Yong, 2005). The goal of surgery is to remove the tumour as well as for surgical resection of the affected portion of the colon or rectum. Patients who underwent colorectal surgery has high risk of postoperative complications, especially for those who have lost 10% of their pre-illness body weight (Bozzetti, 2002). The postoperative complications include reduced dietary intake and potential decreased absorption of nutrients because of the shortened bowel (Bapuji & Sawatzky, 2010).

Chemotherapy can be initiated as adjuvant therapy following surgery for either high relapse risk patients (stage II and III), or in metastatic patients. The standard adjuvant chemotherapy approach is based primarily on tumour stage (Des Guetz et al., 2010). Chemotherapy usually starts at the end of the first month after surgery. In general, an earlier study has suggested that adjuvant chemotherapy is most beneficial for stage 3 colon cancer (Benson, 2006). The aims of adjuvant chemotherapy are to destroy microscopic metastases that may be already present and with the intention to reduce the risk of recurrence (Lombardi et al., 2010) and death. Although the drugs destroy the cancer cells, they also are toxic to healthy host cells, including cells of the oral, oesophageal, and gastrointestinal mucosa. Consequent damage to mucosal cells can cause diarrhoea (Viale, Fung, & Zitella, 2005) and infections, and adversely affect the digestion and absorption of nutrients (Capra et al., 2001). Therefore, chemotherapeutic drugs can exacerbate weight loss in patients with CRC (Bapuji & Sawatzky, 2010). However, chemotherapy is still the first treatment in metastatic disease with the goal of prolonging survival, as well as improving and maintaining quality of life (Labianca et al., 2010).

Radiotherapy is mainly used in colon cancer patients when the cancer has attached to an internal organ or the lining of the abdomen. It is also used to treat colon cancer that has spread to the bones or brain. However,

radiotherapy is initiated for rectal cancer either before or after surgery to prevent the cancer from returning to the area where the tumour started. Radiotherapy is often delivered synchronously with chemotherapy or considered as part of the adjuvant and definitive treatment of rectal cancer (T. Wu, Munro, Guanjian, & Liu, 2005). Similar to chemotherapy, radiotherapy is toxic to tumour as well as healthy host cells within the area of treatment (Capra et al., 2001). Capra and colleagues also reported that at least 11% of patients treated with radiation to the abdomen experience nutritional issues, and up to 15% also developed chronic radiation enteritis (Capra et al., 2001). As a result, the incidence of nutritional issues leading to weight loss tends to be higher in patients who undergo radiotherapy.

Dewys and colleagues (1980) reported one of the earliest studies to characterise weight loss and effect on prognosis in over 3000 patients with a variety of tumour types throughout the mid to late 1970s during enrolment in the Eastern Cooperative Oncology Group (ECOG) protocol. The author found that as little as 6% weight loss predicted poorer response to therapy (Dewys et al., 1980). The author also noted that the overall survival rates, performance status, productivity, and quality of life declined concurrently with weight loss in cancer patients. Of note, approximately 80% of the studied patients presented with some degree of weight loss (> 5%) over 2 to 6 months before receiving treatment.

A variety of symptoms may occur during treatment at all stages of the cancer that can have adverse health effects (Baldwin, 2011). A survey conducted in 122 patients with gastrointestinal and 29 with lung cancers showed that 62% of the patients had one or more symptoms at presentation. Loss of appetite (38%) was the most common symptom in the patients, followed by early satiety (27%) and pain (23%) (Khalid et al., 2007). Thus, the link between presence of adverse symptoms and the clinical and nutritional manifestations of illness is compelling (Baldwin, 2011). Side effects from the cancer treatment may affect the dietary intake of the patients as well as contributing to a declined nutritional status. Hence our randomised controlled intervention study was conducted to attempt to delay, or prevent the occurrence of malnutrition or treat existing malnutrition, in CRC patients

(when compared to those receiving normal nutrition care) by treating nutrition-related symptom through intensive dietary and lifestyle counselling.

2.7 Cancer cachexia

The complex clinical syndrome known as cancer cachexia differs from malnutrition. It is characterised by a negative protein and energy balance, progressive loss of lean tissue with or without loss of fat mass (sarcopenia), anorexia, early satiety, progressive debilitation, and malnutrition (J. D. Bauer et al., 2006; Dewey A, Baughan C, Dean T, Higgins B, & Johnson I, 2007; Fearon et al., 2011), which results in greater risk of organ dysfunction and death (Mattox, 2005). The weight loss seen in patients with cachexia is from both skeletal muscle and adipose tissue, which is distinct to that seen in patients with starvation or anorexia, where weight loss is predominantly from fat (J. D. Bauer et al., 2006; Evans et al., 2008). This variation is due to the metabolic alterations and inflammatory state that occurs in cachexia (Weimann et al., 2006).

Cancer cachexia is most commonly exhibited in up to 80% in patients with advanced stage cancer, particularly those with pancreatic, lung, gastric and, CRC and head and neck malignancies (J. D. Bauer et al., 2006; Dewey A et al., 2007). Cachexia has a significant impact upon patient morbidity, reduces quality of life and is implicated in 30–50% of all cancer deaths as many die from the wasting associated with the condition (Inui, 2002; N. MacDonald, Easson, Mazurak, Dunn, & Baracos, 2003).

The mechanism of cancer cachexia is not well understood. The cause of cancer cachexia is multifactorial, with many axes of complexity. Cancer cachexia is usually considered as the main contributor to weight loss in advanced cancer. Energy intake that is lower than the energy expenditure may result in loss of body weight and decrease in lean tissue (Bosaeus, 2008), which present clinical features similar to cachexia. Cachexia is understood to limit oral intake and thereby lowering energy intake, which may result in a wide variety of anorexia, dysphagia, nausea, xerostomia and change in taste and smell (Blum et al., 2011). As well, other factors may have

indirect influence on energy intake by affecting appetite and the drive to eat, for example, pain, fatigue and psychological problems (Blum et al., 2011).

The nutritional goals and outcomes of patients, particularly those with advanced cancer need to be realistic, individualised and synonymous with the overall goals for the patient (J. D. Bauer et al., 2006). Evidence-based practice guidelines for nutritional management of cancer cachexia provide a clear and evidence-based framework to effectively guide nutritional intervention in patients with cachexia (J. D. Bauer et al., 2006).

Weight stabilisation is an appropriate nutrition intervention goal for patients with cancer cachexia, as it has been shown this can lead to improved quality of life and prolonged survival compared to patients who lose weight (Andreyev et al., 1998; Davidson, Ash, Capra, & Bauer, 2004). In order to accomplish consistent weight in patients with cancer cachexia, it is important to ensure that patients can achieve adequate energy and protein intakes. It has been estimated that an energy intake of approximately 120 kJ/kg/day and protein intake of approximately 1.4 kg/kg/day should be prescribed to patients with cancer cachexia, in order to maintain weight (J. D. Bauer et al., 2006; Davidson et al., 2004).

2.8 Nutritional assessment

In clinical practice, nutrition screening using validated screening methods such as the Malnutrition Screening Tool (MST) (Ferguson, Capra, Bauer, & Banks, 1999), and Nutritional Risk Screening (NSR-2002) (Jens Kondrup, Rasmussen, Hamberg, & Stanga, 2003) are preferable to allow early identification of patients at risk of malnourishment or potentially developing malnutrition (Santarpia, Contaldo, & Pasanisi, 2011; Soeters et al., 2008). Hence, the traditional comprehensive nutritional assessment often includes a measure of dietary intake and medical evaluations such as serum protein levels or immune competence to identify significant weight loss over time. Anthropometric measures such as significantly low or high body weight or BMI, reduction in mid-arm circumference and triceps skinfold thickness, and

functional measurements of muscle strength, can be useful adjunct assessment tools. (DeLegge MH, 2007).

Individually, nutritional screening tools often have limited value in accurately determining a patient's actual nutritional risk. Therefore, a full and detailed nutritional assessment is useful to assess the degree of malnutrition in the patients (J. Kondrup, Allison, Elia, Vellas, & Plauth, 2003; Santarpia et al., 2011) and to determine the overall nutrition goals and intervention required (A. Baker, Wooten, & Malloy, 2011). An effective comprehensive nutritional screening combined with an assessment will generally combine both objective and subjective factors (Ryu & Kim, 2010), comprising of the social demographics of the patients, medical history, anthropometric data, biochemical and clinical assessment, dietary information, functional status and quality of life (Charney & Cranganu, 2010). By using a wide variety of nutritional indicators, a more comprehensive and in-depth assessment of nutritional status (Gibson, 2005) can be achieved.

Isenring and colleagues (2006) suggested that a comprehensive nutrition assessment is the preferred method of identifying malnutrition in patients. Studies have consistently revealed that nutritional status cannot be evaluated from one or two single parameters, and several measurements are required (Geirsdottir & Thorsdottir, 2008). Serum albumin is the most widely used clinical index of nutritional status, but because of its long half-life and its ability to be affected by illness and stress (P. W. Wong, Enriquez, & Barrera, 2001), it can be a poor measure of nutritional status on its own. Many cancer therapy drugs may cause low serum albumin and total lymphocyte count (Forse, Rompre, & Crosilla, 1985).

Early nutritional screening and assessment combined can allow clinical practitioners to identify problems and treat patients with malnutrition or periodically follow-up with those who have high nutritional risk. These may be useful to help patients to face any nutritional challenges before significant weight loss occurs or before other clinical/biological signs of malnutrition appear. Therefore, it is recommended that a comprehensive nutritional status assessment be carried out on each CRC patient at the beginning and during the treatment, so that nutrition intervention may prescribed to the patients.

Nutrition intervention may be beneficial to patients to increase or maintain their weight, improve their response to treatment, and reduce complications.

2.8.1 Dietary intake

The most commonly used techniques for assessment of food and drink consumption are diet history, 24-hour dietary recall, food frequency questionnaire (FFQ), and food diary or food record methods. A detailed dietary history is essential for a quick assessment and overview of daily intake patterns and should include assessment of current food and fluid intake, previous intake, and any recent changes should be noted. From this, an indication of the patient's macro- and micronutrient intakes can be gained (Davies, 2005). In fact, if individuals are able and willing to report their intake objectively, a dietary history would be a valuable adjunct to nutritional assessment to identify if the individual suffers of malnutrition (Soeters et al., 2008).

In a 24-hour dietary recall, a record is made by another person (e.g., a dietitian or a researcher) of everything an individual can recall eating or drinking over the previous 24 hours. For a more comprehensive dietary intake assessment, patients can be asked to make records of all that they eat and drink over a number of days. The greater the number of days recorded, the better the estimate of usual intake but this can create significant burden on the patients, especially if they are unwell at the time. It is important to have at least 2 x 24-hour dietary records, as food intake by individuals can differ markedly on a daily basis. Therefore, at least two days of 24-hour dietary record (1 week day and 1 weekend day) should be obtained. It is also important that consecutive days are not selected and one weekend day is included to help capture the variety of food consumed (Gibson, 2005).

The 24-hour dietary recall and two-day food record have been used in our intervention study. Even though, the 24-hour dietary recall may not be representative of the participant's usual (habitual) intake, it may be assumed to be sufficient for dietetic professionals for estimating energy and protein intake on an individual basis. The 24-hour diet recall or diet history

assessment should aim to detect food aversions, intolerances and problems with feeding, such as taste changes caused by symptoms and side effects of treatment (A. H. Baker & Wardle, 2002). The participant's social history may also provide insights into the failure or inability to obtain or prepare adequate food (Davies, 2005).

The FFQ is a dietary assessment tool used to obtain descriptive information either qualitatively or quantitatively on usual food consumption pattern over a prescribed interval. It has been used to estimate the usual food intake over 12 months and can also provide information on recent changes in dietary intake. It is useful for the assessment of specific nutrient intakes. The validated quantitative Victorian Cancer Council Food Frequency Questionnaire, The Dietary Questionnaire for Epidemiological Studies Version 2 (DQES v2) and the Blue Mountains Eye Study FFQ for older people were used in our survey studies. The questionnaires were adopted to assess the usual daily food and nutrient intakes of the participants over the previous 12 months (Ambrosini, Sofie, Mackerras, Fritschi, & et al., 2003; Giles & Ireland, 1996; Hodge et al., 2000). The Victorian Cancer Council questionnaire has been used in the Australian arm of the Breast Cancer Family Registry, the Australia Prostate Cancer Family Study, the Australian Longitudinal Study of Women's Health and over 20 other smaller epidemiological studies in Australia.

The limitations of each of the mentioned dietary assessment tools include effects of systematic error, which is under- or over-reporting of specific foods, which is common to all dietary intake methodologies. However, dietary assessment used in both studies may provide a degree of accuracy and sensitivity that would still identify poor or inadequate intakes.

2.8.2 Anthropometric measurements

Anthropometric assessment includes weight, height and body composition, which includes, lean body mass, fat stores and body water distribution (Sarhill et al., 2003). For measuring body composition, repeated, direct measurement of body fat or lean tissue mass (mid-upper arm circumference,

triceps skinfold) allow the mapping of changes in an individual, and may be particularly important in patients with cancer (Davies, 2005). The measurement of lean body mass, bone mineral density, and fat mass can be done via sophisticated techniques such as labelled water or dual-energy –ray absorptiometry (DEXA). However, because of cost, accessibility issues and other considerations, the use of these techniques are currently limited, and unavailable in most ambulatory settings. In these instances the bioelectric impedance analyses (BIA) are often used to measure electrical resistance on the basis of lean body mass and body fat composition.

Serial measurements are useful when monitoring weight to determine if the fat or lean body mass is being lost or gained. However, these measurements need to be assessed cautiously in cancer patients even though they provide useful information, because the 'norms' on which they are based represent healthy individuals and, therefore, may not have direct applications to the cancer population (Nelms M, Sucher K, & Long S, 2007).

Weight changes measured accurately and regularly are considered more informative than self-reported, one-off or occasional weight measures as it provides information on the duration and extent of weight loss over time, and as such is highly valuable (Hall et al., 2012). Weight and height are among the simplest and least invasive anthropometric measurements, but there are occasions when they are less useful, for example in fluid imbalances or when patients are unable to stand.

Body Mass Index is calculated from current body weight and height, which is then compared to the World Health Organization's (WHO) BMI classifications (World Health Organization, 1995). However, there is a limitation in using BMI as the sole anthropometric criterion to measure nutritional status in patients with cancer. Pirlich at al. (2006) reported that BMI alone is not an accurate indicator of nutritional status among cancer patients. Malnutrition is often overlooked in patients who still fall within the normal weight (J. Bauer et al., 2002; Wigmore, Fearon, Maingay, & Ross, 1997) in spite of having lost as much as 10–20 per cent weight in the previous six months (Wigmore et al., 1997) or be classified overweight because of body fat masking loss of lean body tissue. This was supported by

a study which showed that of 70% of 781 patients with advanced cancer experienced unintentional weight loss, but only 6.5% had BMI < 18.5 kg/m² (Segura et al., 2005). It also reinforces the fact that BMI alone is not an accurate indicator of nutritional status among cancer patients. Therefore, a comprehensive nutritional assessment is needed in studies of cancer patients.

2.8.3 The scored Patient-Generated Subjective Global Assessment (PG-SGA)

The scored PG-SGA is a validated nutritional assessment tool (Kubrak & Jensen, 2007) and deemed to be the 'gold standard' for nutritional assessment in patients with cancer (Leuenberger, Kurmann, & Stanga, 2010). The scored PG-SGA has a further advantage of being more specific to patients with cancer as it takes into account more acute changes in body weight, dietary intake and a wider array of nutrition impact symptoms likely to be experienced by cancer patients (J. Bauer et al., 2002). It also allows tracking of changes in nutritional status over short periods of time. Moreover, its use is recommended as the standard for nutritional assessment for patients with cancer by clinical practice groups (Duguet, Bachmann, Lallemand, & Blanc-Vincent, 2002) including the American Society for Parenteral and Enteral Nutrition (Directors & the Clinical Guidelines Task) Board of Directors (Directors & the Clinical Guidelines Task, 2002) and the Oncology Nutrition Dietetic Practice Group of the American Dietetic Association (E. A. Isenring, S. Capra, & J. D. Bauer, 2004; Laky et al., 2006; McCallum, Polisena, Kohr, & Group, 2000).

The scored PG-SGA was adapted from the Subjective Global Assessment (SGA) and developed specifically for patients with cancer (F. D. Ottery, 1996). It is a method that correlates very well with objective nutritional criteria. The scored PG-SGA can be used as a screening tool for assessment of nutritional status and as a monitoring and an outcome measure (J. Bauer et al., 2002; E. Isenring, Bauer, & Capra, 2003). This is a reproducible, easy-to-use, cheap, and non-invasive method, and would therefore be a simple method to be introduced into the clinical setting such as in the oncology

wards. It is also correlates highly with quality of life (Bapuji & Sawatzky, 2010).

According to some authors, the scored PG-SGA should be the tool of choice for nutritional assessment in patients with cancer (E. Isenring et al., 2003). It is a good screening method to identify which patients will benefit most from the interventions. It also provides data on the possible causes, which contributes to the preparation of individualised recommendations by a multidisciplinary unit in which a dietitian has a role to play. Another advantage of using the scored PG-SGA is that it can identify some of the key symptoms, which commonly occur in patients with cancer such as poor appetite, nausea, or constipation, and which can then be treated and monitored with appropriate medications and optimum dietary advice (Jane A. Read et al., 2006) for each patient. In addition, the information can be used to understand weight history and to calculate the nutritional requirements and metabolic demands of patients with cancer (Bapuji & Sawatzky, 2010). Therefore, the scored PG-SGA can be used as a nutrition assessment tool as it allows quick identification and prioritisation of cancer patients with malnutrition.

2.9 Physical activity

Physical activity has been reported to have positive long term influences on some of the diseases especially on non-communicable diseases. A study conducted by Reiner et al. (2013) reported that there were negative relationships between higher physical activity levels with weight gain, and risk of coronary heart disease (Victora et al.), Type 2 diabetes mellitus, Alzheimer disease and dementia (Reiner, Niermann, Jekauc, & Woll, 2013).

Physical activity has been examined as primary prevention against most of the chronic diseases such as cancer (Booth, Roberts, & Laye, 2012), whereby a systematic review of epidemiologic studies revealed that for household physical activity approximately every 10 MET-hours/week or 1 hour/week increase is associated with a 1% reduction in cancer risk (Shi et al., 2015) and was associated with a greater protective effect than activities of less intensity. Physically active men and women exhibited a 30%–40%

reduction in the relative risk of colon cancer, and physically active women a 20%–30% reduction in the relative risk of breast cancer compared with their inactive counterparts (Warburton, Nicol, & Bredin, 2006).

Furthermore, a study conducted by Slentz et al. (2005) among 175 sedentary, overweight men and women with mild to moderate dyslipidemia observed that the low amounts of activity, at either intensity approximately equivalent to 17km/week prevented significant accumulation of visceral fat. While the high amount of exercise which was equivalent to 27km/week of vigorous exercise not only prevented increases in visceral fat but actually resulted in sizable and significant decreases in visceral fat, as well as in subcutaneous and total abdominal fat. This suggests that an exercise prescription may reverse metabolic disease (Slentz et al., 2005).

Studies have shown that an average energy expenditure of about 1000 kcal (4200 kJ) per week is associated with a 7% reduction in men and 15% reduction in women in all-cause mortality (Samitz, Egger, & Zwahlen, 2011). In addition, a 10% reduction in all-cause mortality correlated with an increased for vigorous exercise to an energy expenditure of 1500 kcal/week in men and 650 kcal/week in women (Samitz et al., 2011; Warburton et al., 2006).

Additionally, a study has been conducted by Simon et al. (2013) to investigate the relationship between occupational energy expenditure, sitting time, non-occupational physical activity and participation in sports with CRC risk. The study reported that high occupational energy expenditure and less sitting hours can reduce hazard ratios for colon cancer in men. Non-occupational physical activity was found to have inconsistent associations with the endpoint of CRC among men but an inverse association was found between non-occupational activities with the endpoint of CRC among women (Simons et al., 2013).

Another study conducted by Campbell et al. (2013) stated that individuals who conducted more recreational physical activity prior to and after the diagnosis of CRC were found to have lower mortality. In contrast,

longer sitting time was associated with higher mortality (Campbell, Patel, Newton, Jacobs, & Gapstur, 2013).

In study 1, The Australian Institute of Health and Welfare Active Australia Survey physical activity questions were adopted to assess the physical activities pattern of the participants, while in study 2 physical activity level was assessed using the International Physical Activity Questionnaire-Long form. For study 3, the Godin's Leisure Score Index (LSI) of the Godin Leisure-Time Exercise Questionnaire were used. A detailed method of measuring physical activity level has been discusses in each of the study.

2.10 Quality of life

Quality of life (QOL) is a subjective multidimensional construct representing functional status, psychosocial wellbeing, social factors (Marín Caro et al., 2007), health perceptions and disease/treatment related symptoms (Ravasco, Monteiro-Grillo, & Camilo, 2003). Cancer and treatment-induced changes in metabolism (Delano & Moldawer, 2006) lead to alterations in psychological functions (Argiles, 2005), which in turn may affect QOL directly, and by negatively influencing nutritional status. It has been an important issue in oncology to evaluate QOL in patients with cancer (Boscolo–Rizzo, Maronato, Marchiori, Gava, & Da Mosto, 2008). It is being used increasingly as a primary outcome or clinical endpoint in studies to evaluate the effectiveness of the treatment (Heydarnejad, Hassanpour, & Solati, 2011). Recently, clinicians are attempting to evaluate QOL during daily practice as an early indicator of disease progression, and to utilise these evaluations when making decisions about individual patient care (Velikova et al., 2008).

In general, QOL is typically evaluated using questionnaires completed by the patient (Marín Caro et al., 2007). In the last few years, a number of tools have been developed and validated to measure QOL (Boscolo–Rizzo et al., 2008) such as The European Organisation for Research and Treatment of Cancer Care Quality of Life Questionnaire (EORTC QLQ C-30) (Aaronson et al., 1993), and Functional Assessment of Cancer Therapy (FACT) (Hurst & Gallagher, 2006). The most widely applicable instrument to measure QOL in patients with cancer is EORTC QLQ C-30 (Heydarnejad et al., 2011).

The EORTC QLQ C-30 is recommended as the most effective tool as this method includes the impact of the disease together with therapeutic interventions, expectations and personal satisfaction measures (Ravasco, Monteiro-Grillo, Vidal, & Camilo, 2004). Studies have shown that the EORTC QLQ C-30 is developed for cancer patients enrolled in clinical trials and it is a validated, reliable and multidimensional structured questionnaire which is applicable across a range of cultures to assess quality of life of patients with cancer (Aaronson et al., 1993; Gupta et al., 2006; Heydarnejad et al., 2011; Natrah, Sharifa, Syed, Rizal, & Saperi, 2012). Moreover, in patients with cancer, the PG-SGA score has been shown to be significantly associated with quality of life (EORTC QLQ C-30), and therefore can be used to predict the direction and magnitude of change in quality of life (E. Isenring et al., 2003).

The European Organisation for Research and Treatment of Cancer Care Quality of Life Questionnaire-Colorectal38 (EORTC QLQ-CR38) is a disease-specific instrument used to supplement the widely used generic measure of quality of life, the EORTC QLQ-C30, to assess quality of life in patients with CRC. It was developed originally in the Netherlands and has been widely used in many international trials and research settings in oncology (M. A. G. Sprangers, te Velde, & Aaronson, 1999). Since its development in the 1990s, the EORTC QLQ-CR38 has been translated into several languages.

However, during this time, the treatment for CRC has evolved to include the use of radiotherapy or chemoradiation before surgery, ultra-low anterior resection, minimal access surgery and new chemotherapy regimens. The QLQ-CR38, therefore, may no longer sufficiently represent the symptoms that can occur during treatment. The new module, the European Organisation for Research and Treatment of Cancer Care Quality of Life Questionnaire-Colorectal29 (EORTC QLQ-CR29), was then developed after revising the QLQ-CR38 for a few years (Gujral et al., 2007). It has been demonstrated internationally to have both sufficient validity and reliability for usage as a supplement to the EORTC QLQ-C30 to evaluate patient-reported outcomes during CRC treatment in clinical trials and other settings

(Whistance et al., 2009). The EORTC QLQ-CR29 is meant for use on CRC patients in various disease stages and treatment modalities. The module contains symptoms (disease symptoms, side effects of treatment) and functional scales (body image, sexuality, and future perspective) that are associated with CRC and its treatment which comprises of 29 questions. There are separate scales for patients with or without stoma and separate items to evaluate sexual function for men and women. (Whistance et al., 2009).

So far these questionnaires have been translated and validated in Europe and other parts of the world. However, in many cases, the validity and cultural context underlying the development of such instruments are those of the original language and cultural setting (M. A. G. Sprangers et al., 1999). In addition, the EORTC QLQ-C30 and EORTC QLQ-CR29 have been also translated and validated in Malay versions (Yusoff, Low, & Yip, 2010).

2.11 Intervention studies for preventing malnutrition

Maintenance or improvement in nutrition status is the key goal of medical nutrition therapy for individuals undergoing treatment for cancer. Although many patients tolerate therapy well and experience few or no side effects, malnutrition is still a common condition, which affects quality of life and survival for many cancer patients. As previously described, many contributing factors have been implicated in promoting the deterioration in nutritional status. To maintain or improve nutritional status, all barriers associated with oral intake should be aggressively addressed unless aggressive intervention is not warranted (Mary M & Susan R, 2010). Nutrition intervention are purposely-planned actions designed with the intent of changing behaviour, risk factor, environmental condition, or the aspect of health status for an individual, a target group, or the general population (Lacey & Pritchett, 2003). The intervention involves dietetic strategies and strategies to meet the needs of cancer patients, which concentrate on helping patients to maintain and/or improve nutritional intake in the presence of symptoms, regain body weight or minimise weight loss.

Normally, the personalised dietetic intervention consists of strategies to modify the amount of food taken, either through advice or by provision of additional foods as snacks, fortification of foods to increase the energy and nutrient content; and the prescription of oral nutritional supplements. Modifications to food intake should be tailored to individual needs and can be easily varied to avoid monotony and also rely on the use of familiar foods. However, this strategy should further investigate the cost-effectiveness of supplying additional foods (Baldwin, 2011). Ravasco and colleagues (2005a) suggested that this type of intervention should be promptly carried out as early as possible as soon as any risk is identified and in close collaboration with the patient, along with monitoring of compliance to the diet.

E. A. Isenring et al. (2004) conducted a RCT in outpatients receiving radiotherapy to the gastrointestinal or head and neck area to compare those who received either intensive individualised nutrition counselling by a dietitian and oral supplements (if required), with those who received the usual care practice for up to 3 months. In this study, 35% (*n* = 21) of the patients were malnourished (SGA B and C), with a median weight loss in the last 6 months of only 2.6%–3.6%. Even though there were a relatively small number of malnourished patients in this study, improvement of nutritional status was demonstrated once dietetic intervention was implemented. The authors suggested that dietetic intervention in early stages of cancer diagnosis and during treatment is thought to have a positive impact on patient outcomes, which include improving a patient's tolerance to therapeutic regimens, minimising the progression and effects of malnutrition in the patients, decreasing morbidity and improving quality of life.

A similar recent study by Ravasco and colleagues (2005a) showed that patients with CRC undergoing radiotherapy and receiving individualised nutrition counselling based on regular foods or high-protein liquid supplements for one month had better nutritional status and function scores at radiotherapy completion, and after three months, they had less negative side effects from the treatment. At baseline, the vast majority of the patients were well-nourished according to the scored PG-SGA and the BMI index, and only 9% of patients were anorectic. Nevertheless, patients receiving

individualised nutrition counselling had an improvement in anorexia, which was significantly better than the control group during radiotherapy and in reducing fatigue three months after the end of the radiotherapy (Ravasco, Monteiro-Grillo, et al., 2005). The same group reported similar outcomes in patients receiving radiotherapy for head and neck tumours (Ravasco, Monteiro-Grillo, Marques Vidal, & Camilo, 2005).

A RCT by Baldwin and colleagues (2009) demonstrated that patients with cancer who received oral nutritional interventions and gained weight in the first three months of treatment had a significantly greater chance of survival than patients who lost weight in the first three months. Van den Berg and colleagues (2010) also suggested that it is important to maintain an optimal nutritional status for patients with head and neck cancer through nutritional intervention during their oncological treatment. These findings were supported by Creaser and colleagues who found that the success of the cancer patients who were able to maintain their nutritional status during treatment could be attributed to the initial education and ongoing access and support by a dietitian (Creaser, 2010). Therefore, a nutrition intervention can affect a cancer patient's outcome (Geirsdottir & Thorsdottir, 2008).

In this section of narrative review were discussed, as there has been no systematic review to date. The narrative review were focused at seven intervention trials conducted among patient with head and neck, gastrointestinal, colon, lung, ovarian and breast cancer over the past 20 years from year 1993 until 2014 were identified. The trials ranged from two months to twenty-four months. Two trials were included with the consideration that their design and deliveries were very similar to the intervention study planned for this thesis.

The review in this section focuses on the outcome of the intervention on nutritional status parameters consisting of weight, BMI and waist circumference, as well as the quality of life. Both significant and non-significant findings are included for the comparison of the effects from different intervention methods.

2.12 Dietary counselling interventions

The following sub-section reviews RCTs (only) of dietary intervention studies conducted between the years 1993 and 2014. RCTs provide a high quality of evidence (Jansman, Postma, & Brouwers, 2007). The review covers the aspects of intervention design, study length and sample size, energy and protein requirements prescription, and intervention delivery methods. The effects of the dietary intervention on nutritional status parameters and quality of life are discussed. The review is summarised in Table 2.3.

Seven RCTs on dietary intervention conducted on clinically nonhomogeneous group of cancer patients were identified. Five trials included patients undergoing radiotherapy for head and neck malignancies or CRC (E. A. Isenring, Bauer, & Capra, 2007; E. A. Isenring et al., 2004; Ravasco, Monteiro-Grillo, et al., 2005; Ravasco, Monteiro-Grillo, et al., 2005; Um et al., 2014; van den Berg et al., 2010), in which, some patients were receiving cancer treatment with curative intent, whereas others were not. One trial included patients with cancer of the breasts, lungs or ovaries, and all of these patients were receiving chemotherapy only (Ovesen, Allingstrup, Hannibal, Mortensen, & Hansen, 1993). Another trial included patients with newly diagnosed cancer of the stomach or colorectum (C. R. Persson, Johansson, Sjoden, & Glimelius, 2002). Of the patients who underwent surgery in this last study, only a minority received chemotherapy or radiotherapy. All of the interventions involved dietary counselling to individuals. The dietary counselling was given by a dietitian with the purpose/objective to increase the nutritional intake of the patients.The study length varied from two months to twenty-four months. Two of the studies conducted measurement only at baseline and a follow-up assessment at the end of a three-month intervention (Ravasco, Monteiro-Grillo, et al., 2005; Ravasco, Monteiro-Grillo, et al., 2005; Um et al., 2014). While another three carried out multiple repeated measurements between three months and twenty-four months (E. A. Isenring et al., 2007; E. A. Isenring et al., 2004; C. R. Persson et al., 2002). For these three studies, outcome findings at approximately two months are the focus of the review. Additionally, the dietary counselling/and or supplements are effective methods of nutrition

intervention and should be delivered frequently (at least fortnightly) by a dietitian to ensure positive outcomes. (E. Isenring et al., 2008).

Regardless of the duration of the intervention, the improvement in nutritional status and quality of life were significant. Therefore, it was concluded that there was no apparent trend concerning the study length and its effects on nutritional status parameters and quality of life. Other factors such as the type of interventions and delivery methods were likely to be more prominent in predicting the effects of intervention.

The number of patients in the studies varied from 38 to 137. For the study with the smallest sample size of 38 patients (van den Berg et al., 2010), significant outcomes were found in some of the weight changes and prevalence of malnutrition relative to the control group, indicating that the reviewed studies had sufficient power to detect reasonable changes in the studied variables.

In conclusion, there were strong evidence that supports the benefits of dietary counselling in improving nutritional status and quality of life in patients with cancer.

Table 2.3. A review of randomised controlled trials on dietary interventions

Authors	Study design	Patient data	Description of intervention	Outcome of intervention*	Comments
Ovesen et al. (1993)	5-month duration	105 men and women with lung, ovarian or breast cancer undergoing chemotherapy	Individual dietary counselling aimed at a diet to meet or exceed protein and energy requirements + supplements if needed. Individual dietary counselling given before starting chemotherapy and twice monthly for 5 months.	Not significant: Improving or maintaining QOL.	
C. R. Persson et al. (2002)	24-month duration	137 men and women with newly diagnosed colorectal and gastrointestinal cancer with surgery, radiotherapy and chemotherapy treatment	Individual dietary counselling at baseline and every 3–6 months based upon the extent of disease aimed at recommended levels of daily intake. Patients were randomised in a 2 × 2 design between individual support, including nutritional measures (IS); group rehabilitation (GR); IS + GR (ISGR); or standard care (SC).	Significant: The IS + ISGR group managed to gain weight significantly more rapidly and to a greater extent than the GR + SC group. Not significant: Improving or maintaining QOL.	The multiple support such as support and advice given to the patient and family directly by the dietitian, nurses and doctors were provided education and supervision in an early discovery of nutritional problems of the patients.
Isenring et	12-week	60 patients	Regular and intensive dietary	Significant:	Early and intensive

Table.2.3 continued. A review of randomised controlled trials on dietary interventions

Authors	Study design	Patient data	Description of intervention	Outcome of intervention*	Comments
al. (2004b; 2007)	duration	commencing at least 20 fractions of radiotherapy to the gastrointestinal or head and neck area	counselling at baseline, weekly during therapy and every 2 weeks, for a total of 12 weeks. Patients were randomised into the nutrition intervention using the American Dietetic Association Medical Nutrition Therapy (ADA MNT) radiation oncology protocol vs. standard practice (general nutrition talk and booklet).	The nutrition intervention group had statistically smaller deteriorations in weight, nutritional status and global QOL. The nutrition intervention group had a higher mean total energy and protein intake compared with the standard practice group. Mean energy intake: 28–31 kcal/kg/day vs. 25–29 kcal/kg/day. Protein intake: 1.1–1.3 g/kg/day vs. 1.0–1.1 g/kg/day. <u>Not significant:</u> Difference in change of fat free mass between nutrition intervention and standard practice group. Difference in fibre intake between nutrition intervention and standard practice group.	nutrition intervention following the ADA MNT protocol appears beneficial in terms of improving dietary intake, minimising weight loss, deterioration in nutritional status, global QOL and physical function in oncology patients.
Ravasco, Monteiro-	3-month duration	111 men and women colorectal	Dietary counselling aimed at achieving calculated energy	<u>Significant</u>: At 3 months, nutritional intake and	During radiotherapy, nutritional interventions

Table.2.3 continued. A review of randomised controlled trials on dietary interventions

Authors	Study design	Patient data	Description of intervention	Outcome of intervention*	Comments
Grillo, et al. (2005)		cancer outpatients undergoing radiotherapy	and protein requirements at baseline and weekly during therapy. Patients randomised into group 1 (*n* = 37), who received dietary counselling with regular foods; group 2 (*n* = 37), who maintained usual diet plus supplements; and group 3 (*n* = 37), who maintained intake ad lib.	nutritional status in group 1 improved. However, patients in group 2 & 3 maintained nutritional intake and improved 3 of 6 function scores QOL, whereas patients in group 3 worsened all scores QOL .	positively influenced on patient outcomes.
Ravasco, Monteiro-Grillo, et al. (2005)	3-month duration	75 men and women with head and neck cancer undergoing radiotherapy with or without chemotherapy, either definite, adjuvant, or palliative	Dietary counselling aimed at achieving calculated energy and protein requirements at baseline and weekly during therapy. Patients randomised into group 1 (*n* = 25), who received dietary counselling with regular foods; group 2 (*n* = 25), who maintained usual diet plus supplements; and group 3 (*n* = 25), who maintained intake ad lib.	<u>Significant</u>: After radiotherapy, QOL function scores proportionally improved with improved nutritional intake and status in group 1 and group 2 but worsened in group 3. At 3 months, overall QOL maintained or improved in group 1 but maintained or worsened in group 2 and group 3.	During radiotherapy, nutritional interventions positively influenced on patient outcomes.
van den Berg et al.	8-week duration	38 patients with oral cavity,	All the potential patients were given dietary counselling by a	<u>Significant:</u> A significant decrease in weight loss	Early and intensive dietary counselling by

Table.2.3 continued. A review of randomised controlled trials on dietary interventions

Authors	Study design	Patient data	Description of intervention	Outcome of intervention*	Comments
(2010)		oropharyngeal or hypopharyngeal cancer undergoing radiotherapy before, during and after the treatment	dietitian before the start of radiotherapy. Patients were randomised into the individual dietary counselling (IDC) vs. standard nutritional care (SC) and passed to trained nurses during radiotherapy and thereafter.	for IDC group compared with SC group. Malnutrition decreased over time in patients with IDC while malnutrition increased in patients with SC.	a dietitian was effective in reducing weight loss and malnutrition compared with SC in patients with head and neck cancer undergoing radiotherapy.
(Um et al., 2014)	Three sessions of individualised dietary counselling over the duration of radiotherapy	87 patients with cancer around head and neck, thorax and abdomen area	Individualised dietary counselling at baseline, end of radiotherapy and 1 month follow-up by a dietitian. Patients were randomised into the intensive nutrition intervention following the standard nutrition protocol vs. control group who received one session dietary education.	<u>Significant:</u> At 1 month of follow-up, the intensive nutrition intervention group had increased number of patients with stage A status (well-nourished). Insomnia and nausea was significantly improved in the intervention group as assessed by QOL. <u>Not significant:</u> Difference in body weight, BMI, energy intake, blood albumin, total protein total and lymphocyte count between nutrition intervention and control group.	Individualised dietary counselling by a dietitian shown an improvement in nutritionals status and QOL in intervention group compared with control group in cancer patients undergoing radiotherapy.

Note. * Significant level was set at $p < 0.05$

2.13 Thesis aims

2.13.1 General aims

As shown in the previous section of this chapter, both the risk of developing CRC and the management of CRC can be modulated by D&L factors. There are current gaps in our knowledge about the prevalence of D&L risk factors in those who have an increased risk of developing CRC, and it is unknown if the risk profiles differ according to BMI status.

In addition, whilst it has been demonstrated that nutrition interventions have been effective in improving health outcomes of cancer patients undergoing different types of treatments, there is limited information on CRC patients undertaking chemotherapy alone. Furthermore there is no information available on whether a nutrition intervention in CRC patients undertaking chemotherapy will be effective in Malaysia – a country where CRC is increasing. Our studies aim to:

1. Increase our understanding of the prevalence of D&L risk factors in those with a higher risk of developing CRC and to see if the risk profile differed according to BMI status.

2. Determine the effect of an intensive individualised dietary counselling and lifestyle intervention on improving nutritional status and quality of life (QOL) in CRC patients undergoing chemotherapy.

2.13.2 Specific aims

Overall, the aims and objectives of the thesis are to investigate the awareness of knowledge, attitudes and behaviours towards dietary and lifestyle factors in a population at above average risk of developing CRC, and to determine if there were differences between those with CRC and those with IBD. Next, to determine the prevalence of D&L risk factors for CRC according to BMI status in a high risk CRC group. Finally to determine the effect of an intensive individualised dietary counselling and lifestyle intervention on improving nutritional status and quality of life (QOL) in CRC patients.undergoing.chemotherapy.

Chapter 3. Study 1: Knowledge, Attitudes and Behaviours Related To Diet and Lifestyle in a Population at Above Average Risk of CRC and CRC Patients

3.1 Introduction

Colorectal cancer is cancer that forms in the tissue of the large bowel. CRC is the second most commonly diagnosed cancer in both sexes in developed countries (Sessa et al., 2008). Modifiable risk factors for CRC are smoking, lack of physical activity, overweight and obesity, high intake of red and processed meat and excessive alcohol consumption (T. Boyle et al., 2013). Evidence from the prospective cohort study (European Prospective Investigation into Cancer and Nutrition, EPIC) indicated a significant increase of CRC with high consumption of red and processed meat (Norat et al., 2005). Similarly, the main (convincing level) factors identified by the World Cancer Research Fund (WCRF) (WCRF/American Institute for Cancer Research, 2011) that increased CRC risk factors include high intakes of red and processed meat and high alcohol intakes (more than 30 grams alcohol per day), while meta-analyses have further demonstrated the association between CRC and a high consumption of red meat and processed meat (Chan et al., 2011; Larsson & Wolk, 2006). Findings from the EPIC study also report a significant reduction in the risk of CRC for those consumed a high dietary intake of fish (Norat et al., 2005), and the WCRF identified decreased CRC risk associated with regular physical activity, and foods containing fibre, garlic, milk and calcium (WCRF/American Institute for Cancer Research, 2011).These data provide comprehensive evidence on the link between diet- and lifestyle-related risk factors and CRC.

It is acknowledged that D&L can play a role in the prevention of CRC; but CRC develops over one and perhaps two to three decades and so studies in the general population can be long, involved and extremely costly. An alternative is to conduct studies in a high-risk population where changes in neoplastic status are likely to occur at a higher rate and more quickly than in the general population. A relevant high-risk group are patients diagnosed with IBD, who are at increased risk of development of CRC (Vu, Chang, Chen, & Shih, 2012). This patient group was included in the study reported here to determine any differences in D&L practices compared to diagnosed CRC patients, as modifying nutritional factors have been shown to reduce the development of metachronous (i.e., newly developed subsequent to prior lesions) adenomas or polyps in periods as short as 9–24 months. For

example, increasing fibre in complying Familial Adenomatous Polyposis Syndrome (FAP) patients (DeCosse, Miller, & Lesser, 1989) and increasing calcium intakes in patients at risk of developing colorectal adenomas (Weingarten, Zalmanovici, & Yaphe, 2008).

A pilot survey study was conducted by Moss (2008 unpublished data) among 184 participants in Australia (Southern Co-Operative Program for the Prevention of Colorectal Cancer [SCOOP] program cohort) at increased risk of CRC as a result of neoplastic history. Participants were asked about their perceptions of diet, lifestyle and risk of CRC. The findings suggested that this population were aware of their increased risk, with most considering or attempting to make dietary or lifestyle changes. They also recognised some important risk factors but many equally important factors were not acknowledged. This group fell short of success in making changes to key D&L risk factors, suggesting the need for increased support in making changes to moderate their risk. Tailored intervention programs may be beneficial in reducing risk of CRC (Moss, 2009).

People at higher risk of developing CRC are individuals who face a high probability of contracting CRC i.e those with an above average risk of developing CRC arising from having long term IBD for more than 10 years. Alerting people with an above average risk for CRC about their modifiable risk factors, and informing them in a meaningful way about the potential impact of D&L changes that could help mitigate their risk may reduce the occurrence of CRC in this high risk group. Providing access to resources that encourage appropriate D&L changes, and increasing access to screening, may improve CRC rates in those with the highest burden.

Nutritional knowledge that is specifically related to a disease can be achieved through various ways including nutrition self-help groups (Noeres, Von Garmissen, Neises, & Geyer, 2011). In addition, patients who proactively seek nutrition information from various sources have improved nutrition. This desire to engage in healthy behaviours may be particularly salient if the patients are aware of the risk recurrence of the disease (N. Lewis et al., 2012). Even though a lot of information has been disseminated to the public as it concerns cancer backed by scientific findings, some information

circulated has no scientific backing. Therefore, to ensure that the patients are well equipped to manage disease, adequate and evidence-based information should be given so that they can apply it in their daily lives so as to improve their prognosis.

There are currently no lifestyle intervention programs routinely available for individuals considered at increased risk of CRC. Educational materials such as leaflets focusing on general dietary advice may be provided, but these have not been shown to be effective in changing behaviour (Siero, Broer, Bemelmans, & Meyboom-de Jong, 2000). For interventions to be optimally effective, attention must be paid to the distinct needs of this population. Relatively little is known regarding current knowledge of, attitudes and behaviours to, dietary and lifestyle change in those at elevated risk for CRC and how this varies between sub-groups in this population. An in-depth investigation of understanding of what nutritional knowledge these high risk people do have (including how their attitude and behaviour towards dietary and lifestyle changes to reduce CRC) would enable healthcare providers to better define risk, develop and design effective preventive strategies and information dissemination. Therefore, on the basis on this context, we conducted a survey study to get a better understanding of this population on their knowledge of, attitudes and behaviours to, dietary and lifestyle change of developing CRC. This information would be useful in the future to develop a preventive management of CRC for this population.

The cross-sectional study reported here focuses on knowledge, attitudes and behaviours among postoperative CRC patients or those undergoing chemo- and/or radiotherapy, and those with an above average risk arising from having long term IBD for more than 10 years.

3.2 Aims and hypothesis

The survey study aimed to investigate the current knowledge, attitudes and behaviours reflective of dietary and lifestyle changes that may modify the risk of developing CRC in two groups with above average risk of CRC.

The objectives of the survey study were:

1. To determine dietary and lifestyle characteristics of those with CRC undergoing treatment and those with an above average risk of developing CRC arising from having long term IBD for more than 10 years and investigate whether dietary intakes and lifestyle varied between the two groups.
2. To compare the difference between the knowledge of, attitude towards and behaviours relevant to CRC risk factors in those with CRC undergoing treatment and those with an above average risk arising from having long term IBD for more than 10 years.

The research question of the survey study was:

- Is there a higher awareness of CRC risk factors between CRC participants compared to IBD participants?

Our hypothesis is that CRC patients would have a higher awareness of CRC risk factors compared to IBD participants.

3.3 Methods

3.3.1 Study design and study population

The study was a survey, cross-sectional study to determine the difference of knowledge of, attitude and behaviour to, dietary and lifestyle changes in those with postoperative CRC or undergoing chemo and/or radiotherapy and those with an above average risk of developing CRC arising from having long term IBD for more than 10 years.

Participants were selected from the Repatriation General Surgery Clinic, Flinders Medical Centre (FMC) Colorectal Unit Clinic and FMC Gastroenterology (Luminal) Clinic.

The inclusion criteria were as follows:

- Those people who: are in the Repatriation General Surgery Clinic, Flinders Medical Centre (FMC) Colorectal Unit Clinic and FMC Gastroenterology (Luminal) Clinic.; have fully characterised colorectal neoplastic status specifically those who had completed his/her CRC surgery or were undergoing chemo and/or radiotherapy and or those with an above average risk arising from having long term IBD for more than 10 years (e.g., clinically diagnosed ulcerative colitis and Crohn's disease).
- Aged ≥ 18 years old.
- Provide written informed consent.
- Willing to comply to study procedures.

The exclusion criteria were as follows:

- Those people who: are not in the Repatriation General Surgery Clinic, Flinders Medical Centre (FMC) Colorectal Unit Clinic and FMC Gastroenterology (Luminal) Clinic; are not fully clinically characterised as outlined above.
- Non-English speaking.
- Involved in another research project.

3.3.2 Screening and recruitment of participants

Screening and recruitment of CRC participants were carried out simultaneously on potential participants who had visited the Repatriation General Surgery Clinic and Flinders Medical Centre (FMC) Colorectal Unit Clinic. During the clinic day, patients were screened for eligibility to participate in this study. Eligible patients were identified and approached by the clinician who was aware of the inclusion and exclusion criteria. Patients provided a verbal consent to allow their name and address details to be given to the researchers. The IBD participants were selected from an existing patient database in the FMC Gastroenterology (Luminal) Clinic. Only potential IBD participants from Flinders Medical Centre and the Repatriation

General Hospital were selected to be recruited into the study. The IBD patients were also screened for eligibility to take part in the study.

Potential participants were recruited by an invitation letter from the researcher outlining the purpose of the study and the involvement required by the participant (See Appendix A). The invitation letters were sent in a mailed package which also included a form for participants to indicate their preference for a paper or online survey (dietary intakes, knowledge, attitude and behaviour related to D&L changes that could modify the risk of developing CRC questionnaires), an Introduction letter to introduce to participants the researcher's background (See Appendix B), a Participant Information Sheet (See Appendix C), a consent form (See Appendix D) and a self-addressed reply-paid envelope.

The participants who responded to the invitation letter and returned the consent form to the researcher could designate which form of the questionnaires they would prefer to complete according to their preference. For those who preferred paper or a printed copy of questionnaires, a mailed package containing a mailed out letter and all the questionnaires were posted to the participant together with a reply-paid envelope. The brief instructions on how to fill out the questionnaire were provided at the start of each questionnaire.

For those who indicated a preference to answer the questionnaires online, a valid email address was provided to the researcher. The link to the survey was sent to them via email. The guidelines on how to answer the web-based version were provided in the link. Each of the participants was given their own specific link into the questionnaires. There were two separate links to each of the questionnaires with unique passwords given to the participants. For the knowledge, attitudes and behaviours online survey, the questionnaire was created using SurveyMonkey (http://www.surveymonkey.com). Whilst for the dietary intake questionnaire, it was prepared by I-view Pty Ltd, a commercial social marketing company that has considerable experience in delivering health-related on-line questionnaires.

In the online version, the patients were reminded of missing answers if they tried to leave a page incomplete. However, after pressing an “OK” button, they were allowed to continue even if there were still missing answers. Whilst completing the online questionnaires, the patients were able to go back and revise answers to previous items if they wished. All patients were asked to complete and to return their questionnaires, approximately within two weeks after receiving the study questionnaires. The reminder letter for questionnaire return (See Appendix E) from the researcher was sent or a telephone call was made to them if they had not responded and returned the questionnaires later than two weeks.

Subsequently, potential participants were followed up two weeks later to check their interest in participating in the study by a reminder letter (See Appendix F). The reminder letter informed the potential participants that they were free to answer the questionnaires using either the online version or paper version. The same procedures were followed. In addition, participants were followed up with a telephone call from the researcher approximately two weeks after the return of the questionnaires for clarification of any unclear or unusual responses received. There were no incentives to promote the survey response. Survey methods known to increase response rates were used including multiple reminders (e.g. postcard and second questionnaire), stamped return envelopes, personalised cover letters, coloured paper, assurances of confidentiality, and an indication that the study had university sponsorship (Dillman, 1983).

Additional clinical data from medical records were accessed to gain information about their medical history relevant to CRC such as patient co-morbidities, the extent of disease (disease stage) and treatment received. The dietary intakes and knowledge, attitude and behaviour related to D&L changes that may affect the risk of developing CRC from each of the two groups were compared and contrasted.

3.3.3 Sample size calculation

The participants were categorised into the following two groups:

1. Those with CRC (postoperative and those with CRC undergoing chemo- and/or radiotherapy).
2. Those with a long term IBD for more than 10 years

The earlier studies reported around 16–52% knowledge level of D&L risk factors in CRC and IBD patients (CRC patients 47–52% and IBD patients with a lower awareness at around 16%). For the basis of determining the sample size, we chose the proportion of 47% knowledge level of the link between D&L risk factors and CRC as this was estimated from a population in New Zealand with a culture similar to Australia (Cha et al., 2012).

The PASS (Power Analysis and Sample Size) software was used to calculate the sample size and power. Group sample sizes of 44 in group one and 44 in group two would achieve 90% power to detect a difference between the group proportions of 0.3140. The proportion in group one is assumed to be 0.1560 under the null hypothesis and 0.4700 under the alternative hypothesis. The test statistic used was the two-sided Z test with pooled variance (Fleiss, Levin, & Paik, 2013). The significance level of the test was targeted at 0.05.

Allowing for an attrition rate of 10%, we therefore aimed to recruit 49 in group one (those with postoperative CRC and those undergoing treatment) and 49 in group two (those with a long term IBD for more than 10 years).

3.4 Ethics approval

This study was approved by the Southern Adelaide Clinical Human Research Ethics Committee (Application number: 366.13; See Appendix G). Permission to conduct the study was obtained from the Heads or Directors of the Repatriation General Surgery Clinic, Flinders Medical Centre (FMC) Colorectal Unit Clinic and FMC Gastroenterology (Luminal) Clinic.

3.5 Research instruments

Data were collected and collated from both the electronic and paper versions of the questionnaires. The details of the questionnaires are described in the following sub-sections.

3.5.1 Socio-demographic background

The socio-demographic questionnaire was designed to collect information on demographic, socio-economic and lifestyle habits. The demographic and socio-economic sections included age, gender, marital status, education levels, current and past smoking and alcohol habits. Anthropometric assessments (i.e., height and weight) was obtained from self-reports. There were a total of 17 questions which took about 10 minutes to complete (See Appendix H).

3.5.2 Physical activity

The Australian Institute of Health and Welfare Active Australia Survey physical activity questions were adopted to assess the physical activities pattern of the participants (Australian Institute of Health and Welfare (AIHW), 2003) (See Appendix H). These questions are a standard validated instrument used to monitor physical activity participation in the Australian population (Australian Institute of Health and Welfare (AIHW), 2003; M. L. Booth, N. Owen, A. Bauman, & C. J. Gore, 1996; M. L. Booth, N. Owen, A. E. Bauman, & C. J. Gore, 1996). The questionnaire consists of eight questions to assess participation in various types of activity. For each activity type there are two questions—number of sessions and time per week (recorded in hours and/or minutes). There are a number of different measures of participation in physical activity during the previous week, for example, the number of sessions of physical activity, total time spent in each activity, average time spent in each activity, to allow calculation of the proportion of people who were doing a sufficient amount of activity or people who were sedentary.

Total activity time is calculated by adding the number of minutes spent in walking and moderate activity plus the number of minutes spent in vigorous activity (not including gardening and yard work). The time spent in vigorous activity was double weighted as it is considered more intense and has been shown to contribute greater health benefit (Australian Institute of Health and Welfare (AIHW), 2003). The amount of total activity sessions is calculated by adding the number of sessions of walking, moderate activity and vigorous activity (not including gardening, as before). For the purpose of this study, we were interested in determining the proportion of people doing 'sufficient' activity to confer health benefits. Therefore, we used a calculation on the accumulation of at least 150 minutes of activity over a week. The activities included participation in walking, moderate activity, and vigorous activity. Gardening is not included in the calculation of sufficient activity, as there is limited research on the validity of the self-reported intensity of these activities (Armstrong, Bauman, & Davies, 2000).

For calculation of sufficient activity using time only, the data are grouped into three categories: 'sedentary' or 'being inactive' (people who are doing no activity at all or 0 minutes per week), 'insufficiently active' (people who are participating in some activity but not enough to obtain a health benefit or 1–149 minutes per week) and 'sufficiently active' (participation in at least 150 minutes per week) on the basis of Australian Physical Activity guidelines (Australian Institute of Health and Welfare (AIHW), 2003; A. L. Hawkes, Lynch, Youlden, Owen, & Aitken, 2008). In addition, current Australian public health guidelines advocate achieving the equivalent of 150 minutes of moderate-intensity activity per week (Deparment of Health and Aged Care (DHAC), 1999). The Active Australia Survey questions have been reported to exhibit good reliability and acceptable validity (W. Brown, Bauman, Timperio, Salmon, & Trost, 2002).

3.5.3 Knowledge, attitudes, and behaviour to dietary and lifestyle changes assessment

The structured questionnaire was adopted from two existing validated questionnaires to assess the knowledge and attitudes (Dyer, Fearon,

Buckner, & Richardson, 2004) and behaviour dietary and lifestyle changes of the participants (Sessa et al., 2008) (See Appendix H). The questionnaire consisted of 34 questions, including 15 on knowledge of dietary and lifestyle factors associated with CRC risk, 10 on attitudes and 9 on behaviour to change dietary and lifestyle habits.

For the knowledge items the participants were presented a list of D&L factors associated with CRC and asked to indicate whether they thought these factors could impact upon the risk of CRC cancer with response options '1—Increases risk of CRC' or '2—Reduces risk of CRC' or '3—No effect' or '4—Don't know'. For calculation, correct answer were scored '1' and wrong answer were score '0'. A 'total knowledge score' were then calculated by adding the recoded scores (maximum score of 15). For the knowledge category, a total score range from 0–5 was classified as having low knowledge, medium (6–10) and high (11–15). Although total score based on 15 questions, 10 risk factors were presented as they were better aligned to WCRF risk factors with convincing and probable CRC risk factors.

For the attitudes to dietary and lifestyle changes items the response options were '1—Agree', '2—Disagree', and '3—Neither agree nor disagree'. The score was then calculated based on a score of 1 when they agreed with the correct associations and a zero score when they did not agree or neither agreed nor disagreed with the correct associations. Therefore, the total attitudes score was calculated by adding the recoded scores (maximum score of 10). For the attitude category, total attitude score that ranged from 0 to 4 was categorised as low attitude, or high attitude if between 5 and10. A higher score indicates a more positive attitude. Questions about health-related behaviours included whether or not participants performed physical activities, had modified their dietary habits and/or physical activity for fear of developing CRC, and had participated in preventive activities relevant to CRC. Finally, participants were also asked about sources of dietary and lifestyle information in close-ended questions with multiple choice answers provided.

3.5.4 Dietary intake

The validated Victorian Cancer Council Food Frequency Questionnaire—The Dietary Questionnaire for Epidemiological Studies Version 2 (DQES v2) was used to assess the usual daily food and nutrient intakes of the participants over the previous 12 months (Ambrosini et al., 2003; Giles & Ireland, 1996; Hodge et al., 2000) (See Appendix I).

The first page of the DQES v2 includes questions on how many pieces of fresh fruit and how many different vegetables are consumed daily. The results of these questions are used to adjust the results from the frequency component of the food frequency questionnaire (FFQ), which tends to over-estimate intakes. For example, if the answer to question 1 was '2 pieces of fruit per day' and the total fruit intake from question 15 was three pieces per day, the daily intake for each fruit consumed would be scaled down by 2/3. The same applies to vegetables. Other questions determine the amount and type of milk and bread eaten, the type of fat spread used, the amount of sugar consumed daily, the weekly intake of eggs and the type of cheese eaten. With the questions specifying types of foods, more than one answer can be selected. If multiple answers are provided, the nutrients are computed assuming equal intakes of each type of milk, bread, spread or cheese.

The second page of the FFQ consists of four sets of photos depicting three different single portion size factors (PSF) indicating whether on average a person eats median size serves (PSF=1), more than the median (PSF > 1), or less than the median (PSF < 1) for potatoes, vegetables, steak, and meat or vegetable casserole. These serve sizes are based on the distribution of serving sizes reported in the pilot study of 810 Australian Italian and Greek-born men and women (Ireland et al., 1994). By selecting serving sizes that are less than, equivalent to, between or more than the serving size shown in the photos, seven different serving sizes can be attributed to each food class. These serves are allocated scores; never eat = 0, less than A = 0.4, equivalent to A = 0.5, between A and B = 0.75, equivalent to B = 1.0, between B and C = 1.5, equivalent to C = 2.0, and more than C = 2.5, which are then averaged for an individual.

The final pages of the FFQ consist of a list of 74 items with 10 frequency response options, ranging from 'Never' to '3 or more times per day', and 3 questions of more detailed information about the consumption of alcoholic beverages. Daily food intake was calculated by multiplying frequency by relative portion size for each food item in the FFQ. Daily dietary intakes of energy, macro and micro nutrients were calculated from the daily food and beverage intake and computed from the FFQ using software developed by the Anti-Cancer Council of Victoria, which is based on NUTTAB95 (Australian Government Publishing Service, Canberra) nutrient composition data (National Food Authority, 1995).

In addition, the amount of food intake (g/day) per food group of red meat, processed meat, alcoholic beverages, vegetables, fruits and cereals were also calculated. The amount of food intake per food group of red meat included beef, veal, lamb and pork. The processed meat included sausages, hamburger patty, bacon, ham and salami. Alcoholic beverages included light and heavy beer, red, white and fortified wine, and spirits. The vegetables included broccoli, cauliflower, spinach, peas, green beans, cabbage, bean sprouts, carrot, mushroom, tomatoes, lettuce, zucchini, and celery. Fruits included grapes, strawberries, melon, mango, pineapple, avocado, apple, pear, orange, peaches, and banana. Also for cereals included cold breakfast cereal (e.g., Weet Bix™, All Bran™, Branflakes™, corn flakes, muesli), porridge, high fibre, white and wholemeal bread, rice, pasta and crackers.

3.6 Results

3.6.1 Characteristics of participants

A total of 195 potential participants were initially approached into the study, two were not contactable, one returned the invitation letter to the researcher at the beginning of study and one was deceased. At this initial stage 30 participants responded and completed the questionnaires. Out of the remaining 161 patients, only 10 patients refused to participate in the study after they had received a first reminder letter. The second reminder letter was sent to 151 patients to seek their interest in volunteering for participating in

the study. Only one patient refused to take part in the study, initially 4 of the patients were interested to take part in the study but did not return the questionnaires and 14 participants responded and completed the questionnaires (Figure 3.1). Therefore, of the 195 eligible patients, a total of 44 consented to take part in the study of which 14 (31.8%) had CRC and 30 (68.2%) were IBD, giving an overall response rate of 23%.

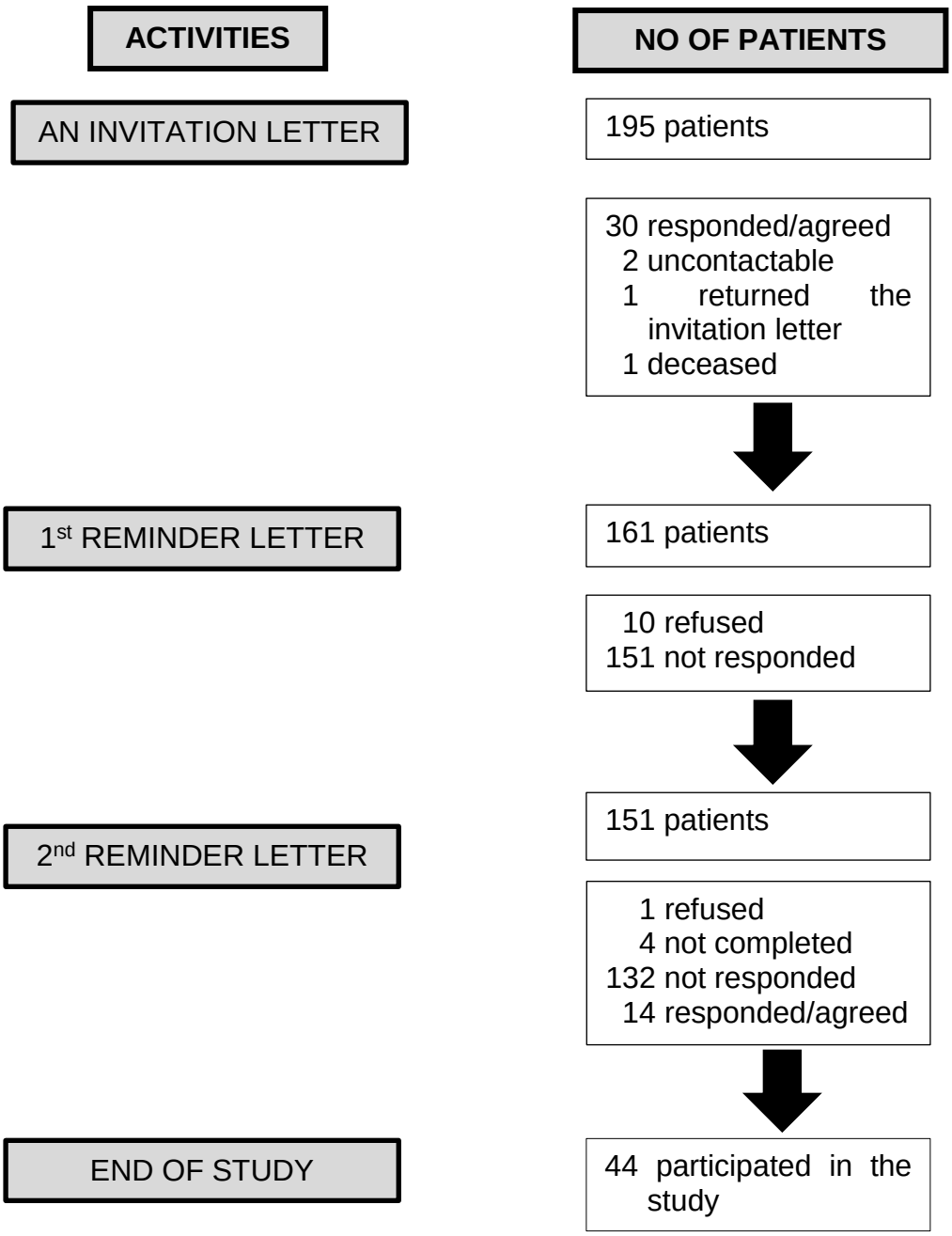

Figure 3.1. Process of recruitment of eligible patients.

Table 3.1 shows the socio-demographic background characteristics of the participants. Independent *t*-test analysis, showed that the baseline results were comparable for mean age between the two groups ($p > 0.05$). Participants in this study were on average in their 50s. Mean age for participants with CRC was 58 years (range: 36–78 years) and for those with

long term IBD was 56 years (range: 21–79 years). Of the participants with CRC, 50.0% were 60 years of age or older and 64.3% were men.

Most IBD participants regularly engaged in physical activity more than 150 minutes per week. On the other hand, few CRC participants reported engaging in more than 150 minutes. One participant in both groups was sedentary not doing any kind of physical activity. Of participants with CRC, 64.3% were insufficiently active (1–149 minutes per week) (Table 3.1). As shown in Table 3.1, most of the participants in IBD group were never - smokers (73.3%) and none of the patients from IBD group were current smokers. However, 5 (35.7%) of CRC participants were currently a smoker even though they knew that cigarettes smoking would increase their risk for developing CRC. There were statistically differences on smoking and physical activity levels between CRC and IBD group respectively ($p < 0.002$; $p < 0.035$). Close to 80% of CRC participants were overweight or obese compared to 60.0% of IBD participants using self-reported height and weight.

Table 3.1. Socio-demographic background and behavioural characteristics of the participants in the colorectal cancer (CRC) and inflammatory bowel disease (IBD) groups

Characteristics	CRC (n=14)		IBD (n=30)		*p value
Age (years)*					
(Mean ± SD)	58.00 ± 11.65		56.13 ± 13.22		0.654
	n	**% of participants**	***n***	**% of participants**	****p* value**
Age group					
21–44 years	2	14.3	4	13.3	0.933
45–64 years	9	64.3	18	60.0	
≥ 65 years	3	21.4	8	26.7	
Gender					
Male	9	64.3	15	50.0	0.375
Female	5	35.7	15	50.0	
Educational level					
Primary/Secondary	6	42.9	15	50.0	0.795
Tertiary	8	57.1	15	50.0	
Occupation					
Unemployed	4	28.6	9	30.0	0.634
Employed	10	71.4	21	70.0	
Smoking status					
Smoker	5	35.7	0	0.0	0.002
Ex-smoker	4	28.6	8	26.7	
Non/never-smoker	5	35.7	22	73.3	
Body Mass Index (BMI),kg/m^2					
Normal, 18.5 – 24.5 kg/m^2	3	21.4	12	40.0	0.476
Overweight, 25.0 – 29.9 kg/m^2	7	50.0	11	36.7	
Obese, ≥30.0 kg/m^2	4	28.6	7	23.3	
Physical Activity Level					
Sedentary (0 min)	1	7.1	1	3.3	0.035
Insufficient (1–149 min)	9	64.3	8	26.7	

Sufficient (≥ 150 min)	4	28.6	21	70.0

*p > 0.05 not significantly different with Independent T-Test

**Chi-square analysis

3.6.2 Dietary intake

The energy and nutrient intakes of the participants in both groups are tabulated in Table 3.2. Dietary intakes of the participants in both groups were comparable and not significantly different. The intakes of the IBD group were consistently higher than the CRC group for 15 out of the 17 nutrients reported, although this was not significantly different.

Table 3.2. Comparisons of estimated usual daily nutrient intake between the colorectal cancer (CRC) and inflammatory bowel disease (IBD) participants

Nutrient intake per day	CRC (n=14)			IBD (n=30)		
	Median	IQR	% macro nutrients	Median	IQR	%macro nutrients
Energy, kJ	6988	5310–8230		7019	5817–10768	
All Fat, g	69	53–85	37	68	55–104	37
Saturated fat, g	27	22–32		28	21–37	
Polyunsaturated fat, g	9	5–12		11	7–17	
Monounsaturated fat, g	23	17–33		24	19–37	
Protein, g	83	62-108	20	89	72–114	20
Carbohydrate, g	175	175-206	43	185	137–286	43
Fibre, g	20	15–23		22	18–30	
Calcium, mg	842	676–1123		1010	693–1219	
Alcohol, g	1.0	0.3–7.0		3	0.4–13.0	
Cholesterol, mg	282	224–333		259	230–331	
Folate, μg	265	178–297		282	220–361	
Iron, mg	11	8–14		12	10–17	
Sodium, mg	2167	1723–3198		2260	1883–3375	
Vitamin C, mg	102	68–140		107	80–148	
Vitamin E, mg	5	4–6		6	4–9	
Zinc, mg	10	7–15		11	8–14	

**p* values are based on Mann-Whitney U test for skewed data

Table 3.3 shows the mean weight (g/day) of usual daily food intake per key food group (i.e., red meat, processed meat, alcoholic beverage, fruit and vegetables, and cereals) between CRC and IBD groups. The CRC group consumed less processed meat, less alcoholic beverages, less vegetables and more fruits and cereals than IBD group but there was a statistically significant difference between CRC and IBD groups only for fruits intake with the CRC group reporting almost 150 g more fruit per day compared to the IBD group ($p < 0.001$).

Table 3.3. Comparisons of the amount food intake per food group between colorectal cancer (CRC) and inflammatory bowel disease (IBD) participants

The amount food intake per food group	CRC (n=14) Mean ± SD	IBD (n=30) Mean ± SD	*p* value
Red meat, g/day	63.7 ± 52.2	68.3 ± 50.2	0.780
Processed meat, g/day	24.5 ± 18.1	33.1 ± 29.4	0.323
*Alcoholic beverages, g/day	79.4 ± 109.1	217.0 ± 507.6	0.535
Vegetables, g/day	83.9 ± 35.6	114.1 ± 59.2	0.086
Fruits, g/day	325.3 ± 159.9	178.5 ± 99.4	**0.001
Cereals, g/day	256.3 ± 160.6	209.1 ± 122.3	0.288

*Statistical analyses were performed on log-transformed data

****p<0.05 statistically significant different with Independent T-Test

3.6.3 Knowledge, attitudes, and behaviour towards healthy diet and lifestyle

Participants identified factors that would increase and decrease the risk for developing CRC. Table 3.4 shows that 66.7% to 90% of IBD participants correctly identified the following as increasing the risk for developing CRC: being obese, being overweight, drinking alcohol, cigarette smoking, eating red and processed meat every day, low fibre intake, and high food fat intake. Meanwhile, 35.7% to 78.6% of the CRC patients correctly identified factors that have been associated with increasing risk for developing CRC. Within the IBD group most of the participants were aware that being

obese/overweight (77–90%) and having a low fibre intake (80%) could increase the risk of developing CRC. There were statistical differences between the CRC and IBD groups on awareness of low fibre intake increase the risk of developing CRC ($p < 0.023$). On the other hand within the CRC group, most of the participants were more aware of cigarette smoking (79%) and eating red and processed meat (71%).

For both the CRC and the IBD groups, most of participants (79% and 83% respectively) were aware that increasing fruit and vegetable intakes could decrease the risk of developing CRC. Only 63–64% of both groups recognised physical activity as a potential mitigating risk factor. A low proportion in both groups (21.4% and 3.3% respectively) were aware that increasing calcium intake could decrease the risk of developing CRC. There were no statistically significant differences between the two groups in terms of knowledge of mitigating risk factors.

Table 3.4. Knowledge related to specified diet and lifestyle factors on risk of colorectal cancer (CRC) among CRC and inflammatory bowel disease (IBD) participants

In your opinion, which things listed below **INCREASE** risk of developing CRC					
Response	CRC		IBD		*p value
	n	%	n	%	
Being obese	8	57.1	27	90.0	0.088
Being overweight	8	57.1	23	76.7	0.519
Drinking alcohol	9	64.3	20	66.7	0.749
Cigarette smoking	11	78.6	22	73.3	0.670
Eating red and processed meat everyday	10	71.4	22	73.3	0.529
Low fibre intake	5	35.7	24	80.0	0.023
High intake of dietary fat	9	64.3	21	70.0	0.220

*Chi-square analysis

In your opinion, which things listed below **DECREASE** risk of developing CRC					
Response	CRC		IBD		*p value
	n	%	n	%	

Engaging in regular physical activity	9	64.3	19	63.3	0.793
Eating 2 serves of fruit and 5 serves of vegetables daily	11	78.6	25	83.3	0.776
Dietary calcium intake	3	21.4	1	3.3	0.242

*Chi-square analysis

Even though most of the participants had some knowledge of risk factors for developing CRC, only 42.9% of CRC group and 20% of IBD group modified their dietary habits and 14.3% of CRC group and 10% of IBD group modified their physical activity levels for fear of developing CRC (Table 3.5). There were no statistical differences between the CRC and IBD groups.

Table 3.5. Modification of dietary habits and physical activity for fear of developing colorectal cancer (CRC) among CRC and inflammatory bowel disease (IBD) participants

Have you modified your physical activity level and dietary habits for fear of developing CRC?	**CRC**		**IBD**		***p* value**
	Yes	**No**	**Yes**	**No**	
	***n* (%)**	***n* (%)**	***n* (%)**	***n* (%)**	
Modified dietary habits	6 (42.9)	8 (57.1)	6 (20.0)	24 (80.0)	0.677
Modified physical activity	2 (14.3)	12 (85.7)	3 (10.0)	27 (90.0)	0.113

*Chi-square analysis

Participants' total knowledge and total attitude scores are shown in Table 3.6. Overall, on average the knowledge of risk factors was medium and attitudes were just in the high category. The average knowledge score, even though it is in the medium category indicates that the groups only had correct knowledge of 7–8 (~50%) out of a total of 15 risk factors. There were no statistical differences between the CRC and IBD groups. Table 3.7 shows knowledge and attitudes categories among the CRC and IBD participants. Majority of IBD participants (66.7%) had a medium knowledge on risk factors of developing CRC. On the other hand, knowledge of CRC patients fell

equally in the low and medium categories. Very few (13–14%) within both groups had a high level of knowledge. Majority of both groups were categorised as having a high attitudes category. There were no statistically significant differences between the two groups.

Table 3.6. Mean ± SD total knowledge and attitude scores among colorectal cancer (CRC) and inflammatory bowel disease (IBD) participants

Total Score	CRC (n=14) Mean ± SD	IBD (n=30) Mean ± SD	*p value
Knowledge	6.71 ± 4.37	7.57 ± 2.73	0.621
Attitudes	5.86 ± 2.17	6.00 ± 1.81	0.819

*p values are based on Mann-Whitney U test for skewed data

Table 3.7. Knowledge and attitude categories among colorectal cancer (CRC) and inflammatory bowel disease (IBD) participants

Category	CRC		IBD		*p value
	n	%	*n*	%	
Knowledge					
Low (0–5)	6	42.9	6	20.0	0.253
Medium (6–10)	6	42.9	20	66.7	
High (11–15)	2	14.3	4	13.3	
Attitudes					
Low (0–4)	4	28.6	7	23.3	0.709
High (5–9)	10	71.4	23	76.7	

*Chi-square analysis

Patients' total knowledge and total attitude scores (median and IQR) according to participants' characteristics are shown in Table 3.8 and Table 3.9 respectively. There were no statistical differences for these variables characteristics between the CRC and IBD groups. Only physical activity level attitude scores were shown to be statistically significantly different between CRC group and IBD group—in those who were already active, the IBD group had a more positive attitude to physical activity compared to the CRC group ($p < 0.05$).

Table 3.8. Median (IQR) knowledge scores among colorectal cancer (CRC) and inflammatory bowel disease (IBD) participants according to characteristics

Participants' characteristics	CRC (n=14)	IBD (n=30)	*p value
Age group			
21–44 years	5.5 (1.0–10.0)	7.0 (3.0–9.5)	0.350
45 – 64 years	8.0 (3.0–9.0)	8.0 (6.0–10.0)	0.430
≥ 65 years	8.0 (4.0–10.0)	8.0 (6.0–8.5)	0.910
Gender			
Male	4.0 (3.0–9.0)	8.0 (7.0–10.0)	0.140
Female	9.0 (8.0–11.0)	8.0 (5.0–9.0)	0.290
Marital status			
Unmarried	9.0 (3.0–11.0)	9.0 (7.0–9.5)	0.960
Married	6.0 (3.0–9.0)	7.0 (6.0–8.0)	0.510
Education level			
Primary/Secondary	6.0 (3.0–9.0)	8.0 (6.0–9.0)	0.530
Tertiary	8.5 (3.0–10.5)	8.0 (6.0–10.0)	0.820
Occupation			
Unemployed	8.5 (6.0–9.5)	8.0 (6.0–8.0)	0.630
Employed	5.5 (3.0–10.0)	8.0 (6.0–9.5)	0.430
Smoking			
Smoker	3.0 (3.0– 0.0)	0.0 (0.0)	-
Ex-smoker	6.5 (3.5–9.5)	7.5 (6.0–9.0)	0.790
Non-smoker	8.0 (8.0–9.0)	8.0 (6.0–10.0)	0.760
BMI (Body Mass Index)			
Normal	3.0 (0.0–10.0)	8.0 (6.0–9.0)	0.340
Overweight	8.0 (4.0–10.0)	8.0 (7.0–10.0)	0.810
Obese	6.0 (3.0–10.0)	7.0 (4.0–9.0)	0.770
Physical activity level			
Not active	6.0 (3.0–9.0)	7.0 (6.0–9.0)	0.530
Active	10.0 (4.5–13.0)	8.0 (6.0–9.0)	0.340
Information about CRC			
No	4.5 (0.5–8.0)	8.0 (5.0–10.0)	0.260
Yes	9.0 (3.0–10.0)	8.0 (7.0–9.0)	0.920
Needs information about CRC			
No	4.0 (3.0–10.0)	8.0 (5.5–9.5)	0.450
Yes	9.0 (8.0–9.0)	8.0 (6.0–9.0)	0.630

IQR, Inter-quartile range; *p values are based on Mann-Whitney U test for skewed data; no p value for smoker as there was no smoker in the IBD group

Table 3.9. Median (IQR) attitude scores among colorectal cancer (CRC) and inflammatory bowel disease (IBD) participants according to characteristics

Participants' characteristics	CRC (n=14)	IBD (n=30)	*p value
Age group			
21–44 years	6.0 (6.0–6.0)	6.0 (5.0–7.0)	0.120
45–64 years	5.0 (4.0–8.0)	6.0 (4.0–7.0)	0.720
≥ 65 years	7.0 (6.0–8.0)	7.0 (6.0–7.5)	0.910
Gender			
Male	6.0 (4.0–8.0)	6.0 (4.0–8.0)	0.940
Female	6.0 (5.0–6.0)	6.0 (5.0–7.0)	0.620
Marital status			
Unmarried	4.5 (3.0–6.0)	6.5 (5.0–7.0)	0.120
Married	7.0 (5.5–8.5)	6.0 (4.0–7.0)	0.260
Education level			
Primary/Secondary	7.5 (6.0–8.0)	6.0 (5.0–7.0)	0.150
Tertiary	5.0 (3.5–6.0)	7.0 (4.0–8.0)	0.215
Occupation			
Unemployed	6.5 (5.0–7.5)	7.0 (4.0–8.0)	0.512
Employed	5.5 (4.0–8.0)	6.0 (5.0–7.0)	0.720
Smoking			
Smoker	5.0 (5.0–7.0)	0.0 (0.0)	-
Ex-smoker	5.0 (3.0–7.0)	6.0 (5.5–7.0)	0.480
Non-smoker	6.0 (6.0–8.0)	6.0 (4.0–7.0)	0.680
BMI (Body Mass Index)			
Normal	6.0 (4.0–9.0)	7.0 (5.0–7.0)	0.930
Overweight	7.0 (6.0–8.0)	7.0 (5.0–8.0)	0.850
Obese	4.5 (3.0–5.0)	5.0 (3.0–6.0)	0.550
Physical activity level			
Not active	6.5 (6.0–8.0)	6.0 (3.0–7.0)	0.260
Active	4.0 (3.0–5.0)	6.0 (5.0–8.0)	0.010*
Information about CRC			
No	6.0 (5.0–7.5)	6.0 (4.0–7.0)	0.840
Yes	5.5 (4.0–8.0)	6.5 (5.0–7.0)	0.770
Needs Information about CRC			
No	6.0 (5.0–8.0)	7.0 (5.0–7.0)	0.710
Yes	6.0 (4.0–7.0)	6.0 (4.0–7.0)	-

IQR, Inter-quartile range; *p values are based on Mann-Whitney U test for skewed data; no p value for smoker as there was no smoker in the IBD group; no p value for needs information about CRC as the medians are the same across of CRC and IBD.

We undertook an exploratory analysis in order to understand if gender or age was an important predictor of knowledge within the CRC group, even though we are aware that the numbers are small. Table 3.10 shows that there are no statistically significant differences in total knowledge scores between the younger age and older ages among CRC and IBD participants. However, there was slightly higher knowledge score in older CRC participants compared to those of a younger age. Awareness of risk factors for developing CRC was not significantly different between genders (Table 3.10). However, total knowledge score shows statistically significant difference between CRC and IBD groups in men ($p < 0.05$). There were also no differences in knowledge scores between younger or older ages in men and women among CRC and IBD participants ($p > 0.05$).

Table 3.10. Total knowledge scores (mean ± SD) among colorectal cancer (CRC) and inflammatory bowel disease (IBD) participants according to characteristics

Participants' characteristics	Total Knowledge Score		*p value
	CRC	IBD	
Age group			
64 years and less	6.45 ± 4.61	7.64 ± 3.07	0.387
≥ 65 years	7.33 ± 3.05	7.38 ± 1.59	0.976
Gender			
Men	5.56 ± 3.71	8.07 ± 2.25	0.050
Women	8.60 ± 4.82	7.07 ± 3.15	0.419
Gender and Age group			
Men and 64 years and less	5.14 ± 3.80 (n=7)	8.08 ± 2.50 (n=12)	0.057
Men and ≥ 65 years	7.00 ± 4.24 (n=2)	8.00 ± 1.00 (n=3)	0.700
Women and 64 years and less	8.75 ± 5.56 (n=4)	7.10 ± 3.70 (n=10)	0.525
Women and ≥ 65 years	6.55 ± 2.33 (n=2)	7.35 ± 3.61 (n=4)	0.331

*p >0.05; not significantly different with Independent T-Test

Table 3.11 shows that 60% of the IBD group feel the level of D&L information about CRC they have received since diagnosis was too little to meet their needs and they were interested to seek information or any D&L advice about CRC. This is in contrast with the CRC group in which 35.7% of the participants indicated that they do need information about CRC. However, there are no statistically significant differences in information needed about CRC between CRC and IBD participants.

Table 3.11. Information needed about colorectal cancer (CRC) for CRC and (inflammatory bowel disease) IBD participants

Do you feel you need information about CRC?	CRC	IBD	*p value
	n(%)	n(%)	
Yes	5(35.7)	18(60)	
No	9(64.3)	12(40)	0.133

*Chi-square analysis

Twenty-nine percent of the CRC group and 40% of the IBD group reported that they did not receive any information about CRC (Table 3.12). Resources given by health care providers were used by both groups, with the most commonly cited providers being physicians (78.6% in CRC group and 43.3% in IBD group), and followed by nurses (21.4% in CRC group and 10% in IBD group) and dietitian (21.4% in CRC group and 6.7% in IBD group) (Table 3.12). Use of mass media (e.g., television and radio) was also widely reported in IBD group (13.3%) and shows a statistically significant difference between CRC and IBD group ($p < 0.05$) (Table 3.12). Both groups (35.7% in CRC group and 43.3% in IBD group respectively) indicated that they want to receive information about CRC by written information such as booklet, leaflets and or brochures (Table 3.12) and there were significantly more IBD participants who preferred information from the internet compared to the CRC participants (27% vs. 0%, $p = 0.033$).

Table 3.12. Sources of information about colorectal cancer (CRC) received and preferred information to receive for both the CRC and inflammatory bowel disease (IBD) groups

	CRC		IBD		*p value
	n	%	*n*	%	
The following sources they receive information about CRC					
None	4	28.6	12	40.0	0.547
Mass media	1	17.1	4	13.3	0.029
Physician	11	78.6	13	43.3	0.304
Nurses	3	21.4	3	10.0	0.139
Scientific journals	1	7.1	0	0.0	0.490
Educational courses	0	0.0	1	3.3	0.151
Dietitian	3	21.4	2	6.7	0.151
How you would like to receive the information about CRC?					
Written information	5	35.7	13	43.3	0.632
Media	0	0.0	4	13.3	0.152
Face to face	2	14.3	6	20.0	0.647
Medical centre	1	7.1	2	6.7	0.953
Internet	0	0.0	8	26.7	0.033

*Chi-square analysis

3.7 Discussion

Even though this study is small, a total of 44 consented to take part in the study of which 14 (31.8%) had CRC and 30 (68.2%) were IBD, and we did not achieve our projected number of participants into the study, which aimed to recruit 49 in group one (those with postoperative CRC and those undergoing treatment) and 49 in group two (those with a long term IBD for more than 10 years). However, it showed that there was a high prevalence of D&L risk factors in these two high risk groups (those with CRC or long-term IBD) combined with only medium levels of knowledge of risk factors and a

high positive attitude towards making changes to these risk factors. There was a very low proportion who had made any attempt to modify their dietary or physical activity habits to reduce their risk of CRC. The IBD group had a lower prevalence rate of some risk factors (e.g., less sedentary, fewer were overweight or obese) and reported better knowledge of some risk factors compared to the CRC group.

3.7.1 Dietary intake and lifestyle

Our results indicate that the CRC group in this study were adopting a sedentary lifestyle with most of them insufficiently active, a significant proportion were past smokers or currently a smoker, and 80% were overweight or obese (Table 3.1) even though most knew that cigarettes smoking, being overweight and not exercising would increase their risk for developing CRC. While for IBD group, 60% were overweight or obese, and majority of them (70%) were sufficiently active (Table 3.1). The evidence that alcohol consumption, physical inactivity, and body fatness increase the risk of developing CRC is now convincing (World Cancer Research Fund/American Institute for Cancer Research, 2011) but this information may not yet be adequately disseminated to those at high risk of developing CRC.

Overall there were no significant differences in dietary intake between the CRC and IBD groups. Our results indicate that in general IBD group in this study were having a better dietary intake as compared to the CRC group (Table 3.2) except alcohol intake which shows a slightly higher level than the CRC group. However, our numbers were small and if we had been able to recruit larger numbers, those nutrients (fibre, folate, vitamin E) that were approaching significance ($\sim p < 0.10$) may have reached significance and may be worthy of further investigation in subsequent larger studies. As CRC patients were undergoing treatment, this may explain why the dietary intake is lower than IBD patients as it may be due to side effects of treatment impacting nutritional symptoms. Additionally, chemotherapy can impact GI function i.e. loss of appetite, vomiting, nausea and diarrhoea. Similar with radiotherapy where radiation to any part of the digestive system may cause

nutrition-related side effects such as alterations in taste and smell, maldigestion and malabsorption.

Both of the CRC and IBD groups had a same % of total energy for macronutrients i.e. 43% carbohydrate, 20% protein and 37% fat. Distribution of carbohydrate for both groups was slightly lower than the estimated Acceptable Macronutrient Distribution Ranges (AMDR) (45 – 65%), while distribution of fat was slightly higher than the recommendation (20 -35%) (National Health and Medical Research Council, 2013). Both of the CRC and IBD groups did not consume enough fibre (25 g/d) intake (Table 3.2). Although not significantly different the CRC participants had on average a lower estimated usual daily intake (20 g/d) than the Recommended Dietary Allowance (RDA) for dietary fibre (25–30 g/day) (Agostoni et al., 2010). However, fibre intake of IBD patients (24 g/day) was closer to the recommendation.

Estimated daily intakes of key food groups were compared. The CRC group consumed approximately 150 g more fruit per day than the IBD group but the other food groups such as alcoholic beverages, red and processed meat, cereals, and vegetables were not significantly different between CRC and IBD groups.

Overall for both groups, the mean ± SD intakes of red meat (63.7 ± 52.2 g/day in CRC and 68.3 ± 50.2 g/day in IBD) were less than the recommendation of 100 g/day. Also processed meat (24.5 ± 18.1 g/day for CRC and 33.1 ± 29.4 g/day for IBD) was less than the upper limit recommendation of 40 g/day. The IBD group consumed approximately three times as much alcoholic beverages and 40% less fruit compared to CRC group (Table 3.3).

Chan et al. (2011) has recommended that intakes of total red and processed meat should not exceed 140g/day. Both groups in this study shows less intake than the recommendation of 140 g/day (88.2 g in CRC and 101.4 g/day in IBD respectively) (Table 3.3). A recent WHO/FAO expect consultation report on diet, nutrition and prevention of chronic disease recommends for fruits and vegetables intake to prevent any chronic disease

such as cancer is minimum of 400 g/day (World Health Organization, 2003). Fruits and vegetables intake of CRC participants were in the recommendation (mean intake of 409 g/day) but IBD group was less from the recommendation (mean intake of 293 g/day). As IBD carries an increased risk of developing CRC (Vu et al., 2012), this may be worthy of further investigation as the combined risk factors of obesity, higher meat consumption, higher intakes of alcoholic beverages, and lower intakes of fruits and vegetables intake may positively correlated with CRC risk (Chan et al., 2011; Magalhães et al., 2012).

3.7.2 Awareness of risk factors for developing colorectal cancer

From this study in two high risk groups (those with CRC or long-term IBD), their knowledge of CRC risk factors were found to be medium level having correctly answered ~ 50% of the questions. This is consistent worldwide, where a substantial body of evidence found a low level of knowledge of CRC risk factors in many countries (M. C. Wong et al., 2013). A multinational survey conducted by The Asia-Pacific Working Group in CRC in various Asia-Pacific regions found that the median knowledge levels of CRC risk factors scores ranges from 0–4 out of 9, with quite a number of regions scoring 0 (Koo et al., 2012). Other studies among indigenous Western Australians (Christou & Thompson, 2012), an ethnically diverse population in South Australia (Javanparast, Ward, Carter, & Wilson, 2012) and outpatients participants in primary care clinic in Hong Kong (Tam et al., 2011) also found low levels of CRC risk factors knowledge.

Even though the knowledge scores of CRC risk factors were medium level for both groups the awareness/level of knowledge of several lifestyle factors associated with CRC (e.g., low fibre intakes and being overweight or obese, and eating 2 serves of fruit and 5 serves of vegetables daily) was higher (although all were not significant) in IBD participants compared to CRC group (Table 3.4). On the other hand, a previous study amongst an adult population in the United Kingdom has showed that the awareness of several lifestyle factors of developing CRC scores were low (McCaffery et al., 2003; Wardle, Waller, Brunswick, & Jarvis, 2001). This demonstrates that

people who had experienced cancer themselves (Su et al., 2013) and those at high risk of developing CRC showed a higher level of knowledge of risk factors for developing CRC. There is a possibility that they are more familiar with the risk factors and disease.

Most of the CRC participants were not as physically active as participants in the IBD group (Table 3.1). Our results are consistent with those described by Dennis et al. (2013) and Grimmett et al. (2011) , who reported that, of people diagnosed with CRC, 82% were not physically active. Most research consistently shows that regular exercise protects against CRC and participation in physical activity programs may reduce cancer recurrence (Dennis et al., 2013). Taken together, those finding strongly suggest the need to develop exercise programs for CRC patients, taking into consideration their disease-specific concerns and issue such as bowel symptoms, as those symptoms often act as barriers to lifestyle changes (Dennis et al., 2013). Therefore, any future programs must teach them to navigate those challenges so that they can engage in safe physical activity after treatment.

Table 3.4 shows 80% of IBD participants and 35.7% of CRC participants knew that low fibre intake would decrease the risk of CRC, but the entire study population did not consume enough (25 g/day) of fibre intake (Table 3.2). Sixty-four percent of CRC patients and 63.3% of IBD patients knew that engagement in regular physical activity decreased the risk of CRC (Table 3.4), yet only 28.6% from CRC group reported being sufficiently active (≥ 150 minutes), however IBD group showed greater physical activity levels than the CRC group (i.e., 70% were sufficiently active) (Table 3.1). Although most of the participants had a medium level of knowledge on risk factors for developing CRC, their behaviours were still not changed to support a healthy life (Table 3.5). Such findings identify discrepancies between knowledge and behaviour.

Even though the percentage of participants who had made a modification to healthy diet (42.9% in CRC group and 20% in IBD group) and increase physical activity level (14.3% in CRC group and 10% in IBD group) is low (Table 3.5), only IBD group indicated that they were wanting to make future lifestyle changes (60%) with a desire for support and resources

compared to CRC group (Table 3.11). Our research suggests that there is a need to provide education about healthy dietary behaviours for people with CRC and people at above high risk of developing CRC. Therefore, results from this survey might be useful in guiding the development of future lifestyle programs for people with CRC and above risk of developing CRC, taking into consideration the types of resources to be designed, behaviours to be addressed and appropriate timing to implement the resources for the targeted group.

The majority of both groups reported that they would like written information or print materials such as booklets, brochures and leaflets as a desired future resource for them to receive information about CRC (35.7 in CRC group and 43.3% in IBD group) (Table 3.12). However, our findings are lower than those of Dowswell et al. (2012) and Dennis et al. (2013) who reported that 92% of their CRC survey patients would like booklets or leaflets to be included when planning D&L interventions.

A study by Ravichandran et al. (2011) reported that majority of the patients aged 15 years or more who attended one of the randomly selected 20 Primary Health Centers (PHC) of four major private hospitals in Riyadh, Saudi Arabia listed television or radio as the best source of information for cancer. In our study only a low proportion of both groups (0% in CRC group and 13.3% in IBD group) suggested television or radio as their preferred resources of information for CRC (Table 3.12). Use of different media is an important strategic tool in dissemination of health information to the targeted population and should be considered in nutrition intervention programs (Ravichandran et al., 2011). Our study provides an early indication that there may be different media channels preferred by different sub-groups of those at risk of developing CRC.

Following our exploratory analysis of knowledge differences between genders and older and younger CRC participants only, when persons aged 64 years and less compared with those above 65 years, there were no differences in their knowledge of CRC risk factors in CRC group (Table 3.10). However, older patients showed slightly higher awareness of the link between D&L risk factors for CRC than younger patients which is

encouraging because they are at higher risk and have a greater need to correctly identify risk factors. This could reflect better knowledge of CRC risk factors among the older population more generally. On the other hand, a study by Power et al. (2011) demonstrated that younger patients were more aware of the link between D&L risk factors for CRC rather than knowledge on symptoms of CRC as compared to older patients. So persons younger than age 50 (at average risk) may not be expected to engage in any CRC program such as CRC screening. There is no identified landmark event that signals the time in which they should become more knowledgeable about the disease. Nor is there clear evidence that the group at greatest risk for the disease is any more knowledgeable about it than the population at large (Powe, Finnie, & Ko, 2006). Nevertheless, women had a higher score than men although this did not reach statistical significance (Table 3.10).

As well our results demonstrated that knowledge and attitude scores were low towards CRC risk factors and in line with both Western countries (Castaneda et al., 2012) or Asian countries (Al-Naggar & Chen, 2011; Su et al., 2013). As highlighted in a previous study that persons with CRC had higher awareness of CRC symptoms, but not on risk factors. Noteworthy, increased exposure to CRC is likely to be associated with greater awareness of the disease and its presenting symptoms and less so with the causal processes involved (Power et al., 2011).

We hypothesised that those with CRC would have a higher awareness of risk factors for developing CRC but this was not supported in this study either by the prevalence of risk factors or the level of knowledge or attitudes towards risk factors. The CRC group, albeit a small number, when compared to the IBD group reported a higher proportion of past and current smokers (29 vs. 27% significant, sig), a higher proportion of patients who were insufficiently active (64 vs. 27% sig), and a higher proportion of people who were overweight or obese (79% vs. 60% not significant, NS). The CRC group did however report having a higher intake of fruit but there were fewer in the group who identified a low fibre intake with CRC risk. There were no significant differences in knowledge or attitudes towards risk factors between the CRC and the IBD group.

Further, more patients in the IBD group had knowledge about some risk factors compared with CRC patients (obesity:90 vs. 57% NS; and fibre: 80 vs. 36% sig), a higher proportion were sufficiently physically active (70 vs. 29% sig) with a higher proportion of normal weight (40 vs. 21% NS). This may be that IBD patients who have a known and diagnosed long term disease are more motivated to maintain or make a modification towards healthy lifestyle to avoid developing CRC. Therefore, development of a D&L intervention should be considered in this targeted high risk group. As well the need to tailor the intervention to individual, the lack of knowledge about the aetiology of CRC and the lack of motivation to change behaviour are critical and gaining considerable attention.

Interest in the development of D&L intervention for CRC patients is growing. A further consideration in the development D&L intervention should be safety and evidence that the interventions are effective in leading to improvements in diet, physical function, body weight, and biomarkers resulting in positive disease outcome. This study demonstrates that even though the level of knowledge of the patients is reasonable the behaviours to maintain and engage in healthy lifestyles is still not encouraging.

3.8 Strengths and limitations of the study

This study had several strengths. The study revealed new information on awareness of D&L risk factors on high risk groups. Importantly, participants that took part in this study were patients clinically well-defined according to their cancer stage and IBD diagnosis. This is important to ensure we are collecting data from correctly defined participants. The data were collected by one person which helps to reduce variance in interpretations of the data and standardise the research activities and outcomes. Given the reliance on self-report, it is important to use validated tools. This study used the validated FFQ to assess participants' food intake and a validated tool to assess physical activity level of the participants i.e., The validated Victorian Cancer Council Food Frequency Questionnaire—The Dietary Questionnaire for Epidemiological Studies Version 2 (DQES v2) and The Australian Institute of

Health and Welfare Active Australia Survey physical activity questionnaire.

The two key limitations of this study are the small numbers and the low response rate. Our power calculation identified that we needed to recruit 49 participants in each group. This was not able to be achieved in the time frame available to the researcher. Recruitment of CRC patients was slow through the clinics. Even though all attempts were made to improve the response rate of participants, it remained low. If more time had been available to the researcher or incentives had been offered, the response may have increased. Given the low numbers, these results may not be generalisable to the CRC or IBD populations. A larger study with higher numbers is warranted to confirm our findings from this study.

A third potential limitation is that there was no validation study undertaken of the actual compiled questionnaires used in this study, but as outlined above all questionnaires had been validated in other studies independently and there is no evidence to suggest that by combining the questionnaires, that they would be answered any differently.

3.9 Conclusion

This study surveyed CRC and IBD patients to gather information about their current D&L, knowledge, attitudes and behaviours about D&L changes to modifying risk factors relevant to developing CRC, resources already used and resources desired for the future. The prevalence of risk factors in two high risk groups is relatively high although the IBD group may have had a better risk profile. Knowledge of and attitudes towards risk factors did not vary between the two groups but overall the results suggest there is a need for D&L intervention programs to help to reduce the risk of either recurrence of CRC (in the case of cancer patients) or reduce the risk of developing CRC (in the case of those with long term IBD). Hence, this finding is important in order to effectively improve knowledge awareness of CRC, D&L modifications such as a well-balanced and healthy diet and engagement in regular exercise, and it may be necessary to begin the nutritional education program.about.CRC.earlier.in.the.life.cycle.

Chapter 4. Prevalence of Diet and Lifestyle Risk Factors according to BMI Status in the Newcastle Environmental Factors and Colon Cancer Study

4.1 Introduction

Colorectal cancer is a complex disease that arises from differential impacts of environmental factors, including D&L choices on different genetic background. It is considered as one of the most preventable whereby 70% to 80% of CRC are due to modifiable risk factors. Modifiable risk factors for CRC include smoking, alcohol consumption, limited physical activity, overweight (BMI 25.0–29.9 kg/m^2) and obesity (BMI≥30.0 kg/m^2) (Harriss et al., 2009) a Western diet characterised by a high intake of red and processed meat, and low intake of dietary fibres (Huxley et al., 2009).

The World Cancer Research Fund (WCRF) / American Institute for Cancer Research (AICR) published a comprehensive review of over 7000 research studies on the link between food, nutrition, physical activity and cancer prevention in 2007 with an update for CRC in 2011 (World Cancer Research Fund/American Institute for Cancer Research, 2007, 2011). Among the modifiable risk factors total body fatness and particularly abdominal fatness, show a convincing link to increased risk of CRC. Indeed the International Agency for Research into Cancer has classified CRC as an obesity-related cancer (IARC Working Group on the Evaluation of Cancer-Preventive Strategies, 2002), with obesity a significant risk factor for CRC. While the association of obesity with CRC is known, the mechanisms by which obesity contributes to CRC are unknown. Evidence suggests that gender may be a significant factor in the association between BMI and CRC (IARC Working Group on the Evaluation of Cancer-Preventive Strategies, 2002). Furthermore the association with BMI is stronger among men than women (Moghaddam et al., 2007; Renehan, Tyson, Egger, Heller, & Zwahlen, 2008) with a 30–70% increased risk of colon cancer in men, whereas the association is less consistent in women (Bardou, Barkun, & Martel, 2013).

To date, the obesity-CRC association has not assessed lifestyle factors according to BMI classification. Evidence shows that the highest consumers of red and processed meat have a 20% increased CRC risk when compared with the lowest consumers (World Cancer Research Fund/American Institute for Cancer Research, 2011) and, the risk of

developing CRC increases by 29% for every 100 g/day of red meat and 21% for every 50 g/day processed meat consumption (Chan et al. 2011). However, it is not known if the higher intakes of red and processed meats are concentrated among those with an obese BMI classification compared to those with overweight and healthy BMI classifications. Although it is difficult to separate the roles of obesity and habitually high red and processed meat consumption in increased CRC risk, it can be argued that high consumption of these foods is still likely to contribute to obesity independent of their direct association with CRC risk. Hence, a novel approach in the study described here is to determine the amount of red and processed meat consumption according to BMI classification in a high risk population.

In addition to the demonstrated red and processed meat associations with increased CRC risk, the links between total alcohol intake and CRC risk are well known (Cho et al. 2004; Fedirko et al. 2011). Although strong public health messages have consistently linked increased risks of CRC with high alcohol intakes and obesity, these lifestyle factors are still evident among CRC diagnoses (Bell et al. 2011). Reportedly the higher relative risk of CRC was 21% and 52% for moderate (> 1–4 drinks/day) and heavy alcohol intakes (≥ 4 drinks/day) respectively when compared with non-drinkers/occasional consumptions (Fedirko et al., 2011). Moreover, men who drank moderately had a 24% increased risk of developing CRC, whereas women had a 8% increased risk when compared with non-drinkers/occasional drinkers (Fedirko et al., 2011). The findings were consistent with the report of the WCRF/AICR of a convincing evidence and probable evidence for men and women that alcohol had carcinogenic effects on the colorectum (World Cancer Research Fund/American Institute for Cancer Research, 2011).

There is a weak but statistically significant non-linear inverse association between fruits and vegetables consumption and the risk of CRC. Independently the relative risk for low fruit and vegetables intake combined was determined as 0.92, while the relative risk for fruits and vegetables alone was 0.90 and 0.91 respectively (Aune et al., 2011). When the fruits and vegetables consumption of an individual increased from a very low level of

intake, a greater risk-reduction can be observed (Aune et al., 2011). An analysis of 452,755 patients in European Prospective Investigation into Cancer and Nutrition (EPIC) to assess a risk by subsite of the colorectum revealed a 14% and 24% reduction in risk of CRC and colon-only cancer risk, respectively, among individuals in the highest quintile intakes of fruit and vegetable (van Duijnhoven et al., 2009). In addition, there is an inverse relationship between obesity and intakes low energy density foods such as fruit and vegetables (Marks, Hughes, & van der Pols, 2006; Vidrine et al., 2013), suggesting an independent role for increased fruit and vegetable consumption among obese individuals diagnosed or at risk of CRC. Much of the evidence for habitually low intakes of fruits and vegetables and increased CRC risk has been generalised among CRC-diagnosed individuals independent of BMI. In the study described here, novel comparisons of the intakes of fruit and vegetables is examined according to BMI classifications, to determine any potential for synergistic associations between obesity and low fruit and vegetable intakes.

Besides the known dietary factors, physical activity has a positive long term influences on reducing the risk of cancer (Baena & Salinas, 2015). Thirty minutes of moderate exercise results in an 11% reduction of CRC incidence (Perera, Thompson, & Wiseman, 2012) and 12% decreased risk of colon cancer . Decreased physical activity and a sedentary lifestyle can decrease the expression of myokines which may be linked to the development of progression of CRC (Ertek & Cicero, 2012).

The WCRF (2011) has reported that the evidence of physical activity protecting against colon cancer is convincing. In addition, sustained moderate physical activity may raise the metabolic rate and increase maximal oxygen uptake. Regular periods of activity increase the body's metabolic efficiency and capacity (the amount of work that it can perform) and in the long term, it may have a beneficial effect on body fatness (World Cancer Research Fund/American Institute for Cancer Research, 2011). Moreover, engaging in physical activity may decrease the risk of developing colon cancer by decreasing inflammation, reducing insulin levels and reduced insulin resistance. In addition to an independent association

between physical inactivity and increased CRC risk, there is a clear role for a sedentary lifestyle in obesity development. However, any association between the combination of obesity, poor dietary choices and physical inactivity in CRC risk have not been specifically investigated, providing a unique opportunity in the study described here.

WCRF meta-analyses showed that there is strong association between environmental factors with CRC risk (World Cancer Research Fund/American Institute for Cancer Research, 2011). Virtually no studies have examined environmental factors (dietary and lifestyle) differences between obese and non-obese CRC patients; therefore, it is important to identify environmental factors that may contribute to the body weight disparity in CRC patients.

A new study (the Newcastle Environmental Factors and Colon Cancer Study) has commenced in the Newcastle Hunter region which aims to elucidate the mechanisms by which environmental risk factors influence colon cancer risk. The participants for this study were patients presenting for surgery who had an initial diagnosis of CRC. The risk factors being explored in the overall study include BMI status, diet and physical activity, stress and colonic microflora. Obese and overweight participants are being oversampled to ensure that participants had a wide range of BMIs. The diet and physical activity data have been analysed in this chapter to determine if there is a difference in diet and physical activity according to BMI status.

Thus this research study will help to address the gap in existing knowledge regarding the role of environmental factors in obese and non-obese CRC patients as most of the studies to date have not differentiated on risk factors based on weight status.

4.2 Aim and hypothesis

The objective of the study was:

- To determine the prevalence of diet and lifestyle risk factors for CRC

according to BMI status in a high risk CRC group.

The research question of the study was:

- Do overweight or obese patients with CRC have a higher prevalence of risk factors than those who are of normal weight?

Our hypothesis is that overweight and obese participants have a higher prevalence of CRC risk factors than normal weight participants.

4.3 Methods

4.3.1 Study design and study population

The study was a survey, cross-sectional study and based on secondary data of the Newcastle study to determine the prevalence of D&L risk factors for developing CRC in patients presenting for gastrointestinal surgery with an initial diagnosis of CRC prior to surgery. The results in this chapter are from recruitment that commenced in June 2011 and continued up until July 2014.

The study was carried out in Newcastle, New South Wales, Australia. Newcastle is a Australia's seventh largest city, 60 km north of Sydney. This Newcastle study took place at the John Hunter Hospital, The Newcastle Private Hospital and the Royal Newcastle Centre Potential participants were provided with a letter of invitation together with a participant information sheet inviting them to take part in the study (Appendix J) Participation in this study involved completion of a consent form (Appendix K), a preliminary questionnaire, The Blue Mountain Eye Study II Food Frequency Questionnaire, the International Physical Activity Questionnaire and the perceived stress questionnaire (Appendix L) prior to surgery. Participants' biometric and medical history were obtained from medical notes. Blood samples were collected prior to or during surgery when blood samples were taken from the participants for diagnostic purposes.

As part of the study protocol, tissue samples (tumour, normal colon, adipose, adenomas [precancerous lesions]) and microbial samples (faecal samples and microbial swabs) were collected from tissue removed from

participants at the time of their scheduled surgery and were in excess of what is normally removed from surgery. The results of this chapter focused on the participants' characteristics, and the prevalence of D&L risk factors only.

4.3.2 Recruitment of participants

Recruitment of participants commenced with three surgeons at the John Hunter Hospital, The Newcastle Private Hospital and the Royal Newcastle Centre. The consent process took place during the participant's pre-surgery appointments, to minimise burden in terms of time commitment.

The inclusion criteria for potential participants were patients undergoing gastrointestinal (large bowel) resection who had an initial diagnosis of CRC prior to the surgery. This initial diagnosis had been made by the clinician before a comprehensive clinical diagnosis of CRC had been completed either during surgery or after pathology had been performed on tissues collected at the time of the surgery. The exclusion criteria were as follows:

- Women who were pregnant
- Children or young people < 18 years old
- Patients who were highly dependent on medical care
- People with cognitive impairment, intellectual disability, or mental illness.

Potential participants received the following: a letter of invitation to participate in the study (Appendix J), participant information for the research study (Appendix J), a consent form (Appendix K), and a preliminary questionnaire (Appendix L) at a pre-surgical appointment. Potential participants were provided with the opportunity to ask questions regarding the information they had received and were informed that they could withdraw from the study at any time. If potential participants decided to participate in the study, the consent form and general questionnaire were returned at the participants' convenience in a prepaid envelope or brought in by the participant or relative on the day of their surgery.

The sample size calculation was not be able to be included in this chapter as the original study was exploratory and this particular study was based on secondary data analysis of the Newcastle study.

4.4 Ethics approval

This study was approved by the Hunter New England Human Research Ethics Committee (Application number: EC00403). Reference number AU-1-B2D8015.

4.5 Research instruments

4.5.1 Socio-demographic background

The socio-demographic data were date of birth, age, gender, whether or not the participants were working outside of the home, medical information and family history of CRC (Appendix L).

4.5.2 Anthropometric measurements

Anthropometric assessments including height, weight and waist circumference were obtained at the surgeon's office. Weight and height of the participants were then used to calculate BMI as follows:

$$\text{BMI, kg/m}^2 = \frac{\text{Weight, kg}}{\text{Height, m} \times \text{Height, m}}$$

The classification of BMI according to the World Health Organization's (WHO) age- and sex-adjusted criteria (World Health Organization, 1995, 2000, 2004) is shown in Table 4.1.

Table 4.1. Body Mass Index (BMI) classifications according to the World Health Organization (WHO)

BMI (kg/m²)	Classification
< 18.5	Underweight
18.5 – 24.9	Normal
25.0 – 29.9	Overweight/pre-obese
≥ 30	Obese

Source: World Health Organization (1995; 2000; 2004)

Waist circumference measurement provides information on the fat distribution irrespective of the BMI (World Health Organization, 1995, 2000). The expected normal values for men and women are less than 90 cm and 80 cm respectively.

4.5.3 Physical activity

Physical activity level was assessed using the International Physical Activity Questionnaire-Long form (IPAQ Research Committee, 2005) (Appendix L). The IPAQ long form requests details of specific types of activities which are walking, moderate intensity activities and vigorous intensity activities within each of the work, transportation, domestic chores and gardening (yard) and leisure-time domains. The version used for this study asked the participants to consider their activity over the last 12 months in an average 7 day period.

The total physical activity scores for the long form computation are derived from the summation of the duration (in minutes) and frequency (days) for all the types of activities in all domains. The sub-scores of each domain specific or activity were calculated. A domain specific score is the sum of the scores for walking, moderate-intensity and vigorous-intensity activities within the specific domain whereas activity-specific scores require summation of the scores for the specific type of activity across domains. The IPAQ incorporates a scoring mechanism whereby each activity is assigned an intensity code expressed in terms of Metabolic Equivalent (METs). The MET is the ratio of metabolic rate during the activity as compared to the metabolic

rate during rest. For each type of activity, the weighted MET minute per week is calculated as follows (IPAQ Research Committee, 2005):

Domain Sub-Scores:

Total MET-minutes/week at **work** = Walk (METs x min x days) + Moderate (METs x min x days) + Vigorous (METs x min x days) at work

Total MET-minutes/week for **transportation** = Walk (METs x min x days) + Cycle (METs x min x days) for transportation

Total MET-minutes/week from **domestic and garden** = Vigorous (METs x min x days) yard work + Moderate (METs x min x days) yard work + Moderate (METs x min x days) inside chores

Total MET-minutes/week in **leisure-time** = Walk (METs x min x days) + Moderate (METs x min x days) + Vigorous (METs x min x days) in leisure-time

Walking, Moderate-Intensity and Vigorous-Intensity Sub-Scores:

Total **Walking** MET-minutes/week = Walk MET-minutes/week (at Work + for Transport + in Leisure)

Total **Moderate** MET-minutes/week = Cycle MET-minutes/week for Transport + Moderate MET minutes/week (Work + Yard chores + Inside chores + Leisure) + Vigorous Yard chores MET minutes

Total **Moderate-intensity** MET-minutes/week = Total **Walking** MET-minutes/week + Total **Moderate** MET minutes/week

Total **Vigorous** MET-minutes/week = Vigorous MET-minutes/week (at Work + in Leisure)

Total Physical Activity Score:

Total Physical Activity MET-minutes/week = **Walking** MET-minutes/week + **Moderate** MET minutes/week + Total **Vigorous** MET-minutes/week

Also, **Total** Physical Activity MET-minutes/week = Total MET-minutes/week (at Work + for Transport + in Chores + in Leisure)

Then, three levels of physical activity were determined as below:

Low (Category 1)

No activity is reported, OR

Some activity is reported but not enough to meet Categories 2 or 3.

Moderate (Category 2)

Either of the following 3 criteria:

a) 3 or more days of vigorous-intensity activity of at least 20 minutes per day, OR
b) 5 or more days of moderate-intensity activity and/or walking of at least 30 minutes per day, OR
c) 5 or more days of any combination of walking, moderate-intensity or vigorous intensity activities achieving a minimum Total physical activity of at least 600 MET-min/week.

High (Category 3)

Any one of the following 2 criteria:

a) Vigorous-intensity activity on at least 3 days and accumulating at least 1500 MET-minutes/week, OR
b) 7 or more days of any combination of walking, moderate- or vigorous-intensity activities achieving a minimum Total physical at least 3000 MET-minutes/week.

As the participants who took part in this study are Australian, the physical activity levels of participants were also expressed for the accumulative minutes of physical activity per week and compared to the Physical Activity Recommendations for Older Australians (65 years and older) (W. J. Brown, Moorhead, & Marshall, 2005). These guidelines state that older people should accumulate at least 30 minutes of moderate intensity physical activity on most, preferably all, days of the week. Therefore in order for individuals to reach the guideline for the accumulated number of minutes of Moderate intensity activity per week for older Australian they

needed to accumulate at least 210 minutes of moderate intensity physical activity per week (30 minutes x 7 days).

For this study, low and moderate physical activity levels were determined using the Australian guidelines. The moderate level captured those who accumulated at least 210 minutes of moderate intensity activities and the low physical activity level captured those who accumulated less than 210 minutes of moderate intensity activities. Using the IPAQ long form, the number of minutes of moderate intensity was determined from summing all of the moderate activity in minutes within each of the work, transportation, domestic chores and gardening (yard) and leisure-time domains.

4.5.4 Dietary intake

The semi-quantitative Food Frequency Questionnaire from the Blue Mountain Eye Study (Appendix L) was used to assess the usual daily food and nutrient intakes of the patients over the last 12 months. The FFQ consists of 38 questions and 138 items with 9 frequency response options, ranging from 'Never' to 'four or more times per day'. Daily dietary intakes of energy, macro and micro nutrients were calculated and computed from the FFQ using software developed by the Newcastle study, which is based on NUTTAB95 nutrient composition data (National Food Authority, 1995).

In addition, the amount of food intake (g/day) per food group of red meat, processed meat, alcoholic beverages, vegetables, fruits and cereals were also calculated. The amount of food intake per food group of red meat included untrimmed red meat, 50% trimmed red meat, 75% untrimmed red meat, meat in a mixed dish, minced meat in tomato sauce, bacon, liver, meat pie and sandwich meats. The processed meat included sausages, hamburger patty, sausage roll, processed meat and frankfurts. Alcoholic beverages included beer, low alcohol beer, red and white wine, sherry and spirits. The vegetables included broccoli, cauliflower, spinach, spring onions, peas, green beans, cabbage, brussels sprouts, carrot, eggplant, mushroom, tomatoes, lettuce and celery. Fruits included stone fruit, grapes, strawberries, other fresh berries, melon, mango, pawpaw, pineapple, watermelon,

avocado, apple, pear, orange, banana and prunes. Also for cereals included cold breakfast cereal (e.g., Weet Bix™, All Bran™, oat bran, cornflakes, rice bubbles, Weeties™, Uncle Toby's Plus Fibre™, Sultana Bran™, Special K™, Just Right™, Sustain™, Nutri-grain™, muesli untoasted, oats/oatmeal/porridge), white and wholemeal bread, oatmeal, scone, white and brown rice, pasta and crackers.

4.5.5 Statistical analysis

The collected data were entered and cleaned by running frequencies and cross tabulations using the statistical software 'Statistical Package for Social Sciences (SPSS) version 19.0 for Windows (SPSS Inc, Chicago, IL, USA). Quantitative data was explored to check for the outliers by Kolmogorov-Smirnov analysis (Coakes & Ong, 2010). All data were normally distributed as indicated by $p > 0.05$ unless otherwise stated. Where data were not normally distributed, analysis was carried out on the natural logarithm of the values to improve the symmetry and homoscedasticity of the distribution.

Descriptive statistics (mean, standard deviation and median was used to describe the socio-demographics, medical background, anthropometric measures, dietary intake and physical activity). As it is well known that dietary intakes can vary by age, gender and total energy intake, the nutrients and food intake estimates were adjusted for these covariates. The comparison of characteristics between gender was made by an Independent T-Test and Analysis of Variance (ANCOVA) adjusted for age, and total energy intake (covariate), while the categorical data were analysed by using Pearson's chi-square test. The differences in continuous variables across BMI classifications were compared with one-way ANOVA and/or Analysis of Variance (ANCOVA) adjusted for age and gender (covariate). Bonferonni post hoc comparisons were conducted to determine whether the normal weight group was significantly different to overweight or obese groups. A statistical probability level of $p < 0.05$ was considered as significant for differences for all tests.

Participants were recruited into this study with an initial diagnosis of CRC that was either confirmed (cancer stage) or not through further clinical diagnostics (e.g. biopsy examination). In order to determine if the presence of cancer, or the stage of cancer was predictive of the key lifestyle variables of diet and physical activity, a regression analysis was performed with the cancer categorical variable as the predictor and nutrients and physical activity as the outcome variables. We found that whether or not cancer was actually present, or the stages of cancer did not significantly predict diet variables or physical activity levels, so our analysis was performed on all 104 participants for the gender comparisons and 96 participants for the BMI comparisons.

4.6 Results

4.6.1 Characteristics of participants

A total of 213 potential participants were initially approached to take part in the study; two withdrew after they gave consent, and two participants were found not to have cancer prior to surgery. Only 104 completed the questionnaires on diet, physical activity level and had their cancer staged clinically while 96 had actual measurements taken for height and weight. In the subsequent analyses where comparisons were made across BMI categories, only the 96 patients with actual measurements of height and weight were included. Other analyses (e.g., for differences between gender) were carried out on all 104 participants.

Table 4.2 shows characteristics for the participants according to gender. There were 63 men and 41 women in this study. The majority of participants (60.3% men, 65.9% women) had a job or were doing any unpaid work outside their home. Half of both participants (49.2% men, 56.1% women) had a family history of cancer (of any type). However, few participants in both genders (14.3% men, 19.5% women) had a family history of CRC or had any cancer other than CRC themselves (9.5% men, 24.4% women). Most of the participants (57.2% men, 68.3% women) were diagnosed with cancer in stage 2 and 3 respectively. The mean age of all the

participants was 68 ± 11.8 years. The majority of both participants were older adults (>55 year) (90.5% men, 87.8% women). Despite an initial diagnosis of CRC prior to surgery, 23 (22%) of the participants were found to not have CRC following the clinical staging of the disease from samples collected during surgery. Table 4.2 summarises the characteristics of participants with no differences found between the genders ($p > 0.05$).

Table 4.2. Characteristics of colorectal cancer (CRC) participants according to gender

Characteristics	Men (n=63)		Women (n=41)		*p value
	n	% of participants	*n*	% of participants	
Do you currently have a job or do any unpaid work outside your home?					
Yes	22	34.9	13	31.7	0.888
No	38	60.3	27	65.9	
Family history of cancer					
Yes	31	49.2	23	56.1	0.332
No	29	46.0	18	43.9	
Any cancer other than CRC					
Yes	6	9.5	10	24.4	0.054
No	54	85.7	31	75.6	
Family history of CRC					
Yes	9	14.3	8	19.5	0.306
No	51	81.0	33	80.5	
Stage of cancer at presentation					
No cancer	15	23.8	8	19.5	0.640
Stage 1	12	19.0	5	12.2	
Stage 2	17	27.0	15	36.6	
Stage 3	19	30.2	13	31.7	
Age group					
Young adults (18–35 years)	0	0.0	2	4.7	0.199
Middle-aged adults (36–55 years)	6	9.5	3	7.3	
Older adults (>55 years)	57	90.5	36	87.8	

*Chi-square analysis

The age and anthropometric characteristics for men and women are presented in Table 4.3. There were no differences in age and waist circumference between genders. The mean age of the participants was 69.13 ± 10.31 years in men and 66.27 ± 13.81 years in women (not significant, *ns*). Men had a higher body weight than women ($p < 0.002$).

Table 4.3. Characteristics of participants with an initial diagnosis of colorectal cancer (CRC) presenting for surgery according to gender

Characteristics	Men		Women		*p* value
	n	Mean ± SD	*n*	Mean ± SD	
Age (years)	63	69.13 ± 10.31	41	66.27 ± 13.81	0.231
Weight (Sung et al.)	58	84.41 ± 15.39	38	73.97 ± 15.83	0.002
Waist (cm)	45	93.2 ± 20.7	20	84.9 ± 12.7	0.105

$p < 0.05$; significantly different from women with Independent T-Test

The following results are reported according to BMI classifications, that is, normal (BMI 18.5–24.9 kg/m²), overweight (BMI 25.0–29.9 kg/m²) and obese (BMI ≥ 30.0 kg/m²). Twenty-seven (27%) of the participants were classified as having a normal weight, 40 (42%) were overweight and 29 (30%) were obese (Table 4.4). The mean BMI for normal weight were 22.2 ± 1.8 kg/m², overweight were 27.5 ± 1.2 kg/m² and obese were 34.6 ± 3.9 kg/m².

As shown in Table 4.4, at the time of this study most of the participants (74.1% normal, 65.0% overweight, 64.3% obese) did not have a job or do any unpaid work outside their home. More than half of them (55.6% normal, 52.5% overweight, 51.7% obese) had a family history of (any) cancer but less of them (25.9% normal, 10.0% overweight, 20.7% obese) have a family history of CRC. Few of them (22.2% normal, 10.0% overweight, 13.8% obese) had any cancer other than CRC themselves. Most of the participants in the normal and obese BMI classifications (44.4% normal, 31.0% obese) were diagnosed with cancer in stage 3 respectively. However, the majority of overweight participants were diagnosed in stage 2 (40.0%). More than half of the male patients were overweight (65.0%), higher than the female patients (35.0%). Table 4.4 summarises the characteristics of the participants with no differences found between BMI classifications ($p > 0.05$).

The study group were on average overweight with a mean ± SD BMI for all participants of 28.17 ± 5.36 with a range of 18.7 to 43.1. There were no differences in age and waist circumference in participants between BMI

classifications. The mean age of the participants was 68.2 ± 15.5 years in normal, 68.4 ± 11.7 years in overweight and 66.8 ± 8.8 years in the obese categories (Table 4.5). As expected, body weight differed significantly between the BMI groups ($p < 0.001$). The mean waist circumference for all groups was above the cut-off value > 90 cm and 80 cm for men and women respectively. Only waist circumference differed significantly between normal and above cut-off value among men (Table 4.5). In addition, the majority of both men and women had a waist circumference above the cut-off value regardless of their normal, overweight or obese classifications (Table 4.5).

Table 4.4. Characteristics of participants presenting for gastrointestinal surgery with an initial diagnosis of colorectal cancer (CRC) according to BMI classifications (*N* = 96 with actual weight and height measured)

Characteristics	BMI Classification (World Health Organization, 1995, 2000, 2004)						*p value
	Normal (18.5–24.9 kg/m^2)		Overweight (25.0–29.9 kg/m^2)		Obese (≥30.0 kg/m^2)		
	n	%	*n*	%	*n*	%	
Do you currently have a job or do any unpaid work outside your home?							
Yes	7	25.9	14	35.0	10	34.5	0.726
No	20	74.1	26	65.0	19	64.3	
Family history of cancer							
Yes	15	55.6	21	52.5	15	51.7	0.967
No	12	44.4	19	47.5	14	48.3	
Any cancer other than CRC							
Yes	6	22.2	4	10.0	4	13.8	0.827
No	21	77.8	36	90.0	25	86.2	
Family history of CRC							
Yes	7	25.9	4	10.0	6	20.7	0.478
No	20	74.1	36	90.0	23	79.3	
Stage of cancer at presentation							
No cancer	6	22.2	7	17.5	8	27.6	0.609
Stage 1	2	7.4	8	20.0	5	17.2	
Stage 2	7	25.9	16	40.0	7	24.1	
Stage 3	12	44.4	9	22.5	9	31.0	
Gender							
Men	15	55.6	26	65.0	17	58.6	0.880
Women	12	44.4	14	35.0	12	41.4	

*Chi-square analysis

Table 4.5. Characteristics of CRC patients presenting for surgery according to BMI classifications (*N* = 96 with actual weight and height measured)

Characteristics	BMI Classification (World Health Organization, 1995, 2000, 2004)			*p* value**
	Normal * (18.5–24.9 kg/m^2)	Overweight* (25.0–29.9 kg/m^2)	Obese* (≥ 30.0 kg/m^2)	
Age (years)	68.2 ± 15.5 (n=27)	68.4 ± 11.7 (n=40)	66.8 ± 8.8 (n=29)	0.928
Weight (Sung et al.)	65.2 ± 8.9 (n=27)	77.7 ± 9.2 (n=40)	97.8 ± 24.3 (n=29)	0.001
Waist (cm)	85.4 ± 12.1 (n=18)	88.2 ± 18.8 (n=24)	98.3 ± 24.3 (n=17)	0.190
Cut-off waist, cm				
Men: n (%)				
< 90 cm	13 (48.1)	9 (22.5)	3 (10.3)	***0.013
> 90 cm	14 (51.9)	31 (77.5)	26 (89.7)	
Women: n (%)				
< 80 cm	5 (18.5)	4 (10)	2 (6.9)	***0.572
>80cm	22 (81.5)	36 (90.0)	27 (93.1)	

*All values are mean ± SD

**One-way ANOVA test

***Chi-square analysis

4.6.2 Dietary intake

Table 4.6 and Table 4.7 show the estimated usual nutrient intake according to gender and BMI classifications. There were some dietary differences according to gender – women had lower total sugars and alcohol and higher fibre and vitamin A intakes compared to men (Table 4.6).

There were no significant differences in dietary intake according to BMI classifications, with or without adjustment for gender, age and total energy intake (Table 4.7). Overall the overweight group has the poorest nutrition (Table 4.7). Mean protein intakes are lower than the other groups, however still met the Australian recommended dietary intake (RDI): on average 084 g protein/kg/day for men and 0.75 g protein/kg/day for women (Australian Government, 2006). Mean dietary fibre intake were lower in the overweight group , and did not meet the adequate intake (AI) for men (30 g fibre/day), but did meet the AI for women (25 g/day) (Australian Government, 2006).

Mean total sugar intakes were significantly difference among gender ($p < 0.041$) (Table 4.6). Mean alcohol intake was significantly lower in women compared to men ($p < 0.01$) (Table 4.6). Mean vitamin A was significantly lower in men compared to women ($p < 0.004$) (Table 4.6). Mean vitamin A intake was lower among the overweight group compared to the other BMI groups, and did not meet the recommended dietary intake (RDI) for adult men (900 µg/day) or women (700 µg/day) for all the BMI groups (Table 4.7) (Australian Government, 2006).

The proportion of energy from macronutrients according to BMI groups are shown in Table 4.8. The proportions of energy derived from carbohydrate, protein and total fat were not statistically significant among BMI groups however, across all three weight groups, the mean contributions to total energy intake from total protein and total fat did meet the acceptable macronutrient distribution range (AMDR) but the mean contribution from total carbohydrates did not (Australian Government, 2006).

Table 4.9 shows the mean weight (g/day) of usual daily food intake per key food group (i.e., red meat, processed meat, alcoholic beverage

intake, fruit and vegetables intake, and cereal intake) according to gender. Women consumed less processed meat, less alcoholic beverages and more fruits and vegetables than men after adjusting for total energy intake and age.

Table 4.10 shows the mean weight (g/day) of the key food groups amongst the BMI groups. There was no significant difference in the amounts of daily food intake after adjusting for total energy intake, age and gender.

Table 4.6. Estimated usual daily nutrient intakes (mean ± SD) according to gender for the previous 12 months according to gender for participants with an initial diagnosis of CRC for the 12 months prior to presenting for surgery (*N* = 104)

Nutrient intakes values	Men* (*n* = 63)	Women*(*n* = 41)	*p* value***
**Energy, kcal	2412 ± 868	2058 ± 830	0.992
**Energy, kJ	8925 ± 3618	8576 ± 3458	0.992
**Total carbohydrate, g	208.9 ± 87.3	227.1 ± 89.8	0.211
**Protein, g	101.7 ± 48.7	91.6 ± 32.3	0.561
**Total fat, g	76.9 ± 37.1	73.1 ± 42.2	0.836
**Saturated fat, g	30.5 ± 15.4	27.2 ± 17.8	0.350
**Monounsaturated fat, g	27.9 ± 14.1	26.4 ± 16.2	0.782
**Polyunsaturated fat, g	11.4 ± 6.4	12.4 ± 6.7	0.265
***n*-3 fatty acid, mg	468.7 ± 394.9	427.8 ± 253.6	0.880
**Fibre, g	25.6 ± 12.5	32.0 ± 14.1	0.011
**Cholesterol, mg	388.2 ± 333.6	285.3 ± 117.1	0.131
Total sugar, g	110.7 ± 51.3	134.3 ± 64.2	0.041
**Calcium, mg	898.8 ± 466.9	918.8 ± 414.0	0.465
**Alcohol, g	20.2 ± 23.0	5.5 ± 10.7	0.010
**Vitamin A, µg	419.3 ± 381.8	513.8 ± 685.3	0.004
**Vitamin E, mg	7.8 ± 4.1	8.5 ± 4.4	0.243

*All values are mean ± SD

**Statistical analyses were performed on log-transformed data

***ANCOVA test (Analysis of Covariance) adjusted for the covariate i.e. age and total energy intakes (kcal/day).

Table 4.7. Estimated usual daily nutrient intakes (amount/day) for the previous 12 months among normal, overweight and obese for participants for the 12 months prior to presenting for surgery (*N* = 96)

Nutrient intakes values	BMI Classification (World Health Organization, 1995, 2000, 2004)			***p* value
	Normal* (18.5–24.9 kg/m^2)	Overweight* (25.0–29.9 kg/m^2)	Obese* (≥ 30.0 kg/m^2)	
**Energy, kcal	2205 ± 904	1993 ± 780	2298 ± 945	0.884
**Energy, kJ	9190 ± 3770	8307 ± 3250	9575 ± 3939	0.884
**Total carbohydrate, g	235.0 ± 90.1	196.6 ± 75.9	242.3 ± 101.0	0.609
**Protein, g	102.8 ± 45.1	94.6 ± 6.7	100.4 ± 36.2	0.761
**Total fat, g	76.7 ± 41.7	71.3 ± 32.8	82.5 ± 47.5	0.141
**Saturated fat, g	29.2 ± 17.7	28.2 ± 14.0	32.1 ± 20.0	0.293
**Monounsaturated fat, g	27.5 ± 15.9	25.6 ± 12.5	30.3 ± 18.1	0.120
**Polyunsaturated fat, g	12.5 ± 7.4	10.8 ± 5.1	12.4 ± 7.3	0.292
***n*-3 fatty acid, mg	465.3 ± 334.2	465.2 ± 412.1	407.3 ± 253.5	0.709
**Fibre, g	30.07 ± 13.8	26.4 ± 14.1	30.0 ± 13.8	0.774
**Cholesterol, mg	340.8 ± 232.3	352.7 ± 362.3	346.0 ± 172.6	0.122
Total sugar, g	132 ± 58	112 ± 52	131 ± 65	0.350
**Calcium, mg	1033.2 ± 576.9	872.3 ± 420.6	886.1 ± 357.9	0.802
**Alcohol, g	12.8 ± 16.8	16.2 ± 23.7	15.2 ± 20.9	0.504
**Vitamin A, µg	533.4 ± 565.5	369.9 ± 258.4	572.6 ± 750.7	0.262
**Vitamin E, mg	8.0 ± 4.7	7.3 ± 3.4	9.2 ± 5.0	0.074

*All values are mean ± SD

**Statistical analyses were performed on log-transformed data

***ANCOVA test (Analysis of Covariance) adjusted for the covariate i.e. gender, age and total energy intakes (kcal/day).

Table 4.8. Proportion of energy from macronutrients among normal, overweight and obese participants for the 12 months prior to presenting for surgery with an initial diagnosis of colorectal cancer (CRC) (*N* = 96)

Proportion of energy from macronutrients	BMI Classification (World Health Organization, 1995, 2000, 2004)				
	Normal * (18.5–24.9 kg/m^2)	Overweight * (25.0–29.9 kg/m^2)	Obese* (≥ 30.0 kg/m^2)	AMDR	**p value
Carbohydrate, %	43.6 ± 9.2	39.7 ± 8.3	42.1 ± 6.5	45–65%	0.917
Protein, %	18.9 ± 3.7	19.0 ± 4.4	18.1 ± 3.3	15–25%	0.991
Total fat, %	30.5 ± 6.1	32.1 ± 6.4	31.0 ± 6.1	20–35%	0.256

AMDR = Acceptable Macronutrient Distribution Range; percentages do not add up to 100% as alcohol also contributing

*All values are mean ± SD

**ANCOVA test (Analysis of Covariance) adjusted for the covariate i.e. gender and age

Table 4.9. The mean amount food intake (g/day) over the last 12 months according to gender in participants with an initial diagnosis of CRC prior to presenting for gastrointestinal surgery (*N* = 104)

Daily intake per food group	Men* (*n* = 63)	Women* (*n* = 41)	*p* value***
**Meat, g/day	118.3 ± 89.0	102.9 ± 91.6	0.467
**Processed meat, g/day	43.5 ± 53.0	22.8 ± 15.8	0.026
**Alcoholic beverages, g/day	429.8 ± 564.6	95.7 ± 247.1	0.001
Vegetables, g/day	407.1 ± 209.9	477.3 ± 187.7	0.014
**Fruits, g/day	327.7 ± 285.9	552.4 ± 383.2	0.001
**Cereals, g/day	151.2 ± 134.1	183.2 ± 103.8	0.132

*All values are mean ± SD

**Statistical analyses were performed on log-transformed data

***ANCOVA test (Analysis of Covariance) adjusted for the covariate i.e. gender, age and.total.energy.intakes.(kcal/day)

Table 4.10. The amount food intake per food group (g/day) over the last 12 months among normal, overweight and obese participants with an initial diagnosis of colorectal cancer (CRC) prior to presenting for gastrointestinal surgery (*N* = 96)

The amount food intake per food group	BMI Classification (World Health Organization, 1995, 2000, 2004)			
	Normal (*n* = 27)* (18.50 – 24.99 kg/m^2)	Overweight (*n* = 40)* (25.00 – 29.99 kg/m^2)	Obese (*n* = 29)* (≥30.00 kg/m^2)	*p* value***
**Meat, g/day	105.1 ± 74.5	109.5 ± 88.2	136.4 ± 110.1	0.743
**Processed meat, g/day	37.3 ± 68.8	31.6 ± 28.5	37.4 ± 35.3	0.161
**Alcoholic beverages, g/day	276.3 ± 414.8	323.2 ± 574.9	332.2 ± 504.0	0.486
Vegetables, g/day	481.5 ± 240.8	395.6 ± 193.1	456.0 ± 193.8	0.671
**Fruits, g/day	436.1 ± 355.5	417.0 ± 344.6	446.1 ± 369.8	0.425
**Cereals, g/day	188.9 ± 111.8	141.9 ± 117.6	177.6 ± 141.4	0.455

*All values are mean ± SD

**Statistical analyses were performed on log-transformed data

***ANCOVA test (Analysis of Covariance) adjusted for the covariate i.e. gender, age and total energy intakes (kcal/day).

4.6.3 Physical activity

Table 4.11 shows the physical activity level category of patients in MET minutes/week according to IPAQ. Most of the participants (*n* = 66, 63.5%) were in the high category of physical activity level, MET minutes/week. The mean high category of the patients was 8672 ± 5187 MET minutes/week. There were no significant differences in MET minutes/week according to gender.

In those classified as having high levels of physical activity according to the IPAQ, the overweight group has less mean MET minutes per week than the normal weight group ($p < 0.050$) after adjusting for covariates of gender and age (Table 4.12).

As the participants were on average older Australian residents, the physical activity levels were also determined according to the Physical Activity Recommendations for Older Australians (65 years and older) (W. J. Brown et al., 2005) (Table 4.13). Overall 47.9% of all participants reached the recommended physical activity level of at least 210 accumulated minutes per week. The physical activity level category after adjustment for gender and age, showed no statistically significant difference amongst the BMI groups. However, the overweight group shows the lowest amount of engagement (MET minutes/week) in moderate and high levels of physical activity although this was not significant.

Table 4.11. Physical activity level category, MET minutes/week according to IPAQ (IPAQ Research Committee, 2005)

Physical activity Level Category	Mean ± SD (MET minutes/week)
Low, *n* = 18	108 ± 173
Moderate, *n* = 20	1356 ± 669
High, *n* = 66	8672 ± 5184

Table 4.12. Physical activity level category, MET minutes/week among normal, overweight and obese colorectal cancer (CRC) participants prior to presenting for surgery (*N* = 96) according to IPAQ (IPAQ Research Committee, 2005)

Physical activity Level Category, MET minutes/week	BMI Classification (World Health Organization, 1995, 2000, 2004)			*p* value**
	Normal * (18.5–24.9 kg/m^2)	Overweight * (25.0–29.9 kg/m^2)	Obese* (≥ 30.0 kg/m^2)	
Low (*n* = 17)	80.0 ± 138.5 (***n* = 3**)	100.0 ± 182.6 (***n* = 7**)	145.7 ± 203.1 (***n* = 7**)	0.985
Moderate (*n* = 15)	1782.8 ± 693.1 (***n* = 4**)	938.0 ± 267.7 (***n* = 7**)	1790 ± 363.6 (***n* = 4**)	0.228
High (*n* = 64)	14178.5 ± 1265.7 (***n* = 20**)	7525.8 ± 4360.1 (***n* = 26**)	13038.6 ± 8127.8 (***n* = 18**)	0.050

*All values are Mean ± SD

**ANCOVA test (Analysis of Covariance) adjusted for the covariate i.e. gender and age.

Table 4.13. Physical activity level category (accumulated minutes per week) among normal, overweight and obese CRC patients prior to presenting for surgery (*N* = 96) according to the Physical Activity Recommendations or Older Australians (65 years and older) (W. J. Brown et al., 2005)

Physical activity Level Category (accumulated minutes per week)	BMI Classification (World Health Organization, 1995, 2000, 2004)			
	Normal * (18.5–24.9 kg/m^2) (*n* = 29)	Overweight * (25.0–29.9 kg/m^2) (*n* = 40)	Obese* (≥ 30.0 kg/m^2) (*n* = 29)	*p* value***
**Low (< 210 minutes/week)	93.7 ± 51.1	74.6 ± 70.2	54.5 ± 60.1	0.898
n (%)	12 (44.4)	24 (60.0)	14 (48.3)	
**Moderate (≥ 210 minutes/week)	613.3 ± 383.2	373.4 ± 165.5	672.0 ± 438.5	0.503
n (%)	15(55.6)	16(40.0)	15(51.7)	

*All values are mean ± SD

**Statistical analyses were performed on log-transformed data

***ANCOVA test (Analysis of Covariance) adjusted for the covariate i.e. gender and age.

4.7 Discussion

This chapter examined the differences in D&L variables according to BMI status in older overweight Australians who were either at high risk of CRC or who had CRC as they presented for gastrointestinal surgery. We found that there were no substantial differences in dietary intakes according to weight status but did find that women reported having better intakes of some key nutrients and foods when compared to men. Overall, surprisingly 63% reported having high levels of physical activity over the last 12 months and within this category, the overweight group had the lowest levels of accumulated weekly minutes.

4.7.1 Characteristics of participants

The incidence rates of CRC are rising in many countries due to changes in individual and environmental risk factors and the ageing population is often assumed to be the main factor driving an increase in CRC incidence and mortality rates (Dolatkhah et al., 2015). The mean age of the CRC patients presenting for surgery in our study was 69.13 ± 10.31 years in men and 66.27 ± 13.81 years in women respectively with the majority of patients being older adults (> 55 years) at 90.5% in men and 87.8% in women (Table 4.2). From a study done in the developed world, cancer incidence is more frequent among elderly (Jemal et al., 2011).

The majority of both genders had a waist circumference above the cut-off value (>90 cm for men, >80 cm for women) (Table 4.5). As all women in this study are post-menopause age, they are likely to have increased their abdominal fat stores, with fat deposits in a pattern that is similar to males which means that women have increased mortality risk once the women reach post-menopause age (Kannel, Hjortland, McNamara, & Gordon, 1976).

The majority of participants were overweight and obese in our study as per the aims of the study and the recruitment protocol to ensure there was a spread of BMI across the participants (Table 4.4). Overweight and obesity is associated with increased health complications (Williams, Mesidor,

Winters, Dubbert, & Wyatt, 2015). An estimation of 11% of CRC cases in Europe were caused by overweight and obesity, and obesity was associated with 30% to 70% of attributed colon cancer risk among men (Bardou et al., 2013).

Even though, our results indicate that there was no statistical significant difference in waist circumference among normal, overweight and obese groups (Table 4.4), the obese participants did have the highest waist circumference. Also, majority of both men and women had a waist circumference above the cut-off value regardless of their normal, overweight or obese weight classifications (Table 4.5). It has been recognised by the National Institute of Health (National Heart & The National Institute of Diabetes and Digestive Kidney Diseases, 1998) that waist circumference and BMI, predict obesity-related health risk. The guidelines report that the health risk increases significantly from normal weight through to the obese categories, and that within each BMI category for both men and women, those with high waist circumference values are at a greater health risk than those with normal waist circumference values (National Heart & The National Institute of Diabetes and Digestive Kidney Diseases, 1998).

4.7.2 Dietary intake

Diet has long been considered a risk factor in CRC aetiology (Magalhães et al., 2012) and a causal factor in the mechanism of CRC (Yusof et al., 2012). The risk of colon cancer is higher with increased intake of red meat and lower consumption of fruits and vegetables which defines the predominant pattern (Magalhães et al., 2012). Our results indicate that in general the women in this study were having a better dietary intake as compared to the men (Table 4.6). Women consumed enough 25 g/day of fibre intake (Australian Government, 2006) and less alcohol consumption. As reported by the WCRF 2011, there is convincing evidence that food containing dietary fibre protects against CRC, and that alcoholic drinks consumption in men increases the risk of developing CRC (World Cancer Research Fund/American Institute for Cancer Research, 2011).

None of the patients in BMI groups and also both men and women did not meet the recommended dietary intake (RDI) for vitamin A in adult men (900 µg/day) or women (700 µg/day) (Australian Government, 2006) (Table 4.6 and Table 4.7). It has been suggested that vitamin A is an antioxidant and antioxidants are known to protect against cancer (Mamede et al., 2011). Although there is no convincing evidence that antioxidants protect against CRC (World Cancer Research Fund/American Institute for Cancer Research, 2011).

Dietary intakes of energy, macro- and micronutrients have been implicated in the aetiology of CRC (Ryan-Harshman & Aldoori, 2007). Several studies have shown that high dietary intakes of energy and energy-supplying macronutrients (i.e., carbohydrate, protein and fat) may have a positive association with the risk of developing CRC (Ryan-Harshman & Aldoori, 2007; Sun et al., 2012). In our study the proportion of energy from the macronutrients (i.e., protein and total fat) did meet the acceptable macronutrient distribution range (AMDR) whereas the proportion of total energy from carbohydrates did not (Australian Government, 2006) (Table 5.8). This may suggest that CRC patients are more motivated to maintain or make a modification towards healthy lifestyle to protect against CRC.

Besides, previous studies suggested a positive correlation between dietary fat and CRC risk (P. Boyle, Zaridze, & Smans, 1985; Walker & Burkitt, 1976), which resulted in dietary recommendation based on reduction in total fat intake. However, a recent study suggests that dietary fat does not seem to be a major risk factor for CRC (Franco et al., 2005).

Several studies revealed a direct association between total energy intake and risk of developing CRC (Ryan-Harshman & Aldoori, 2007; Tayyem et al., 2015), where caloric restriction was found to reduce cancer incidence in rodents and in humans (Longo & Fontana, 2010). In fact, the potential mechanism is thought to be through insulin-like growth factor-1 (IGF-1) where increasing energy is responsible for glycaemic overload, a promoter of tumour cell *in vitro* (Lin et al., 2010). Additionally, the study by Zelenskiy et al. (2014) found a direct association between dietary glycaemic load and CRC risk. In contrast, our findings indicate that overweight and obese groups did

not meet acceptable macronutrient distribution range (AMDR) for carbohydrate (Table 4.8). But their fat energy contributions did meet the acceptable macronutrient distribution range (AMDR) in overweight and obese groups.

Estimated daily intakes of key food groups differed according to gender but were not significant according to BMI status. Overall for the group as a whole, the mean ± SD intakes of red meat (112.3 ± 90.0 g/day) were higher than the recommendation of 100g/day but processed meat (35.4 ± 43.5 g/day) was less than the upper limit recommendation of 40 g/day. Men consumed approximately twice as much processed meat as women, four times as much alcoholic beverages and 40% less fruit compared to women. There was only a 70g difference in weight of daily vegetables consumed between men and women although this was significant after adjusting for age and total energy intake.

High intake of red and processed meat, intake of alcohol has been documented to have positive association with the risk of CRC (Clarke & Lockett, 2014; Magalhães et al., 2012). A study in 340,148 men and 227,021 women aged above 50 years in US showed that high consumption of fruits and vegetables were associated with 15 and 26% reduction in the risk of CRC and rectal cancers among men respectively when compared to people with less suitable food choices, however, no association was found among women (Wirfalt et al., 2009). In contrast, females in this study reported a better nutritional intake compared to males i.e. less intake of processed meat, alcohol intake and high intake of fruits and vegetables (Table 4.9). This may suggest that female CRC patients are more motivated to maintain or make a modification towards a healthy lifestyle to protect against CRC.

Chan et al. (2011) has recommended that intakes of total red and processed meat should not exceed 140 g/day. Men in our study exceeded this recommendation and reported consuming approximately 162 g/day whereas the women on average were more compliant with the recommendation, reporting the consumption of a total of 126 g/day of red and processed meat over the previous 12 months prior to presenting for gastrointestinal surgery. With respect to intakes according to BMI status, the

total red and processed meats for the normal and overweight groups were similar (143 g/day and 141 g/day) and close to the upper limit of the recommendation, but the obese group on average exceeded the recommendation (174 g/day) (Table 4.9). This may be worthy of further investigation as the combined risk factors of obesity, high waist circumference and higher meat consumption may compound the risk of CRC (Chan et al., 2011; Magalhães et al., 2012).

It is difficult to estimate the servings of alcohol, fruit, vegetables and cereals from the weight of foods reported as being consumed on a daily basis as often mixed dishes are included in the category and serve sizes vary according to specific examples of foods that contribute to the category (e.g., the weight of a serve size is quite different for dried fruit compared to fresh fruit). However, the reported g of alcohol per day gives an indication of the standard drink equivalents (10 g alcohol/standard drink). Men reported having the equivalent of 2 standard drinks of alcohol (mean ± SD; 20.2 ± 23 g alcohol/ day) and women reported the equivalent of half a standard drink (5.5 ± 10.7 g alcohol/day).

Alcohol consumption has been consistently linked with an increased risk for both colon and rectal cancer (Franco et al., 2005; World Cancer Research Fund/American Institute for Cancer Research, 2011). The effect was stronger in men compared to women, with 11% increased risk in men and 7% in women (Clarke & Lockett, 2014). Findings in this study have shown that men consumed higher alcohol intake compared to women (Table 4.9). It is strongly recommended that alcohol intake should be limited or avoided with men drinking under two standard drinks/day and women drinking under one standard drink/day (Clarke & Lockett, 2014).

Generally it may easier to alter diet than to change smoking, alcohol intake or body weight in high risk CRC patients (Tarr et al., 2014). Men had lower quality diets and the obese group consumed higher intakes of total red and processed meat combined. Estimates of nutrient and food intakes rely on self-report questionnaires which are often time consuming to complete and it can be difficult to estimate usual intakes over a 12 month period. In this study we used the Blue Eye Mountains Food Frequency which has been validated

(Ambrosini et al., 2003; Giles & Ireland, 1996; Hodge et al., 2000) and used in an older population. Food frequencies are recognised has providing reasonable estimates of usual mean intakes for groups and can be used to test differences between groups although participants may over- or under-estimate their actual intakes (Marks et al., 2006).

The number of participants in this study was relatively small and the results may not be generalisable to a broader population at high risk of developing CRC. Any dietary change modifications that are being suggested by health professionals to mitigate the risk of CRC need to be based on the individual needs, their environment, current dietary patterns and culture of different groups to enhance adoption (Tarr et al., 2014).

4.7.3 Physical activity

Higher physical activity is a protective risk factor against CRC. A systematic review indicates that individuals who are physically active have a 24% lower risk of developing CRC than those who have a sedentary lifestyle (Wolin, Yan, Colditz, & Lee, 2009). In another meta-analysis conducted by the same author (Wolin, Yan, & Colditz, 2011), there was a reported 16% reduction in the incidence of colonic adenomas for both men and women with increased physical activity. The study by Wolin et al (2011) also showed a 35% reduction in the incidence of large colonic polyps in physically active CRC patients. The meta-analysis suggests that physical activity has a role across the carcinogenic process and in colon cancer prevention.

In the IPAQ the three levels of physical activity consist of low, moderate and high based on the total physical activity scores from the summation of the duration (in minutes) and frequency (days) for walking, moderate-intensity and vigorous-intensity (IPAQ Research Committee, 2005). The mean MET minutes/week for the high activity level is considerable greater than the other activity levels (Table 4.11). However it must be remembered that the categories are not exercise intensity categories and it includes walking and other low intensity activities therefore the mean value will always be quite high.

In our study most of the participants were highly or sufficiently physically active in the previous 12 months according to IPAQ categories (IPAQ Research Committee, 2005) and the Physical Activity Recommendations for Older Australians (65 years and older) (W. J. Brown et al., 2005) (Table 4.12 and Table 4.13). Our finding that 2/3 of this group reported such a high level of physical activity using the IPAQ physical activity levels is not expected. This is likely due to overestimation in self-reporting activity but on the other hand, this population were aware of their increased risk with most considering or attempting to make dietary changes, and so may have actually engaged in regular physical activity. However this rather high level of reported physical activity is unlikely as the participants are all presenting for gastrointestinal surgery and it would be expected that physical activity would be low due to their serious underlying disease that is causing them to present for significant surgery. Within those reporting high physical activity levels, the overweight group had significantly lower MET minutes/week than those with normal weight, suggesting that the overweight group might be a specific group to target in future interventions. When the Australian Physical Activity Recommendations were used as the benchmark, 48% of participants were reaching the recommendation of at least 210 minutes per week. This may be a more reasonable estimate but is still relatively high compared to figures reported for the general Australian population (Brown et al., 2005).

These findings are in contrast with the study among breast cancer patients in Australia which indicated that the majority of participants exercised less after being diagnosed with cancer (Milne, Gordon, Guilfoyle, Wallman, & Courneya, 2007). As well a study by Lewis et al. (2014) in 453 newly diagnosed patients with stage II non-metastatic colon cancer from North Carolina which showed that physical activity levels of participants is low. It is most likely that the participants have for some reason, overestimated the minutes and the level of exertion of each activity in the IPAQ.

As the results demonstrated that the majority of the CRC participants regardless of whether they were in the normal weight, overweight and obese

group were physically active according to the recommendation. In addition, the obese group shown the high intake of red meat and alcohol consumption but the highest intake of fruit compared to normal and overweight groups. As well, women shown a better dietary intake compared to men. So overall, obtaining a healthy weight through the management of dietary and lifestyle modification for this population should be one of the main health messages to be been addressed.

4.8 Strengths and limitations of the study

The study was the first to investigate the interactions between weight status and other dietary and lifestyle CRC risk factors which can be serve as a baseline data or new information on high risk groups. Another strength of this study was the participants that took part in this study were patients clinically well-defined on patients' cancer stage and presence/absence of cancer. Furthermore, the finding of this study only analysed the measured height and weight to calculate BMI, and analyses were adjusted for known covariates due to the well-known issues of people under-reporting their weight and misreporting their height. Also, the study used the validated Blue Mountains Eye Study FFQ to assess participants' food intake and a validated tool to assess physical activity level of the participants (i.e., IPAQ questionnaire).

Even though, IPAQ is a validated questionnaire developed to monitor self-reported PA levels in healthy adults (Craig et al., 2003), and the most commonly used self-report tool of PA worldwide (van Poppel, Chinapaw, Mokkink, van Mechelen, & Terwee, 2010),the large amount of questions asked, low compliance, difficulties in completing the questionnaire perhaps in combination with side effects from the disease and its treatment, may have affected the accuracy of the participants' answers. Again, the limitations of this study due to small numbers and sampling method as convenience sample of presenting patients which means that the results may not were be generalisable to other clinical settings. Although all had the initial diagnosis of CRC prior to presenting for gastrointestinal surgery, some were subsequently diagnosed as not having CRC which may not represent the all set of CRC

population. In addition, relying on self-report of diet and physical activity may likely to be limited somewhat by recall error and relying on the sincerity of the participants to complete the questionnaires. Surprisingly, there were many of this group in high category of physical activity level. It could be due to overestimate or over-reporting self-reporting physical activity questionnaire.

4.9 Conclusion

Even though, this was a small study, it revealed that women had better nutritional practices than men but there were no differences in diet according to BMI classification. There were no consistent differences in physical activity according to BMI status but within those classified into high physical activity category, the overweight group had a lower number of MET minutes per week than the normal weight group. Overall, obtaining a healthy weight through the management of dietary and lifestyle modification for this population should be one of the main health messages to be addressed.

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Chapter 5. Intensive Individualised Dietary and Lifestyle Counselling on Improving Nutritional Status and Quality of Life among CRC Patients Undergoing Chemotherapy

5.1 Introduction

In the previous chapters of this thesis, knowledge and awareness of D&L factors associated with CRC risk were investigated and compared among different CRC sub-populations in a developed country. However, the risk of malnutrition during cancer therapies remains poorly understood, particularly among CRC patients in developing countries such as South East Asia. The incidence of CRC is increasing in South East Asian countries (Sung et al. 2008) as Western D&L factors are being adopted (Pourhoseingholi, 2012). In the study described here, the role of nutrition counselling is investigated, in improving malnutrition among Malaysian patients receiving various treatments for CRC.

Cancer treatments generally include surgery, radiation-therapy, chemotherapy, either alone or in combination (Paccagnella et al., 2010). All of these treatments can result in damage to normal tissues, and at the same time produce intense side effects that often affect nutritional status. Cancer therapies may affect nutritional status through alterations to the metabolic system and/or reduction in food intake (Delano & Moldawer, 2006). Some surgery, depending on the site and extent, could negatively influence the nutritional status of the patients (Mary M & Susan R, 2010). For example, extensive resection of the small bowel can lead to malabsorption of macro- and micronutrients, which could lead to malnutrition (Capra et al., 2001). Existing research suggests that patients undergoing surgery for upper gastrointestinal or CRC are particularly at risk of malnutrition (Farreras et al., 2005; Nitenberg & Raynard, 2000).

Other cancer treatment factors contributing to malnutrition may include nausea, vomiting, diarrhoea, constipation, dry mouth, mouth sores, and changes in taste and smell (Capra et al., 2001). Nausea and vomiting are the most common side effects of chemotherapy and many patients will limit their food intake to manage these side effects. Electrolyte imbalance, dehydration, weight loss, and weakness may result if nausea and vomiting is not controlled (Capra et al., 2001), all of which can eventually lead to malnutrition. In addition, diarrhoea is a common complication in CRC patients undergoing chemotherapy. It occurs in approximately 20% to 30% of the

patients (Daudt et al., 2011) and can be debilitating and potentially lead to malnutrition through malabsorption (Kornblau et al., 2000).

Radiotherapy plays a fundamental role either as a primary or adjuvant treatment of a variety of malignancies (Unsal et al., 2006). Patients undergoing radiation treatment experience side effects depending on the radiation dose and duration of treatment (Capra et al., 2001). Radiotherapy is toxic to tumour as well as healthy host cells within the area of treatment (Capra et al., 2001). Therefore, any treatment directed to any part of the gastrointestinal tract or pelvic area are likely to cause nutrition-related side effects (Mary M & Susan R, 2010) that may result in malabsorption that in turn may lead to weight loss (Guckenberger & Flentje, 2006). Radiotherapy may also cause tiredness, which can lead to a decrease in appetite and a reduced desire to eat (Ireland J & Wells M, 2003)

The prevalence of malnutrition in patients with cancer is reported to range from 40% to 84% (L. Brown et al., 2008) while studies of hospitalised cancer patients have reported that 56% to 76% of patients are either malnourished or suspected to be at risk of being malnourished (J. Bauer et al., 2002; Jane A. Read et al., 2006). The prevalence of malnutrition in cancer patients may vary among different clinical settings (Daudt et al., 2011) depending on the different classifications of malnutrition used (Daudt et al., 2011) and the malignancy itself, including the type and location of tumour, stage of the disease, and treatment received and on the type of nutritional assessment method used (J. Bauer et al., 2002). About 20% of cancer patients are reported to die of malnutrition or its complications rather than the malignant disease itself (B. W. Wu et al., 2009)

Malnutrition among patients with cancer is associated with longer hospital stays (J. Bauer et al., 2002), reduced responses to and increased complications from therapies (Tong et al. 2009), increased health-care costs (Correia & Waitzberg, 2003), poorer quality of life (QOL) (De Luis et al., 2006; von Meyenfeldt, 2005), low total energy intakes (Ottery, 1990), and lower survival rates (Paccagnella et al., 2010). There may be a greater prevalence of weight loss and malnutrition in patients with advanced stage of disease but nutrient and energy depletion may still occur with patients in

early stage disease (Khalid et al., 2007). Regardless of stage of disease, patients with cancer, and particularly cancers of the lower gastrointestinal tract, are at high risk of weight loss and subsequent malnutrition (Dewys et al., 1980)

Evidence shows that among those diagnosed with CRC, weight loss of more than 10% of pre-treatment body weight is also associated with malnutrition (Burden et al., 2010). Moderate to severe malnutrition in patients with CRC undergoing chemotherapy has been observed (Dintinjana et al., 2008) in association with weight loss (Dewys et al. 1980). Unaddressed malnutrition has been associated with reduced response to treatment, poor survival (Paccagnella et al., 2010) and diminished QOL (Capra et al., 2001). It is therefore important to maintain good nutritional status of the patients to improve the effects of anticancer therapy, sustain the ability to confront stress, and minimise the side effects of treatment (Wie et al., 2010). A good nutritional status should be maintained for patients through nutritional intervention during cancer treatment (van den Berg et al., 2010) and this is a common challenge amongst oncology patients (Heredia et al., 2008).

The evidence for malnutrition during cancer treatments highlights the need for early identification and appropriate intervention in CRC patients The extent of malnutrition should be identified early, followed by strategies that can generate positive outcomes for the patient (Capra et al., 2001). Nutrition can play an important role in the management of the cancer patient. Nutritional intervention is essential to prevent and/or reverse malnutrition (van Bokhorst-de van der Schueren, 2005). Thus, preventing or reversing malnutrition through nutritional intervention should adequately address these symptoms to improve patient outcomes. These outcomes may include patients' functional status, nutritional status, QOL, minimisation of nutrition impact symptoms, response to treatment, and survival (Capra et al., 2001).

Evidence from the study by Isenring et al. (2007) showed that intensive individualised nutrition counselling by a dietitian using a standard protocol in accordance with the American Dietetic Association Medical Nutrition Therapy resulted in improved dietary intake of cancer patients compared to usual practice (E. A. Isenring et al., 2007). Even a study by

Ravasco et al. (2012) confirms that individualised dietary counselling may be beneficial in maintenance of adequate dietary intakes and body weight, resulting in improved nutritional status and QOL of cancer patients (Ravasco, Monteiro-Grillo, & Camilo, 2012). Most notably, the beneficial effects can be observed in association with individualised dietary counselling were generally maintained for 3 months after the completion of radiotherapy (Ravasco, Monteiro-Grillo, et al., 2005).

In addition, early and intensive individualised nutrition intervention can be beneficial to oncology patients at risk of malnutrition (N Macdonald, 2003; Ravasco, Monteiro-Grillo, et al., 2005). The provision of nutrition intervention for patients with CRC is to stabilise or improve nutritional status (E. A. Isenring et al., 2007; Ravasco, Monteiro-Grillo, et al., 2005), to minimise the side effects of chemotherapy treatment and maximise quality of life (Marín Caro et al., 2007), and improve clinical outcomes (L. Brown et al., 2008; Dintinjana et al., 2008). The potential routes to malnutrition among CRC patients undergoing chemotherapy are schematically represented in Figure 5.1.

There is strong evidence suggesting that dietary and lifestyle intervention plays an important role in preventing malnutrition in cancer patients, but maintaining adherence to the dietary management has been difficult for patients. Additionally, there is evidence that has shown that self-efficacy is a predictor of positive behaviour change like that involved in or necessary for initiating or maintaining recommended dietary management for cholesterol reduction (Burke, Dunbar-Jacob, Sereika, & Ewart, 2003). The definition of self-efficacy is an individual's perception of how capable the person is to perform that specific behaviour and stresses the use of specific types of behavioural and cognitive strategies within particular conditions - or in other words the belief in one's own ability to achieve an outcome (Burke et al., 2003). More recently, a study among South Korean post-gastrectomy patients has reported that self-efficacy improved after intensive nutritional education which suggested that the clinical dietitian gave patients the courage to overcome their fear of changing dietary intake and improve their QOL by improving their confidence (Lee et al., 2016). This study was

designed to provide important data and contribute to the scientific evidence about effects of intensive individualised D&L intervention to overcome the depletion in nutritional status, and to improve the quality of life in patients with CRC undergoing damaging treatments.

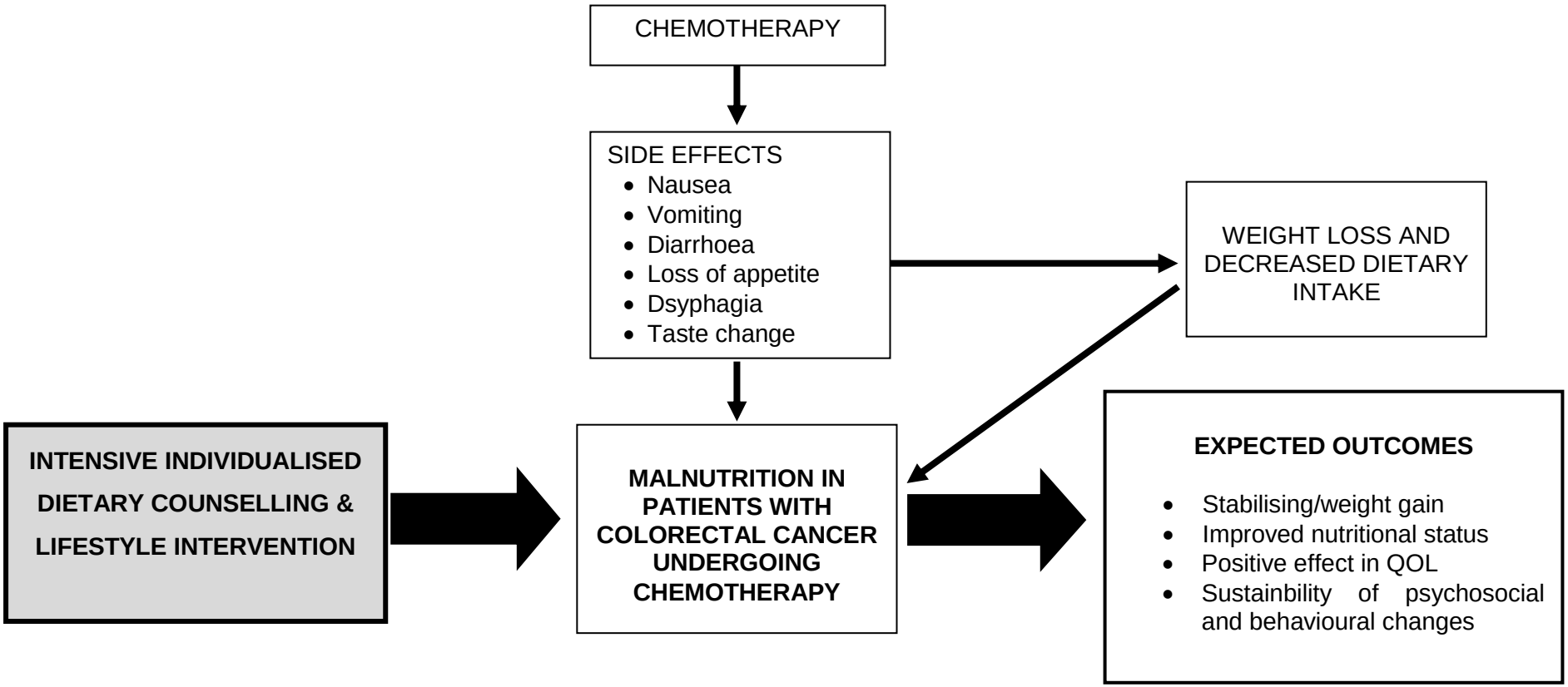


Figure 5.1. The conceptual framework

5.2 Aims and hypothesis

The aims of this study were to determine the effect of an 8-week intensive individualised nutrition counselling intervention on nutritional status and quality of life in patients with CRC undergoing adjuvant chemotherapy as compared to a control group of the same type of patients who received usual care.

The specific objectives of the intervention study were to:

1. Determine and compare the prevalence of malnutrition in patients with CRC undergoing adjuvant chemotherapy who received an 8-week intensive individualised nutrition counselling intervention and a control group who receive usual care.
2. Compare the effect of intensive individualised nutrition counselling (intervention) versus usual care (Centers for Disease Control and Prevention) on improving nutritional status, quality of life, psychosocial factors and behavioural attitudes in patients with CRC undergoing adjuvant chemotherapy.
3. Examine the sustainability of the changes in nutritional status, quality of life, psychosocial and behavioural changes in patients with CRC undergoing adjuvant chemotherapy in the intervention versus the control group 8 weeks post-intervention trial.

Our hypothesis is that in CRC patients receiving adjuvant chemotherapy, those that receive the intensive individualised nutrition counselling will have better nutritional and QOL outcomes than those receiving usual nutrition care.

5.3 Significance of study

Evidence-based practice guidelines for the nutritional management of patients receiving radiotherapy have been based on strong evidence that nutrition support improves outcomes in patients with gastrointestinal or head and neck area cancer undergoing radiotherapy (E. Isenring et al., 2008). Evidence highlights that dietary counselling by a dietitian, with or without the

use of commercial nutritional supplements as the most effective methods of nutrition intervention and have been found to improve in dietary intake (E. A. Isenring et al., 2007; Ravasco, Monteiro-Grillo, et al., 2005), nutritional status, and QOL in nutritionally-at-risk cancer patients undergoing radiotherapy (E. Isenring, S. Capra, & J. Bauer, 2004; Ravasco, Monteiro-Grillo, et al., 2005) (National Health and Medical Research Council grade of recommendation A).

Conversely, Bauer and others have reported that there is currently insufficient evidence to routinely recommend dietary counselling in patients with cancer receiving chemotherapy due to a lack of well-designed and high quality randomly controlled clinical studies (J Bauer, Isenring, & Ferguson, 2008). Most studies have investigated the effect of nutrition counselling on patients receiving radiotherapy or a combination of treatments and only one earlier study (Ovesen et al., 1993) has reported on the effects of nutritional counselling in patients receiving chemotherapy alone. In the study conducted by Oversen et al. (1993), QOL was measured using a non-validated tool and so the findings may not be generalisable. Bauer and others believe that this early study by Ovesen et al. (1993) should not be included in meta-analyses as it did not use a validated tool for global QOL assessment (Halfdanarson, Thordardottir, West, & Jatoi, 2008). Therefore, further research needs to be conducted in this area (J Bauer et al., 2008).

Dietary counselling is therefore the focus of this present study as early intervention is warranted in order to combat malnutrition in patients with CRC undergoing chemotherapy. Research in this area is urgently required and the dietary counselling and lifestyle intervention implemented in the study will also serve as a reference in designing intervention programs for the prevention and management of cancer in all clinical settings. On other hand, the role of the dietitian may be fully utilised in the oncology setting to conduct dietary counselling due to the effects of cancer and its treatment on nutrition among cancer patients. Patients might have no or limited information of how good nutrition practices could help them to respond well to treatment.

To the author's knowledge, this is the first intervention study using dietary counselling and lifestyle intervention in patients with CRC undergoing

chemotherapy alone. It is the first RCT to be reported in a Malaysian clinical setting, which makes this a significant study as cancer is increasing in Malaysia and strategies to improve health outcomes in cancer patients should be evaluated in the local clinical settings. In addition, this is one of the few studies that investigates the relationship between self-efficacy and the maintenance of dietary/lifestyle changes in patients following an intervention. Even though intensive dietary counselling has been shown to improve nutritional status and QOL in patients with cancer, there has been no research published to date (to the authors' knowledge) on the sustainability of cognitive and behavioural changes in patients with cancer following dietary counselling intervention. Other dietary intervention studies, however, have shown that an increasing self-efficacy and a greater readiness to make behavioural changes will improve behaviours in adults in a more sustainable fashion (Sallit, Ciccazzo, & Dixon, 2009).

5.4 Methods

5.4.1 Study design and study population

The intervention study was an open (masking not used), prospective, RCT to examine the effects of intensive individualised dietary counselling on dietary intake, nutritional status and QOL in patients with CRC undergoing adjuvant chemotherapy. It was designed as an 8-weeks RCT of intensive, individualised dietary counselling with an eight-week post intervention follow-up visit without dietary counselling compared to a control arm intervention of usual care. The study was carried out from March 2011 to April 2012. Details of the study design are illustrated in Figure 5.2.

Nutritional status is the balance between requirements modulated by activity and disease (requirements), on one hand, and nutrient intake altered by absorption (intake), on the other. Also defined as intake of a diet sufficient to meet or exceed the needs of the individuals will keep the composition and function of the otherwise healthy individuals within the normal range (Jeejeebhoy et al., 2015). Nutritional assessment is needed to determine the nutritional status of cancer patients which generally include anthropometric

data, biochemical and clinical assessment, and dietary information, used either alone or more effectively in combination. It can provide an excellent assessment of nutritional status of cancer patients. The malnutrition score was determined by the Scored Patient-Generated Subjective Global Assessment (PG-SGA) and QOL as assessed by the European Organisation for Research and Treatment of Cancer- Quality of Life Questionnaire-Cancer30 (EORTC QLQ-C30) and the newly validated CRC- specific module European Organisation for Research and Treatment of Cancer- Quality of Life Questionnaire-Colorectal29 (EORTC QLQ-CR29). The secondary outcome measures were D&L parameters which included anthropometric measurements, as well as dietary intake and the sustainability of participants' changes on psychosocial, behaviour, nutritional status and QOL.

At week eight after completion of the intervention period, dietary counselling was not performed and follow-up assessments were carried out at week sixteen. For this follow-up (post intervention) visit, measurements were only made to the nutritional assessment using the scored PG-SGA, anthropometric data, QOL questionnaire, 2-day 24-hour dietary records, and psychosocial factors questionnaire (Figure 5.2).

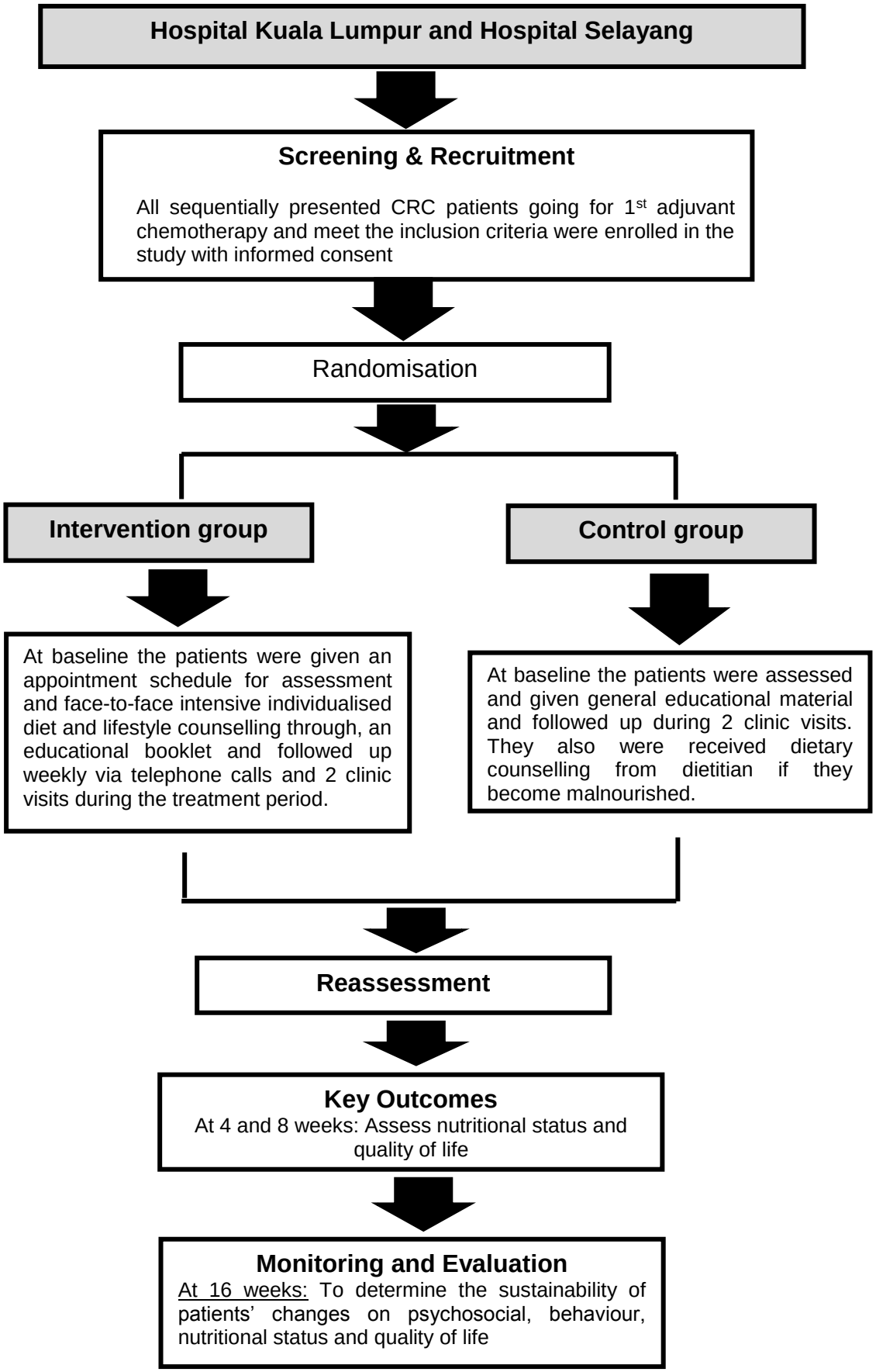


Figure 5.2. Study design

5.4.2 Participants and study setting

The intervention study was conducted at the Day Care Oncology Clinic at Hospital Kuala Lumpur and Day Care Oncology Clinic and Palliative Ward at Hospital Selayang, Malaysia among CRC patients undergoing chemotherapy. The grant for this study was funded by the Fundamental Research Grant Scheme (FRGS) Malaysia which is a non-commercial funding body. The purpose and protocol of the study were explained to the patients (See Appendix M) and their written consent was obtained prior to the commencement of the intervention study (See Appendix N).

5.4.3 Screening and recruitment of participants

Screening and recruitment of sequential presenting patients were carried out simultaneously on patients who visited the Day Care Oncology Clinic at Hospital Kuala Lumpur and Day Care Oncology Clinic and Palliative Ward at Hospital Selayang, Malaysia during the study period.

The recruitment was based on referral by the physicians. Collaboration with the physicians is important because the strength of the recommendation by the physician is pivotal (Ockene Jk, 1999). In this study, even though the physicians did not participate directly in the recruitment activities, their show of support by referring patients to the study had a significant impact on the ability to reach the target for the number of participants.

The inclusion criteria for potential patients were as follows:

- CRC patients who have completed surgery and about to commence first adjuvant chemotherapy
- Aged ≥ 18 years old
- Provided written informed consent
- Willing to comply to study procedures
- Able to read and write in Malay language.

The exclusion criteria for potential patients were as follows:

- Had a diagnosis of other cancer.
- Involved in another research project.

5.4.4 Intervention

The intervention study consisted of an intensive individualised dietary and lifestyle counselling involving the prescription of a modified therapeutic diet according to the individual participant's requirements. The main goal of a nutritional intervention is to enable every participant to maintain and/or achieve his or her calculated energy and protein requirements. The intervention carried out was in the form of an intensive individualised dietary counselling, given on a one-to-one basis by the same research dietitian throughout the study.

During the clinic visits, patients were screened for eligibility to participate in this study. The screening and the recruitment of patients was made via referral by the oncologist who was aware of the inclusion and the exclusion criteria. The selected patients were given a simple explanation from the oncologist about the research study. They were encouraged to voluntarily agree to join the study. Once the patients agreed, the oncologist informed the researcher.

After eligibility was confirmed, the patients received a brief description of the study from the researcher, and if they were interested, a more detailed description was given. The explanation included a description of the purpose of the study, the randomisation procedure, the follow-up schedule and potential benefits of the research study. The patients were also given time to read the participant information sheet (See Appendix M) and to consider their participation before agreeing and volunteering to participate in the research study. Once they agreed to participate in the research study, they were asked to sign the informed consent form (See Appendix N) and they returned the form to the researcher. Subsequently, a date was then fixed for the participant's baseline measurements to be taken at the clinic. At each assessment visit (visit 2, 3, 4 and 5), a token of appreciation of Ringgit

Malaysia (RM) 20 was given to each of the participants for their willingness to participate.

To meet the specific nutritional goals for each participant, individual directions for dietary counselling were given. In addition, nutritional prescriptions were based on the American Dietetic Association Medical Nutrition Therapy (ADA MNT) protocol for cancer patients (Yusoff et al., 2010) (Table 5.1). Total energy requirements were estimated using the quick method based on body weight. For normal or non-obese participants, an actual (current) body weight was used. For obese participants (BMI > 29.9 kg/m^2), ideal body weight (IBW) was used to estimate the total energy requirement (Yusoff et al., 2010).

Table 5.1. Nutritional prescriptions for the intervention group (IG) study participants

Nutrient	Nutritional prescription
Energy	30 kcal / 126 kJ to a maximum of 35 kcal / 144 kJ per kg body weight per day
Protein	20% from the overall energy intake which were estimated at > 1.0 to a maximum of 1.6 g of protein per kg body weight per day
Carbohydrate	50–60% from total energy
Fat	20–30% from total energy

Source: ADA 2006 (Yusoff et al., 2010)

The dietary intervention was structured and changes were only made to the energy and protein component of the diet. Individually tailored sample meal plans and recipe suggestions were provided during the visits. This process involved the prescription of a therapeutic diet modified to provide for individual requirements, thereby recognising personal eating patterns, feasible consistency and preferences.

In the dietary counselling strategies, advice on, and descriptions of treatment related symptoms that may negatively impact on dietary intake and

nutritional status were also provided to the participants with practical advice on how to deal with these symptoms. The dietitian was available to answer any queries or provide more information when requested.

Lifestyle counselling involving general advice to cease/reduce smoking and limit alcohol consumption was also provided to the participants during the study period. General advice on physical activity was also emphasised. The exercise should be done at a lower intensity and progress at a slower pace especially for those who were already on an exercise program. The principal goal was to maintain activity as much as possible (Doyle et al., 2006). Participants were reminded and encouraged to comply with the respective dietary intervention over the 16-week study period. Throughout the study, the participants were supported with the scheduled visits to the clinic and regular phone calls to develop a rapport to facilitate ongoing participation during the study period.

5.4.4.1 The Intervention Group (IG)

The IG received tailored and more intensive and ongoing nutrition support and lifestyle advice as compared with the control group. At the baseline visit, IG participants were asked about their dietary intake using a 24 hours dietary recall. Based on the estimated dietary intake, the researcher was able to estimate whether these participants were consuming their recommended dietary requirements for protein and energy. Then, a personalised energy requirement was calculated for each participant based on body weight (Yusoff et al., 2010).

Participants in the IG were instructed to follow a dietary intake based on the calculated energy and protein requirements. The distribution of macronutrients in the menu was 50% of total energy from carbohydrate, and 30% from fat. Participants were given a sample menu of 1500 kcal (or ~6300 kJ) and its modification to increase energy to 1800 kcal (or ~7500 kJ) and 2000 kcal (or ~8400 kJ). There was also examples of texture modification for different food groups. The modification was made according to the participant's need to encourage an adequate dietary intake in

participants (See Appendix O). They also received written materials i.e. the booklet containing information on nutrition and cancer in Malay (See Appendix P) and English language (See Appendix Q).

The sample menu developed prior to the intervention implementation was explained to the participants. In brief, the first part of the education covered the basic concept of malnutrition which is common in patients with CRC which was then followed by a more intense dietary management intervention based on the recommendations of the American Dietetic Association (ADA) (Yusoff et al., 2010).

The brief advice on engaging exercise was given to the IG. They were advice to start the exercise at a lower intensity and progress at a slower pace and to maintain the activity as much as possible.

5.4.4.2 The Control Group (CG)

These participants received the standard practice of the clinic. Nutritional advice was based on a guideline specifically focused on treatment of symptoms such as nausea, vomiting, loss of appetite and diarrhoea, and how to deal with the symptoms through nutritional approaches. Basically, the advice was given by the oncologist or nurses in the clinic. However, those who were assessed as having moderate and severe malnutrition during the recruitment were referred to see a service dietitian for dietary counselling but not as intensive as in the IG.

As in the IG, the same booklet was given to the CG (See Appendix P and Q). Information was delivered in the form of verbal, visual and written information. The first part of the education covered the basic concept of the malnutrition which is common in patients with CRC and followed by the simple guideline specifically focused on managing symptoms during the treatment.

5.4.5 Process of trial implementation

Each participant visited the clinics on five different sessions [first, second (baseline), third, fourth and fifth visits] over the 16-week study period. The intervention activities consisted of anthropometric measurement, intensive individualised dietary and lifestyle counselling (only for IG), food record and an intervention booklet in English and Malay version.

At the first visit, screening and recruitment were conducted. The procedure outlined in Figure 3.1 was performed during the visit. In addition, all the participants were also given comprehensive verbal instructions on the method of recording food intake using the 2-day 24-hour dietary record. Information on usual dietary intake using the diet history method was obtained from the participants during the initial screening visit. During the trial, dietary intake data were collected at each the four clinical visits using a self-administered 2-day 24-hour dietary record. The participants who were less educated were asked to seek assistance from their family members to record for them. They were asked to complete the 2-day 24-hour dietary record of food intakes before their next visit, which was used as the basis for their individualised dietary advice. They were also advised to record their dietary intake to cover one weekday and one weekend day. The first visit took about 15 to 25 minutes to accomplish.

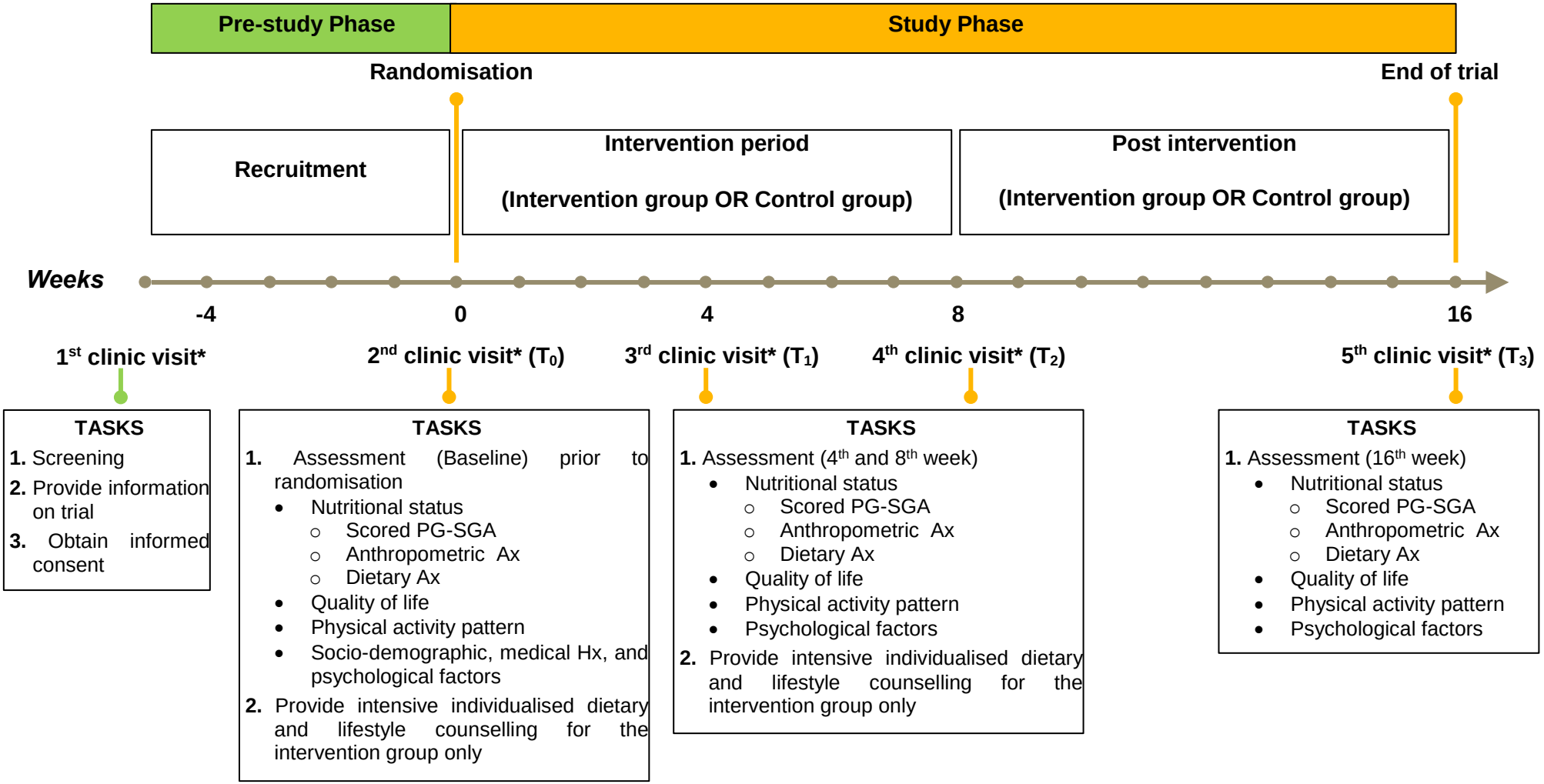
During the baseline visit (week 0), the researcher obtained the IG history of dietary intake and problems with food intake via a 24-hour dietary recall. Based on the estimated dietary intake, the researcher was able to determine if these participants consumed their dietary intakes based on their estimated requirements. The dietary advice was given individually and was structured based on the ADA MNT protocol for cancer patients as listed in Table 5.1 which they were expected to follow throughout the study. A standard sample menu of 1500 kcal/6300 kJ, 1800 kcal/7500 kJ and 2000 kcal/8400 kJ menu was given and modification was made according to the participant's needs (See Appendix O). The contact time at the baseline visit was the longest, which took about 45 minutes to an hour for each participant. However, the use of an existing diet plan greatly reduced the contact time between the dietitian and the participants.

At the week 4 and week 8 visits, the 2-day 24-hour dietary record from the previous visit were discussed with IG participants. Consumption of the texture modified diet as recommended was also reviewed as necessary. Participants who did not comply with the dietary advice (especially total energy and protein needs) were provided with additional practical and individualised advice based on their personal circumstances in order to facilitate compliance.

During the final visit at week 16, a post-intervention assessment was conducted on the participants by using the same method as used in baseline assessment but without the dietary counselling. The IG participants were encouraged to continue with the diet regimen. A graphical presentation of the study protocol and timeline is shown in Figure 5.3.

A postgraduate student was hired as an enumerator to help the researcher with post-intervention assessments. The enumerator was trained to help in interviewing the participants and carrying out anthropometric measurements. To minimise the degree of inter-rater variability caused by researcher and enumerator, every effort was made to keep the same enumerator measuring a particular variable at both the pre-intervention and post-intervention visits.

Both IG and CG participants were instructed to attend the clinic for all the visits. For those recruited but did not turn up for the assessment and intervention session on the scheduled date, they were followed up by telephone calls and an alternative arrangement was made within one week of the.originally.scheduled.visit.



Ax: Assessment; **Hx**: History; **PG-SGA**: Patient-Generated Subjective Global Assessment

***Participants must attend clinic for all clinic visits; if participants are unable to attend during the scheduled date, an alternative arrangement can be made with the researcher but must be within the week of visit.

Figure 5.3. A graphical presentation of the timeline and protocol for the Intervention Study assessing the effect of an 8-week intensive individualised nutrition counselling intervention on nutritional status and quality of life in patients with colorectal cancer (CRC) undergoing chemotherapy.

At baseline, data collection was carried out in all participants and with the exception of the socio-demographic questionnaire which was used once at baseline only, the same methods and instruments were used repeatedly at Week 4, Week 8, and Week 16. The details of the assessment and procedure are shown in Table 5.2.

Table 5.2. The assessment procedure at Week 0 (baseline), Week 4, Week 8, and Week 16

The assessment procedure	Weeks			
	0*	4	8	16
Questionnaire				
Social demographic background	√			
The scored PG-SGA	√	√	√	√
EORTC QLQ-C30 and EORTC QLQ-CR29	√	√	√	√
Godin Leisure-Time Exercise Questionnaire	√	√	√	√
Stages of change and self-efficacy for exercise and diet	√	√	√	√
Dietary assessment				
1-day 24-hour dietary recall	√			
2-day 24-hour dietary record		√	√	√
Anthropometric measurements				
Body weight	√	√	√	√
Height	√			
Waist circumference	√	√	√	√
Hip circumference	√	√	√	√
Percent body fat	√	√	√	√

*Baseline assessment prior to random group allocation

5.4.6 Measured outcomes

5.4.6.1 Primary outcomes

5.4.6.1.1 Malnutrition score

A. The scored Patient-Generated Subjective Global Assessment (PG-SGA)

The nutritional status of the participants was performed by using the scored

Patient-Generated Subjective Global Assessment (PG-SGA) (See Appendix R). It had been validated and used as a specific nutritional assessment tool for patient with cancer (E. Isenring et al., 2003; Laky et al., 2006; McCallum et al., 2000; F. D. Ottery, 1996). High agreement between physician, nurse, and dietitian for the overall subjective nutritional classification has been previously reported , and patients were found having no problem in completing the PG-SGA (C. Persson, Sjödén, & Glimelius, 1999). PG-SGA is a sensitive tool to detect changes in short/acute time periods (J. Bauer et al., 2002). PG-SGA had 98% sensitivity and 82% specificity in predicting SGA categories (J. Bauer et al., 2002).

The scored PG-SGA consists of two sections with seven domains. The first section of this assessment, which was in the form of a check box format comprises assessment of changes in body weight, food intake, gastrointestinal symptoms, and functional capacity, and was completed by the participants. The remaining questions in the second section, which cover all relevant diagnoses, evaluation of metabolic stress such as fever, fever duration, use of corticosteroids (prednisolone chronically – even short term use of corticosteroids can adversely impact protein status and muscle mass), and finally the physical examination including muscle wasting (temporal areas, deltoids, and quadriceps with a loss of bulk and tone by palpation), loss of subcutaneous fat (triceps region and midaxillary line at the level of the lower ribs) and oedema (ankle or sacral) or ascites were completed by the researcher. Each of the domains is described below:

i. Weight

This section of PG-SGA indicates current body weight (kilogram) and height (metres) of the participants. It also includes questions on the participants' weight at 6 months and 1 month prior to the visit. The domain also documents if the participant's weight has decreased; remained unchanged or increased in the past 2 weeks. The obtained current body weight is used to determine the level of weight changes in the past two weeks, and is scored from 0 to 1. Participants with weight loss in the previous two weeks get a score of 1 while those without any change in weight status obtain 0. Weight measurements taken over the last 6 months were retrieved from each

participant's medical file, and were used to compute the percentage of body weight change as follows:

$$\textbf{\% Weight change} = \frac{wt1 - wt2 \times 100}{wt1}$$

where wt1 = usual body weight (Sung et al.)
wt2 = actual body weight (Sung et al.)

The score was given based on the percentage in weight loss, previous 1 month weight data was used while 6 month weight data was used only if there was no 1 month weight data. Weight loss in 1 month of 10% or greater was given a score of 4 while weight loss of 0–1.9% obtained a score of 0. Weight loss in 6 months of 20% or greater was given a score of 4 while that of 0–1.9% obtained a score of 0.

ii. Food intake

The food intake domain within the PG-SGA rates the current food intake of the participants compared to the past month. It establishes if the food intake is 'unchanged', 'more than usual' or 'less than usual'. The domain asks if the participant is currently eating normal or less than normal amounts of food; little solid food; only liquids; only nutritional supplements; very little of anything; or only tube feedings or parenteral nutrition.

iii. Nutrition impact symptoms

This domain contains a checklist of gastrointestinal problems that may interfere with the participants being able to achieve an adequate dietary intake during the past two weeks. These problems include nausea, oral sores/ulcers, painful swallowing, dysphagia, loss of appetite, diarrhoea, being bothered by smell, feeling full quickly and fatigue. Scoring for these items ranged from 0 to 3 points depending on the participant's perception of their impact on dietary intake. A score of 0 indicated no problem eating whereas 3 indicates the presence of problems with severe impact on dietary intake.

iv. Activities and function

This domain rates the participant's activity over the past month to find out whether it was 'normal with no limitation'; 'not normal but able to get up and about with fairly normal activities'; 'not feeling up to most things but in bed or chair less than half the day'; 'able to do little activity and spend most of the day in bed or chair', or 'pretty much bedridden, rarely out of bed'.

v. Disease and its relation to nutritional requirements

Within this section all relevant diagnoses are listed in a checklist and others not in the list are required to be specified. A maximum score of 1 point is assigned for each diagnosis.

vi. Metabolic demand

The metabolic domain determines the score for metabolic stress by obtaining the number of variables known to increase protein and energy needs. It specifically scores levels of fever, duration of fever and corticosteroids used. An additive score of 3 points assigned for a patients who has a fever of > 120 F (3 points) and is on 10 mg of prednisolone chronically (2 points).

vii. Nutrition-related physical examination

The nutrition domain includes a clinical evaluation by the researcher of three aspects of body composition: fat, muscle and fluid status. These are examples of areas that can/should be considered in determining loss/deficit (or excess fluid). Each aspect of the exam is rated for degree of deficit with muscle deficit impacting the point score more than a fat deficit. Temples (temporalis muscle), clavicles (pectoralis and deltoids), shoulders (deltoids), interosseous muscles, scapula (latissimus dorsi, trapezius and deltoids), thigh (quadriceps), and calf (gastrocnemius) muscles are assessed for wastage. Orbital fat pads, triceps skinfold, and fat overlying lower ribs are examined to determine the level of fat loss. Since the assessment is subjective, each aspect of the examination is rated for a global degree of deficit. Participants without any deficit are given a score of 0 while those with mild, moderate and severe deficits get scores of 1, 2, and 3 respectively.

For each domain of the PG-SGA, a score ranging from 0 to 4 was given, depending on the impact on nutritional status. The sum of scores obtained in each domain of the PG-SGA was used to determine the total PG-SGA scores. The total scores that range from 0 to 35 and those with a higher score reflect a greater risk of malnutrition or indicate lower nutritional status of the patient (F. Ottery, 2000). These scores were applied to global assessment categories by assigning a global rating of Stage A (well-nourished), Stage B (moderately malnourished/moderately thin) or Stage C (severely malnourished/very thin). Then, a critical need for nutrition intervention was identified and classified based on the attention needed: 0–1 point: no intervention; 2–3 points: health education; 4–8 points: dietetic intervention; ≥ 9 points: a critical need for nutrition support intervention.

Participants rated as Stage A did not have any weight loss or deficits in nutrition impact symptoms, dietary intake, functioning, and physical examinations. Those in Stage B had moderate deficits or showed recent improvement in weight, nutrition impact symptoms, dietary intake, function and physical examinations. Participants with any severe PG-SGA categories (weight loss, nutrition impact symptoms, dietary intake, function and physical exam) were rated as severely malnourished.

B. Anthropometric measurements

The anthropometric measurements carried out in the study included body weight, height, waist and hip circumference, and body fat. These measurements were taken directly before the interview with all the participants and carried out during all visits. The measurement was done with the same researcher to ensure a similar technique was adopted and therefore, reducing measurement bias.

i. Body Mass Index

The measurements were taken from participants who were shoeless and wearing lightweight clothing with empty pockets, without watches and other accessories. Weight was determined to the nearest 0.1 kg using a digital weighing scale (SECA, British Indicators Ltd., UK). The machine was

calibrated every morning with a standard weight before it was used. Height was measured in the standing position to the nearest 0.1 cm using a SECA microtoise tape (206; Vogel and Halke GmbH & Co, Hamburg, Germany) which attached to the wall. The participants were asked to stand straight with the head in the Frankfurt plane, feet together, knees straight, and heels, buttocks, and shoulder blades in contact with the vertical surface of the wall. All anthropometric measurements were taken twice by the same investigators, and the average was determined. Height measurement was only performed at baseline visit.

Weight and height of the participants were then used to calculate BMI according to the formula on page 97.

ii. Waist circumference

Waist circumference measurement provides information on the fat distribution irrespective of the BMI (World Health Organization, 1995, 2000). Waist circumference was measured using a non-elastic tape recorded in centimetres to the nearest 0.1 cm. The waist circumference measurement was taken at the distance around the smallest area below the rib cage and above the umbilicus (belly button), with the tape held in horizontal plane (parallel to the floor).The measurement was taken at a normal minimal respiration. All anthropometric measurements were taken twice by the same investigators, and the average was determined. The expected normal values for men and women are less than 90 cm and 80 cm respectively.

iii. Hip circumference

The hip circumference measurement was taken at the widest point over the buttocks, with the tape held in a horizontal plane, touching the skin but not indenting the soft tissue. The participants were asked to stand erect with arms at the side and feet together. The measurement is taken to the nearest millimetre. All anthropometric measurements were taken twice by the same investigators, and the average was determined.

iv. Waist-hip ratio (WHR)

Waist-hip ratio was determined using the following formula:

$$\text{WHR} = \frac{\text{Waist circumference (cm)}}{\text{Hip circumference (cm)}}$$

Participants were then classified into two groups based on WHR as shown in Table 5.3.

Table 5.3. Classification of waist-hip ratio (WHR) according to the World Health Organization (1995; 2000)

Gender	WHR	Classification
Male	< 1.0	Normal
	≥ 1.0	Increased risk
Female	< 0.85	Normal
	≥ 0.85	Increased risk

v. Percent body fat

The Omron body fat monitor HBF-302 (Omron Healthcare Co., Ltd., UK) was used to obtain participants' body fat percentage with accuracy up to 0.1% and total body fat mass measured to the nearest 0.1 kg. Participants were asked to empty their bladders 30 minute prior to measurement. Participants stood in an upright position and held the device with both hands away from their body. Each measurements were taken twice by the same investigators, and the average was determined. The Omron device is a BIA assessment where a small, safe electrical signal is passed through the body and there is resistance by non-conducting tissues. The resistance is called impedance and it is greatest in fat tissue, while fat-free mass which contains 70 -75% water allows the signal to pass much more easily. The cut-off points for percentage of body fat were those recommended by Omron HBF-302 (Table 5.4).

Table 5.4. Classification of body fat percentage according to Omron Body Fat Monitor HBF-302

Gender	Body fat percentage (%)	Classification
Male	< 10	Low
	10–20	Normal
	20–25	Moderate
	> 25	High
Female	< 20	Low
	20–30	Normal
	30–35	Moderate
	> 35	High

C. Dietary intake

Dietary intake was measured through a 24-hour dietary recall at baseline and two days of 24-hour dietary records (one weekday and one weekend day) prior to each of the three subsequent clinic visits (at Week 4, Week 8 and Week 16). The participants were required to keep record of all food and beverage intakes within each 24 hour period of data collection.

For guidance, both IG and CG were provided an explanation by the researcher on how to fill in or record their two-day intake in a food diary. They were also given a detailed manual instruction, together with a food album, to help them to fill in their two-day food intake. A food album of commonly consumed food included details of typical household measurements (glass, cup, Chinese rice bowl, plate, tablespoon, and teaspoon) which were used to facilitate recalls of serving size and improve accuracy. Details of food information and descriptions, which included food brand names, methods of food preparation and cooking, as well as recipes of any mixed dishes eaten during the study period), were also recorded. Meanwhile, in situations where foods and beverages were consumed away from home, the participants were encouraged to describe the quantities of foods and beverages consumed using the household measures as well.

Participants who were less educated were asked to seek assistance from their family members to record for them. They were asked to complete

the 2-day 24-hour dietary record of food intakes before the next visit, which was used as the basis for their individualised dietary advice and was also used to assess compliance with dietary advice.

A computerised local dietary analysis program (Nutritionist Pro Version 2.0; First Data Bank Year The Hearst Corp. USA) was used to analyse the nutrient intakes of the patients. The foods and beverages consumed by the participants were coded by the food item and amount and analysed for nutrient content which were primarily based on the Malaysian Food Composition Table (Tee, Ismail, Mohd Nasir, & Khatijah, 1997).

If the foods were not available in the Malaysian database, other sources of information, which were the Singapore Food Facts (Dyer et al., 2004) was sought. However, a standardised local recipe was used to correct individual food intake when information was not available on the nutrient contents for certain food items or recipes. For food items or food dishes for which no local recipes were available, the nutrient value of raw ingredients were used for diet analysis; it was added with basic ingredients (such as cooking oil and salt) or substituted with the most similar food item. For the commercially available food, information from nutritional facts of the food package was obtained or if not complete, it was sought from manufacturers.

The software was then used to calculate dietary intake at baseline (based on one 24-hour dietary recall) and other subsequent assessment time points (based on average intake over each 2-day period of dietary record). Data obtained were analysed using the statistical software 'Statistical Package for Social Sciences (SPSS) version 19.0 for Windows (SPSS Inc, Chicago, IL, USA). Reported in this thesis were estimated intakes of energy, protein, carbohydrates, fat, and fibre.

5.4.6.1.2 Quality of life

Quality of life (QOL) was measured using the European Organisation for Research and Treatment of Cancer- Quality of Life Questionnaire-Cancer30 (EORTC QLQ-C30) (See Appendix S) and the newly validated CRC-specific module European Organisation for Research and Treatment of Cancer-

Quality of Life Questionnaire-Colorectal29 (EORTC QLQ-CR29) (See Appendix T). Participants were asked to complete the questionnaires during their 4 clinic visits.

The EORTC QLQ-C30 instrument is a 30 item cancer-specific questionnaire that includes six function scales (physical, emotional, cognitive, social, role, and global health/QOL), three symptom scales (fatigue, pain, nausea/vomiting), and six single items assessing symptoms (dyspnoea, insomnia, appetite loss, constipation and diarrhoea) and the financial impact of the disease (E. A. Isenring et al., 2007). The questions appear in Likert scale format with four response answers as follows; 1 (Not at all), 2 (A little), 3 (Quite a bit) and 4 (Very much) except for global health status which employs a seven point response scale ranging from 1 (very poor) to 7 (excellent). All raw data were linearly transformed through Syntax description order; to give a score between 0–100. QOL scores for subscales and the total were calculated according to EORTC's guidelines (Aaronson et al., 1993).

Higher scores on the global health status and function scales indicate higher level of QOL, better functioning, whereas higher scores on the symptom scales and single items denote increased symptoms or worse financial impairment (P. Fayers & Bottomley, 2002). A difference of 5–10 points in the scores represents a small change, 10–20 points a moderate change, and greater than 20 points a large clinically significant change from the patient's perspective (Osoba, 1999). This questionnaire has been validated to be used among breast cancer patients in Malaysia (Na, WYb, & CHc, 2010).

Briefly, the EORTC QLQ-CR29 is meant specifically for use among CRC patients varying in disease stage and treatment modality (Peng et al., 2011). The questionnaire constitutes 29 items addressing symptoms (gastrointestinal, urinary, pain and others), and functional areas (sexual, body image and others) that are associated with CRC and its treatments. There are separate scales for patients with or without a stoma (which can be compared) and separate items addressing sexual function for men and women (Whistance et al., 2009). The questionnaire has a Likert scale of four

response categories which are the same as those used in the QLQ-C30. The questionnaire asks about the past week in all items except the ones on sexuality, which request the participants to evaluate the past four weeks. Similar with the EORTC QLQ-C30, all scales and single-items measures is linearly transformed to give a score from 0 to 100 according to the algorithm recommended by developers. The approval for both questionnaires were obtained by the European Organisation for Research and Treatment of Cancer Quality of Life (See Appendix U).

5.4.6.2 Secondary outcomes and demographics

5.4.6.2.1 Socio-demographic background, medical history, smoking habit and alcohol consumption

The questionnaire was designed to collect information on demographics, socio-economic measures, medical history and lifestyle habits. The assessment was obtained by interviewing the participants. The questionnaire was pre-tested on ten individuals prior to use to ensure clarity of wording, with some adjustments made after this process. The socio-demography information was obtained at baseline only.

The demographic and socio-economic sections included age, gender, marital status, ethnicity, education levels, monthly income and current and past smoking and alcohol habits. Medical history information on chronic diseases, which covered year of diagnosis, and medication received was obtained from medical records. In addition, information on CRC history which covered the mode of treatment, year of diagnosis, stage of cancer, and family history of having any chronic diseases was obtained. There were a total of 20 questions which took about 10 minutes to complete.

5.4.6.2.2 Physical activity

Physical activity was assessed using Godin's Leisure Score Index (LSI) of the Godin Leisure-Time Exercise Questionnaire (Godin & Shephard, 1985) (Please see Appendix V). This is self-administered questionnaire where participants were asked to complete the question during each of the four

clinic visits.

The LSI is a 3-item questionnaire assessing the average frequency and duration of mild (minimal effort, no perspiration), moderate (not exhausting, light perspiration), and strenuous of physical activity (heart beats rapidly, sweating) performed during free time in a typical week. Using this information it is possible to estimate average weekly exercise minutes for mild, moderate, and strenuous activities plus combined scores for moderate plus strenuous exercise minutes. For analyses, participants were categorised as completely sedentary (i.e., 0 minute of moderate or strenuous exercise per week), insufficiently active (i.e., some moderate to strenuous minutes of activity but not enough to meet public health exercise guidelines), or meeting public health exercise guidelines (i.e., ≥ 60 minute of strenuous exercise per week or 150 minute of moderate plus strenuous exercise per week) as defined by the American College of Sports Medicine and the Centers for Disease Control (Garber et al., 2011).

The LSI has been successfully used with adults and cancer survivors (K. S. Courneya & C. M. Friedenreich, 1997). In addition, it has been found to be a reliable and valid measure as compared to nine other self-reported measures of physical activity behaviour (Jacobs, Ainsworth, Hartman, & Leon, 1993).

5.4.6.2.3 Stages of readiness for exercise and to change dietary intake

The cognitive and behavioural measures and potential changes of the participants were developed using an adapted version of the questionnaire of the self-efficacy and the stages of exercise behaviour change (Marcus, Eaton, Rossi, & Harlow, 1994) and diet behaviours questionnaire (Burke et al., 2003; Craig et al., 2003). The reliability test for the self-efficacy scale over a two-week period was reported in an earlier study - 0.90 (the kappa index of reliability for the stages of change instrument over a two week period was 0.78 (Marcus et al., 1994). This is a self-administered questionnaire where participants were asked to complete the questionnaire during their 4 clinic visits (Please see Appendix V).

The Stages of Behavioural Change is a four-item measure designed to place participants into either the Pre-contemplation, Contemplation, Action, or Maintenance stage. Pre-contemplation describes an individual who is not engaged in the behaviour and has no intention of becoming involved in the behaviour in the future. Contemplation describes an individual who is not engaged in the behaviour but is thinking about becoming involved in the behaviour in the future. Action describes an individual who has initiated to do some of the behaviour. Maintenance describes an individual who is regularly engaging in the behaviour. A stage of behaviour change model questionnaire for meeting dietary guidelines (i.e. eating 5 or more servings of fruits and vegetable a day, being physically active for at least 30 minutes 5 days per week) was used in this study using 2 compiled questions. Then followed with a question that asked participants who reported engaging in the behaviour how long they had been doing so. The compiled question is similar to that recommended by Prochaska and Diclemente (Prochaska & DiClemente, 1983).

The questionnaire of the self-efficacy scales for health-related behaviours used a multi-item situational confidence scale. The participants were asked to consider situations in which some people might find it difficult to engage in the behaviour and then ask them to rate how confident they are that they could undertake that behaviour at the criterion level in the various situations. Each item was rated on a 5-point Likert scale ranging from 1 (not at all confident) to 5 (completely confident). A five item self-efficacy measure was designed to measure confidence in one's ability to persist with exercising in various situations using a single standard question "I am confident I can participate in regular exercise when:…".There were seven items to measure the confidence that the participants would have in consuming a healthy diet under different situations using a single standard question "How confident are you that you could …" (See Appendix V).

5.4.6.3 Pre-testing and validation study of instruments

Among the questionnaires used in this study, the scored PG-SGA, EORTC QLQ C30 and EORTC QLQ CR29, the Godin Leisure-Time Exercise

Questionnaire and the self-efficacy and the stages of exercise and diet behaviours change questionnaire have been validated in other studies (K. S. Courneya & C. M. Friedenreich, 1997; Jacobs et al., 1993). The questionnaires on belief of exercise and diet and behavioural changes on overall health, although based on existing constructs and questionnaires, were constructed for this research. After construction, the questionnaires were examined by experts from the supervisory committee. Necessary modification was done on the questionnaires based on the recommendation from the supervisory committee. In addition, a pre-testing was conducted on the questions relating to the participants' beliefs of the role of diet and physical activity in modifying CRC risk.

The pre-testing on the belief of diet and physical activity questionnaire was carried out on a group of fifteen patients in Day Care Oncology Clinic and Palliative Ward, Hospital Selayang, Malaysia. The objective of this pre-test was to evaluate the clarity and readability of the question and the overall structure of the questionnaire. The patients were requested to give comments on clarity and interpretability of the questionnaire. If there were comments from the patients, the questionnaires were reviewed and amended accordingly. Based on the pre-test survey, there was no need to re-structure the questionnaire.

On top of that, a reliability analysis was carried out on changes and self-efficacy of diet and physical activity questionnaires. The Cronbach's α values for each questionnaire were presented in Table 5.5. The result shows that the value of the Cronbach's $\alpha > 0.70$ for questions of belief on actively engaged doing physical activity and consuming a healthy eating diet. This shows that the questionnaires have relatively high internal consistency.

Table 5.5. Cronbach's α for changes and self-efficacy of diet and physical activity questionnaires

Questionnaires		No of items/questions	Cronbach's α
Self -belief	Physical activity	5	0.92
	Diet	7	0.89

5.4.7 Sample size calculation

The primary outcome measure was nutritional status, as measured by the PG-SGA score. A recent study by Isenring and colleagues (2007) assuming clinically significant difference of 5 units or more in the scored PG-SGA in one group relative to another group of patients with gastrointestinal or head and neck area cancer undergoing radiotherapy with standard deviation of 4.6 units. Which $Z(1-\alpha/2)$ = 1.96 z score for level of significance an in two-sided test, $Z(1 - \beta)$ = 0.84 z score for power of the test.

$$\mathbf{N} = \frac{2 \times [Z(1-\alpha/2) + Z(1 - \beta)]^2}{(\Delta)^2}$$

$$= \frac{2 \times (1.96 + 0.84)^2}{(5/4.6)^2}$$

= **11 patients per group**

Hence, in order to detect a 20% difference in mean nutritional status between groups, with a power (β) of 90% and a probability (α) of 0.05, 12 respondents had to be included in each group. Allowing for a high 'drop-out' rate of > 20% and the fact that this type of study had not been conducted in a Malaysian setting previously, the study aimed to recruit a total of 24 respondents per group to maximise the power to detect clinically significant differences.

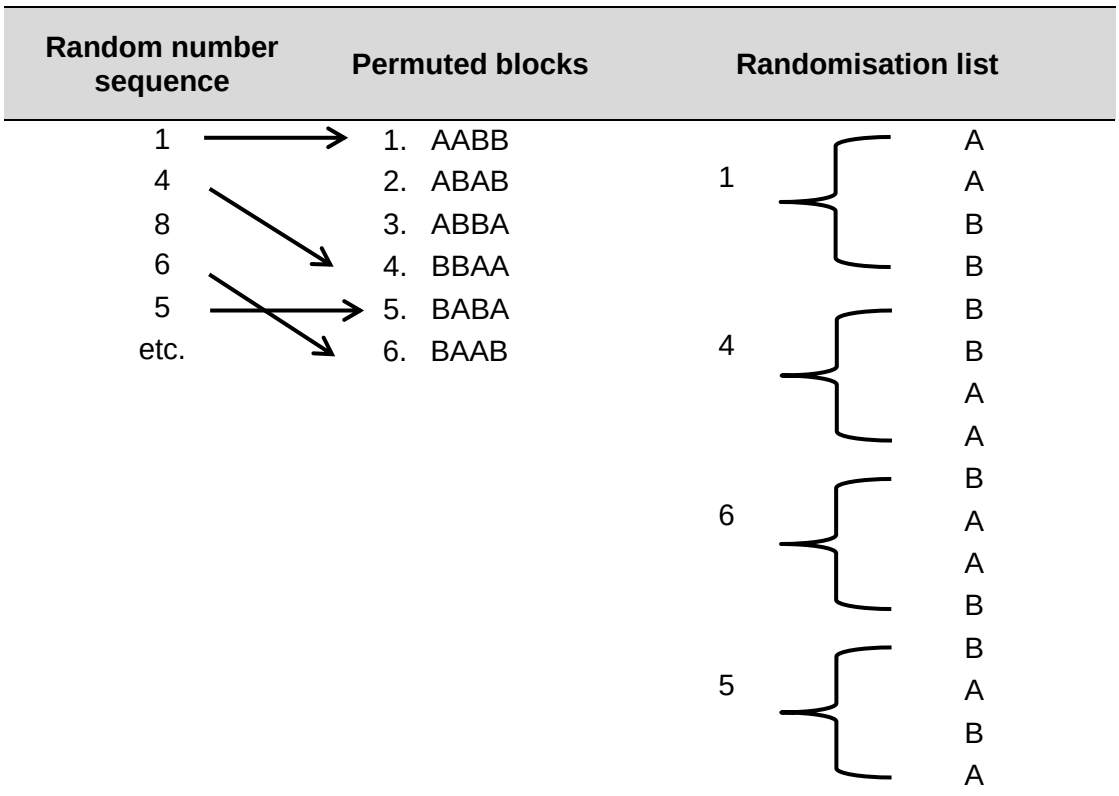
5.4.8 Randomisation

The researcher was aware of the treatment allocation but the clinicians were blinded to the participants' treatment allocation.

Allocation of participants into the two treatment groups was done by a permuted block method for block size of four, with A for intervention group and B for the control group. This block of four had six different possible arrangements of two As and Bs (Beller, Gebski, & Keech, 2002) and generated from a computer. Therefore, a random number sequence is used to choose a particular block, which sets the allocation order for the first four participants. Similarly, the treatment group is allocated to the next four participants in the order specified by the next randomly selected block. The process is then repeated (Beller et al., 2002). Permuted block randomisation was used to ensure that the treatment group numbers were evenly balanced at the end of block (Beller et al., 2002; Keech, 1998).

Allocation was made by asking the participants to pull a sealed envelope out of a box. The envelope was opened on the spot, deciding which group the participant would be allocated to.

Figure 5.4 shows a permuted block method for block size of four that were used in the study.



A random number sequence is generated from a statistical textbook or computer. Each possible permuted block is assigned a number (1 to 6 in the above example). Using each number in the random number sequence in turn selects the next block, determining the next four respondent allocations. Numbers in the random number sequence greater than the number of permuted block combinations (7, 8, 9 and 0) as in the above example are not used to select blocks.

Figure 5.4. The permuted block method of randomisation for block size of four, with A and B being treatment groups (A = intervention and B = control)

5.4.9 Ethics approval

This study was registered with and the Australian New Zealand Clinical Trials Registry (ANZCTR) (Universal Trial Number: U1111-1120-5586). The intervention study was approved by the Southern Adelaide Health Service/Flinders University Human Research Ethics Committee (SAFUHREC) (Application number: 465.10; See Appendix W) and the Medical Research Ethics Committee (MREC), Ministry of Health Malaysia (NMRR-11-285-8064; See Appendix X). Permission to conduct the study was obtained from the director of Hospital Kuala Lumpur and Hospital Selayang, Malaysia.

5.4.10 Statistical analysis

Data were checked for the normality by Kolmogorov-Smirnov analysis (Coakes & Ong, 2010). All data were normally distributed as indicated by $p>0.05$ unless otherwise stated. If the data were not normally distributed, analyses were carried out on the natural logarithm of the values to improve the symmetry and homoscedasticity of the distribution. Still, if the data were not normally distributed even after logarithm transformation, then non-parametric analysis (Mann-Whitney test) was performed and presented as medians followed by the inter-quartile range (IQR).

In this trial, descriptive statistics including percentages, mean values, standard deviation, range, and median was used to describe the baseline demographic, medical background, nutritional status level, QOL, physical activity level, stages of change on physical and dietary behaviours, anthropometric, and dietary intake. Median were used when the data were skewed. When the data becomes skewed the mean loses its ability to provide the best central location for the data because the skewed data is dragging it away from the typical values. In addition, the median is not strongly influenced by the skewed values. The values of each of the two treatment groups were compared using an independent T-Test, while the categorical data were analysed by using Pearson's chi-square test.

Nutritional status is the dependent variable on the primary analyses. A one-way ANOVA was performed to assess the relationship between nutritional status and QOL. An intent-to-treat (ITT) analysis was performed to determine the effect of the intervention study on the assumption that participants adhered to the dietary advice at entry into the intervention study and had baseline and endpoint values of PG-SGA score. In other words, ITT analysis includes every subject who is randomised according to randomised treatment assignment regardless of their noncompliance, regardless of subsequent withdrawal from treatment or deviation from the protocol and anything that happens after randomisation. The effects of intervention between treatment groups on primary and secondary outcomes were carried out by using the SPSS General Linear Model (GLM) for repeated measure procedure. This method is quite robust to violation of the assumption of

normality (Coakes & Ong, 2010).

A partial Eta-squared measure was used to compare the magnitude of changes with the large effect size indicating a large change in magnitude (Rapp-Kesek, Ståhle, & Karlsson, 2004). Using Cohen's classification, the value of partial Eta-squared was considered to be a small effect size at 0.01, a moderate effect size at 0.06 and a large effect size at 0.14 (Cohen, 1988).

The changes from baseline to week 16 in anthropometric, nutritional status, QOL and dietary intake measurements were computed. The comparison of changes between the groups was made by an Independent T-Test, while the changes within the group were compared with Paired T-Test.

The collected data was analysed using the statistical software 'Statistical Package for Social Sciences (SPSS) version 19.0 for Windows (SPSS Inc, Chicago, IL, USA). A statistical probability level of $p<0.05$ were considered as significant for differences for all tests.

5.5 Results

5.5.1 Recruitment, enrolment and patients follow-up

The researcher screened 50 potentially eligible patients with 42 participants (84%) consenting to enter the study. Patients were excluded because they did not meet the study's criteria (n=6) or refused to participate (n=2). Figure 5.5 shows the participants enrolment and follow-up with their respective treatment groups. A total of 42 participants were randomised into the two groups: the intervention group (IG) and control group (CG). There were 22 participants in the IG and 20 participants in the CG who completed the intervention and presented at the follow-up 8 weeks after the intervention.

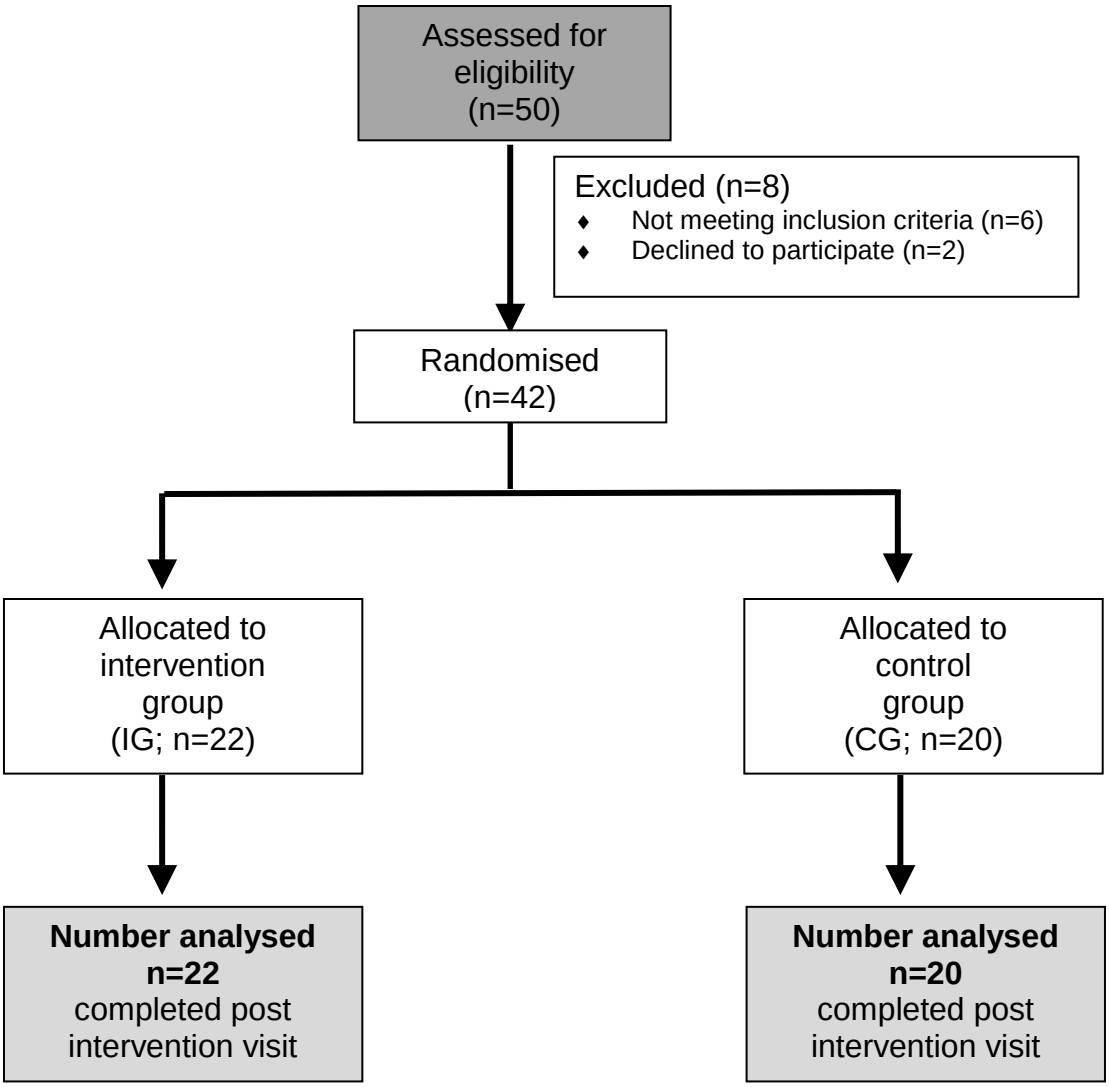


Figure 5.5. Consort diagram showing the flow of participants through each stage of the trial.

5.5.2 Baseline comparisons between the treatment groups

5.5.2.1 Demographic and socio-economic background

The demographic and socio-economic characteristics of the study participants between the IG and CG at baseline are presented in Table 5.6.

There was no statistical difference in age between the two groups. The mean age of the participants was 58.91 ± 8.63 years in the IG and 55.00 ± 10.80 years in the CG. The majority of them were male and Chinese, were not working, and had attained a secondary level of education. All of the participants were married. The monthly household income status of the

participants was divided into low (less than RM2000), middle (RM2001–5000) and high income brackets (above RM5000) based on the report of Department of Statistics Malaysia (DSM) (Department of Statistics Malaysia, 2012). More than half of the participants from IG (54.5%) were classified as being from the low-income bracket. In contrast, less of the participants from the CG (25.0%) were from the low-income bracket. There were no statistical difference in socio-demographic background between the two groups.

Table 5.6. Demographic and socio-economic background of the participants in the intervention group (IG) and control group (CG) at baseline

Characteristics	IG (*n* = 22)		CG (*n* = 20)		
Age (years) (Mean ± SD)	59.0 ± 8.6		55.0 ± 10.8		0.905
	n	% of participants	*n*	% of participants	*p value
Gender					
Male	13	59.1	14	70.0	0.461
Female	9	40.9	6	30.0	
Ethnicity					
Malay	4	18.2	6	30.0	0.173
Indian	0	0.0	2	10.0	
Chinese	18	81.8	12	60.0	
Educational level					
Primary	6	27.3	6	30.0	0.271
Secondary	9	40.9	6	30.0	
Tertiary	4	18.2	1	5.0	
Others	3	13.6	7	35.0	
Employment status					
Government sector	1	4.5	2	10.0	0.318
Private sector	4	18.2	2	10.0	
Self-worker	5	22.7	5	25.0	
Not working	12	54.5	8	40.0	
Pensioners	0	0.0	3	15.0	
Monthly household income**					
Less RM2000	12	54.5	5	25.0	0.088
RM2001–5000	8	36.4	9	45.0	
Above RM5000	2	9.1	6	30.0	
Marital status					
Single	0	0.0	0	0.0	-
Presently married	22	100.0	20	100.0	
Widowed/divorced	0	0.0	0	0.0	

*Chi-square analysis, no *p* value as all participants from both groups were married

**based on average monthly gross income in urban area (Department of Statistics Malaysia, 2012)

5.5.2.2 Cancer characteristics and lifestyle habits

Table 5.7 shows the cancer characteristics of the participants in both groups. Most of the participants in both groups (59.1% IG, 60.0% CG) were diagnosed with stage 2 CRC. The majority (68–70%) of the participants in both the IG and the CG had been diagnosed with cancer for 2 years. All of the participants (100%) in these two groups were undergoing chemotherapy treatment and had undergone surgery for their CRC before commencing their chemotherapy. Few participants in both groups (9.0% IG, 10.0% CG) had a family history of other cancers. There were no patients with a stoma.

Table 5.7. Cancer characteristics of colorectal cancer (CRC) participants in the intervention group (IG) and control group (CG) at baseline

Characteristics	IG (*n* = 22)		CG (*n* = 20)	
	n	**% of** participants	***n***	**% of** participants
Cancer stage				
Stage 2	13	59.1	12	60.0
Stage 3	9	40.9	8	40.0
How long diagnosed with CRC				
1 year	7	31.8	6	30.0
2 year	15	68.2	14	70.0
Family history of having cancer				
Yes	2	9.0	2	10.0
No	20	91.0	18	80.0

As shown in Table 5.8, at the time of the trial most of the participants in these two groups were non-smokers and the majority had also never smoked. Only 13.6% and 15.0% from the IG and CG were actively smoking, and smoking on average less than 10 cigarettes/day. In terms of smoking behaviours since CRC diagnosis, 27.3% (6) in the IG and 25.0% (5) in CG

indicated that they were cigarette smokers at the time they were diagnosed with CRC. Of these, half of them in both groups quit smoking after their CRC diagnosis within one year of being diagnosed with cancer. A small number in both groups (9.1% IG; 10.0% CG) also had smoked more than 20 cigarettes/day in the past.

Table 5.8. Smoking habits of the participants in the intervention group (IG) and control group (CG) groups at baseline

Characteristics	IG (*n* = 22)		CG (*n* = 20)	
	n	% of participants	*n*	% of participants
In the past, did you smoke?				
Yes	6	27.3	5	25.0
No	16	72.7	15	75.0
On average, in the past how many cigarettes did you smoke each day?				
NA (Not applicable)	16	72.7	15	75.0
< 10 cigarettes/day	4	18.2	3	15.0
10–20 cigarettes/day	0	0.0	0	0.0
> 20 cigarettes/day	2	9.1	2	10.0
Do you currently smoke cigarettes?				
Yes	3	13.6	3	15.0
No	19	86.4	17	85.0
When did you quit smoking?				
NA	19	86.4	17	85.0
< 1 year after being diagnosed	3	13.6	3	15.0
1–2 years after being diagnosed	0	0.0	0	0.0
3–4 years after being diagnosed	0	0.0	0	0.0
> 4 years after being diagnosed	0	0.0	0	0.0
On average, currently how many cigarettes do you smoke each day?				
NA	19	86.4	17	85.0
< 10 cigarettes/day	3	13.6	3	15.0
10–20 cigarettes/day	0	0.0	0	0.0
> 20 cigarettes/day	0	0.0	0	0.0
Have you tried to quit smoking?				
NA	19	86.4	15	75.0
Yes	0	0.0	2	10.0
No	3	13.6	3	15.0
How long have you successfully stopped smoking?				
NA	16	72.7	15	75.0
< 1 year	3	13.6	2	10.0
> 2 years	0	0.0	0	0.0
Still smoking	3	13.6	3	15.0

The majority (82–90%) of the study participants did not consume alcoholic drinks at the time of this trial. Table 5.9 shows the drinking habits of the participants in both groups. There were 31.7% of participants in IG and 20% from CG who had consumed alcoholic drinks in the past. Some stopped consuming alcoholic drinks after they had advice from the doctor (13.6% IG; 10.0% CG).

Table 5.9. Drinking habits of the participants in the intervention group (IG) and control group (CG) at baseline

Characteristics	IG (*n* = 22)		CG (*n* = 20)	
	n	**% of** participants	***n***	**% of** participants
Do you currently consume alcoholic drinks such as beer, wine or liquor?				
Yes	4	18.2	2	10.0
No	18	81.8	18	90.0
How frequently have you had at least one alcoholic drink?				
NA (Not applicable)	18	81.8	18	90.0
Daily	0	0.0	0	0.0
Once a week	1	4.5	0	0.0
Once a month	0	0.0	2	10.0
Once a year	3	13.6	0	0.0
How many standard alcoholic drinks do you currently have during one drinking occasion?				
NA	19	86.4	18	90.0
1–2 beer	2	9.1	1	5.0
> 3 beer	1	4.5	1	5.0
Did you consume alcoholic drinks in the past?				
Yes	7	31.7	4	20.0
No	15	68.3	16	80.0
When did you stop consuming alcohol?				
NA	19	86.4	18	90.0
<1 year ago	1	4.5	1	5.0
1–2 year ago	1	4.5	1	5.0
3–4 years ago	1	4.5	0	0.0
Why did you stop?				
NA	15	68.3	16	80.0
Advice from the doctor	3	13.6	2	10.0
Still consuming alcohol	4	18.2	2	10.0

5.5.2.3 Nutritional status

The prevalence of malnutrition as determined by the PG-SGA is shown in Table 5.10. Fourteen (33.3%) of the participants were well-nourished (SGA = A), 26 (61.9%) were moderately malnourished (SGA = B), and 2 (4.8%) were severely malnourished (SGA = C) based on the PG-SGA global rating. Ten (23.8%) of the participants required no intervention. Health education was offered to four (9.8%) of them. The majority of the participants (66.7%) required dietetic intervention. The critical intervention was not required for any of the participants.

Table 5.10. Baseline characteristics of colorectal cancer (CRC) participants prior to chemotherapy

Baseline characteristics	*n* (%)
PG-SGA global rating	
A (well-nourished)	14 (33.3)
B (suspected or moderately malnourished)	26 (61.9)
C (severely malnourished)	2 (4.8)
Triage intervention	
No intervention (Score of 0–1)	10 (23.8)
Health education (Score of 2–3)	4 (9.5)
Dietetic intervention (Score of 4–8)	28 (66.7)
Critical interventions (≥ 9)	0 (0.0)

The nutritional status of the IG and CG participants according to the scored PG-SGA and PG-SGA global rating is tabulated in Table 5.11 and Table 5.12 respectively. Baseline nutritional status based on PG-SGA scores were comparable in both the IG and CG participants (8.7 ± 1.9 vs 7.9 ± 1.6) (Table 5.11). No statistical significant difference was found between the PG-SGA scores of the participants in the IG and CG for men and women. Even though the nutritional status for the IG and CG did not differ significantly, there were more malnourished (Stage B and C) participants in the IG (*n* = 16, 72.7%) compared to those in CG (*n* = 12, 60%) (Table 5.12).

Table 5.11. Comparisons of nutritional status between the intervention group (IG) and control group (CG) and nutritional status of men and women according to the scored Patient-Generated Subjective Global Assessment (PG-SGA) in the IG and CG at baseline

Nutritional status	IG		CG		p value
	n	Mean ± SD	*n*	Mean ± SD	
PG-SGA scores					
Men	13	7.3 ± 1.8	14	7.8 ± 1.6	0.47
Women	9	5.9 ± 3.5	6	8.0 ± 1.8	0.79
Group	22	8.7 ± 1.9	20	7.9 ± 1.6	0.36

p > 0.05; not significantly different from the CG with Independent T-Test

Table 5.12. Comparisons of nutritional status between the intervention group (IG) and control group (CG) according to the Patient-Generated Subjective Global Assessment (PG-SGA) global rating at baseline

Nutritional status	IG (*n* = 22)		CG (*n* = 20)		*p* value
	n	%	*n*	%	
PG-SGA global rating					
A (well-nourished)	6	27.3	8	40.0	0.071
B (suspected or moderately malnourished)	14	63.6	12	60.0	0.210
C (severely malnourished)	2	9.1	0	0.0	0.431

p>0.05; not significantly different from the CG with Chi-square

Although low BMI and malnutrition are associated, 23 out of 36 participants in the normal or overweight/obese ranges in our study were at risk of malnutrition or severely malnourished (SGA B and C) (Table 5.13).

Table 5.13. Baseline Body Mass Index (BMI) categories and Patient-Generated Subjective Global Assessment (PG-SGA) global rating in colorectal cancer (CRC) participants

BMI category	PG-SGA global rating			Total (*n*)
	A	B	C	
Underweight (< 18.5 kg/m²)	1 (7.1%)	5 (19.2%)	0 (0.0%)	6 (26.3%)
Acceptable weight (18.5–24.9 kg/m²)	11 (78.6%)	20 (76.9%)	2 (100.0%)	33 (78.6%)
Overweight/obese (≥25 kg/m²)	2 (14.2%)	1 (3.8%)	0 (0.0%)	3 (7.1%)

5.5.2.4 Anthropometric measurements

Table 5.14 shows baseline BMI, waist circumference and percentage body fats were comparable in both the IG and CG respectively. At the baseline, the mean BMI of the participants in the IG and CG respectively were 20.9 ± 2.5 and 22.1 ± 2.8 kg/m^2, indicating that on average, participants were of normal weight based on the World Health Organization's (WHO) age- and sex-adjusted criteria (World Health Organization, 1995) and majority of the participants from both group were in the normal BMI category (80%). There was no significant difference between groups on mean of BMI.

In this study, all the participants from the IG and CG had a waist circumference and waist-hip ratio that placed them in the normal category based on the cut-off value of < 90 cm for men and < 80 cm for women on waist circumference and < 1.0 for men and < 0.85 for women on waist-hip ratio. The waist-hip ratio in men was higher in the CG compared to the IG at baseline ($p < 0.05$). Mean percentage body fat respectively in both groups (IG = 21.84 ± 4.21; CG = 22.07 ± 4.00) was slightly higher than the recommended level in men (moderate category). However, in women the

mean percentage body fat was within normal limits in both groups. There was no significant difference in percentage body fat between the two groups.

Table 5.14. Anthropometric measurements of the participants in the intervention group (IG) and control group (CG) groups at baseline

Characteristics	IG (*n* = 22)	CG (*n* = 20)	p value	Cut-off of normal value
	Mean ± SD	Mean ± SD		
Anthropometric measurements				
Height (m)	1.63 ± 0.09	1.62 ± 0.09	0.900	
Body weight (Sung et al.)	55.7 ± 10.5	58.4 ± 10.3	0.390	
BMI (kg/m^2)	20.9 ± 2.5	22.1 ± 2.8	0.150	18.5–24.9
Waist circumference (cm)				
Men	86.4 ± 3.4	88.5 ± 4.7	0.180	< 90
Women	76.0 ± 3.5	76.5 ± 9.5	0.880	< 80
Waist-hip ratio (WHR)				
Men	0.88 ± 0.01	0.92 ± 0.04*	0.007	< 1.0
Women	0.84 ± 0.04	0.85 ± 0.03	0.880	< 0.85
Percent body fat				
Men	21.84 ± 4.21	22.07 ± 4.00	0.880	10–20
Women	24.44 ± 5.45	23.16 ± 6.17	0.680	20–30

*$p < 0.05$; significantly different from the CG with Independent T-Test

5.5.2.5 Dietary intake

In all, 42 participants completed the one-day dietary recall at baseline. The energy and nutrient intakes of the participants in both groups are tabulated in Table 4.17. The current energy intake was 1363 ± 278 kcal/day or 5707 ± 1165 kJ/day for IG participants and 1382 ± 365 kcal/day or 5787 ± 1529 kJ/day for CG participants; while the protein intake was 51 ± 14 g/day for IG participants and 52 ± 15 g/day for CG participants. Both energy and protein intakes were within the acceptable requirement for the participants. For macronutrient intake, the intake was within acceptable range for carbohydrate (51–52%; acceptable range = 50–55%), protein intake (15%; acceptable range = 15–20%) and fat intake (33–34%; acceptable range = 30–35%) (Yusoff et al., 2010) . However, the fibre intake for both groups was less than recommended requirement. Dietary intakes of key nutrients for the participants in both groups at baseline were comparable and not statistically different.

Table 5.15. Comparisons of estimated daily nutrient intake of key nutrients between the intervention group (IG) and control group (CG) at baseline, as measured by 24 hours food recall

Nutrient intake	IG (*n* = 22)		CG (*n* = 20)		p value
	Mean ± SD	Range	Mean ± SD	Range	
Energy, kcal	1363 ± 278	1023–2254	1382 ± 365	734–2016	0.840
Energy, kJ	5707 ± 1165	4283–9437	5787 ± 1529	3073–8439	0.840
Protein, g	51 ± 14	19–90	52 ± 15	27–88	0.970
Protein, as % of energy	15%	7-22%	15%	12-21%	0.771
Carbohydrate, g	175 ± 27	137–229	176 ± 43	114–269	0.810
Carbohydrate, as % of energy	52%	40-64%	51%	39-62%	0.910
Fat, g	50 ±18	31–110	52 ± 16	19–81	0.780
Fat, as % of energy	33%	23-44%	34%	21-53%	0.412
*Fibre, g	4.8 ± 3.3	1.3–14.0	5.5 ± 4.3	1.0–14.9	0.710

$p > 0.05$; not significantly different from the CG with Independent T-Test

*Statistical analyses were performed on log-transformed data

5.5.2.6 Quality of life

The median scores for the global health status, the various functional areas and symptoms are presented in Table 5.16. In this study, the median global health status (M. R. Keighley et al.) score for both groups, was 66.7 with IQR (62.5–66.7) and (54.7–66.7) respectively which is slightly better than the EORTC reference value global score of 61.3 ± 24.2 for all cancer types, and of all stages (Burns, Rohrich, & Chung, 2011). Among the three domains of EORTC QLQ C-30, the highest scores were for functional scales and followed by the global health status, while the symptom scales were the lowest scores. The median functional score in each sub-domain (physical, role and social) were same value in both IG and CG respectively. While, the IG reported significantly more problems with pain than the CG.

The new module, the EORTC QLQ-CR29, was also used to assess the QOL specifically for patients with CRC. The median score of each item of the participants in both groups and without stoma are tabulated in Table 5.17. The median score of each item of the participants in both groups were comparable with no significant differences. The lowest score were the symptom scales followed by the functional scales.

Table 5.16. Median (IQR) for EORTC QLQ-C30 scores of the participants in the intervention group (IG) and control group (CG) at baseline

EORTC QLQ-C30	IG (n=22)	CG (n=20)	p value
Global health status/QOL	66.7 (62.5–66.7)	66.7 (54.2–66.7)	0.810
Functional scales			
Physical functioning	86.7 (80.0–93.3)	86.7 (86.7–93.3)	0.810
Role functioning	66.7 (33.3–66.7)	66.7 (33.3–66.7)	0.510
Social functioning	66.7 (66.7–66.7)	66.7 (66.7–66.7)	0.910
Symptoms scales/items			
Fatigue	55.6 (33.3–66.7)	44.4 (33.3–66.7)	0.750
Nausea and vomiting	50.0 (33.3–54.2)	50.0 (33.3–62.5)	0.840
Pain	50.0 (33.3–50.0)	33.3 (33.3–33.3)	0.010*
Appetite loss	33.3 (33.3–66.7)	33.3 (33.3–66.7)	0.910
Diarrhoea	66.7 (33.3–66.7)	66.7 (66.7–66.7)	0.810

p values are based on Mann-Whitney U test for skewed data; $p < 0.05$ shows the significant difference between IG and CG participants

Note:

Higher score for global health status/QOL represents a better QOL

Higher score for functional scale represents a high/healthy level of functioning

Higher score for symptom scale/item represents a high level of symptomatology/problems

Table 5.17. Median (IQR) for EORTC QLQ-CR29 of the participants in the intervention group (IG) and control group (CG) at baseline

EORTC QLQ-CR29	IG (n=22)	CG (n=20)	*p* value
Functional scales			
Body image	100.0 (100.0–100.0)	100.0 (100.0–100.0)	0.960
Anxiety	66.7 (66.7–75.0)	66.7 (66.7–66.7)	0.070
Weight	100.0 (100.0–100.0)	100.0 (100.0–100.0)	0.960
Sexual function: men	0.0 (-33.3–0.0)	0.0 (-33.3–0.0)	0.910
Sexual function: women	-33.3 (-33.3–0.0)	-33.3 (-33.3–0.0)	0.910
Symptoms scales			
Abdominal pain	0.0 (0.0–0.0)	0.0 (0.0–0.0)	0.960
Bloated feeling	0.0 (0.0–0.0)	0.0 (0.0–0.0)	0.960
Dry mouth	33.3 (33.3–33.3)	33.3 (33.3–33.3)	0.750
Trouble with taste	33.3 (33.3–33.3)	33.3 (33.3–33.3)	0.670
Impotence	0.0 (-33.3–0.0)	0.0 (-33.3–0.0)	0.670
Dyspareunia (difficult or painful sexual connection)	0.0 (-33.3–0.0)	0.0 (-33.3–0.0)	0.910

p values are based on Mann-Whitney U test for skewed data
$p < 0.05$ shows the significant difference between IG and CG participants
Note:
Higher score for functional scales represents a better level of functioning
Higher score for symptom scales represents more symptoms (more problems)

5.5.2.7 Physical activity

As shown in Table 5.18, the IG participants were significantly more active with a higher strenuous plus moderate minutes than the CG at baseline ($p < 0.005$), although there was no significant difference between the groups for mild exercise accumulated minutes per week. The data in strenuous minutes are spread out over a wider range of values in SG participants. The CG group were perform less strenuous activity. Overall, all of the participants in both groups (100%) were not meeting the public health guidelines of >150 minutes per week at baseline.

Table 5.18. Comparisons of exercise behaviours in the IG and CG groups at baseline, using accumulated minutes per week (Godin Leisure-Time Exercise Questionnaire)

Exercise behaviours	IG (n=22)	CG (n=20)	*p value
	Mean ± SD	Mean ± SD	
[1]Weekly exercise			
Mild minutes	115.9 ± 121.8	127.5 ± 100.6	0.740
[1]Strenuous plus moderate minutes	109.0 ± 68.3	30.0 ± 61.5*	0.005
% Meeting public health guidelines	0.0	0.0	

*$p > 0.05$; not significantly different from the CG with Independent T-Test

[1]Statistical analyses were performed on log-transformed data

Notes.

Categorised of participants' exercise pattern:

Completely sedentary—0 min of moderate or strenuous exercise per week.

Insufficiently active—some moderate to strenuous minutes of activity but not enough to meet public health guideline.

Meeting public health exercise guidelines—≥60 min of strenuous exercise per week or 150 min of moderate plus strenuous exercise per week.

Guidelines defined by the American College of Sports Medicine and the Centers for Disease Control (Garber et al., 2011).

5.5.2.8 Relationship between nutritional status and QOL

Generally, cancer patients experience functional limitations, cognitive alterations, and emotional stress, and overall QOL depends on psychological, nutritional, and physical well-being (Ravasco et al., 2012).

Spearman's rho was performed on all trial participants combined to examine whether CRC patients showed a relationship between nutritional status (as measured by PG-SGA) and QOL using EORTC QLQ C-30 at baseline (Table 5.19). There was a significant negative correlation between PG-SGA score and global QOL (r= -0.338, $p < 0.05$). For PG-SGA score and symptom scales, there were also significant correlations for fatigue, nausea and vomiting, and loss of appetite (r= -0.319, $p < 0.05$; r= -0.607, $p < 0.001$; r= -0.537, $p < 0.001$) indicating better nutritional status (low total score of PG-SGA), with better QOL of the participants (high score of global QOL and lower symptom scales).

Table 5.19. Correlation between PG-SGA total mean score and independent variables (n=42)

Independent variables	Relationship (r)	Significance (*p*)*
Global health status/QOL	-0.338	0.029
Symptom scales		
Fatigue	-0.319	0.039
Nausea and vomiting	-0.607	0.001
Appetite loss	-0.537	0.001

*Spearmen's rho

5.5.3 Effects of intensive individualised dietary counselling and lifestyle intervention over a 16-week period

This section evaluates the effects of intensive individualised dietary counselling and lifestyle the IG versus the CG over a 16-week study period on the primary endpoints which were the nutritional status and QOL. Baseline values are included in all tables of results to facilitate ease of comparisons over time.

5.5.3.1 Nutritional status changes

The prevalence of malnutrition in these participants is shown in Table 5.20.

Across all participants, 14 (33%) of the patients were well-nourished (SGA = A), whilst 26 (62%) were moderately malnourished (SGA = B) and 2 (5%) were severely malnourished (SGA = C) at baseline. During treatment, more participants in the IG were assessed as well-nourished and less were assessed as malnourished compared with CG according to PG-SGA global rating (Table 5.20). This was statistically significant at week 8 (x^2 = 4.7, $p < 0.05$) and at week 16 (x^2 = 9.5, $p < 0.01$), when the proportion of malnourished participants in the CG remained more than pre-treatment levels.

Over the total 16 weeks, the mean PG-SGA scores decreased in the IG and increased in the CG indicating an improved nutritional status in the IG and a decreased nutritional status in the CG ($p < 0.001$ time*group interaction, repeated measures ANOVA) (Figure 5.6).

Table 5.20. Changes in PG-SGA global rating categories of the participants in the intervention group (IG) and control group (CG) over 8 week intervention trial and a follow-up visit at 16 weeks

Nutritional status	Baseline (n=42)		Week 4 (n=42)		Week 8 (n=42)		Week 16 (n=42)	
	IG	CG	IG	CG	IG	CG	IG	CG
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
PG-SGA global rating								
A (well-nourished)	6 (27.3)	8 (40.0)	9 (40.9)	7 (35.0)	14 (63.6)	6 (30.0)	16 (72.7)	5 (25.0)
B (suspected or moderately malnourished)	14 (63.6)	12 (60.0)	13 (59.1)	13 (65.0)	8 (36.4)	14 (70.0)	6 (27.3)	15 (75.0)
C (severely malnourished)	2 (9.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
***p* value**[1]	0.026		0.121		0.011		0.001	

[1]chi-square tests

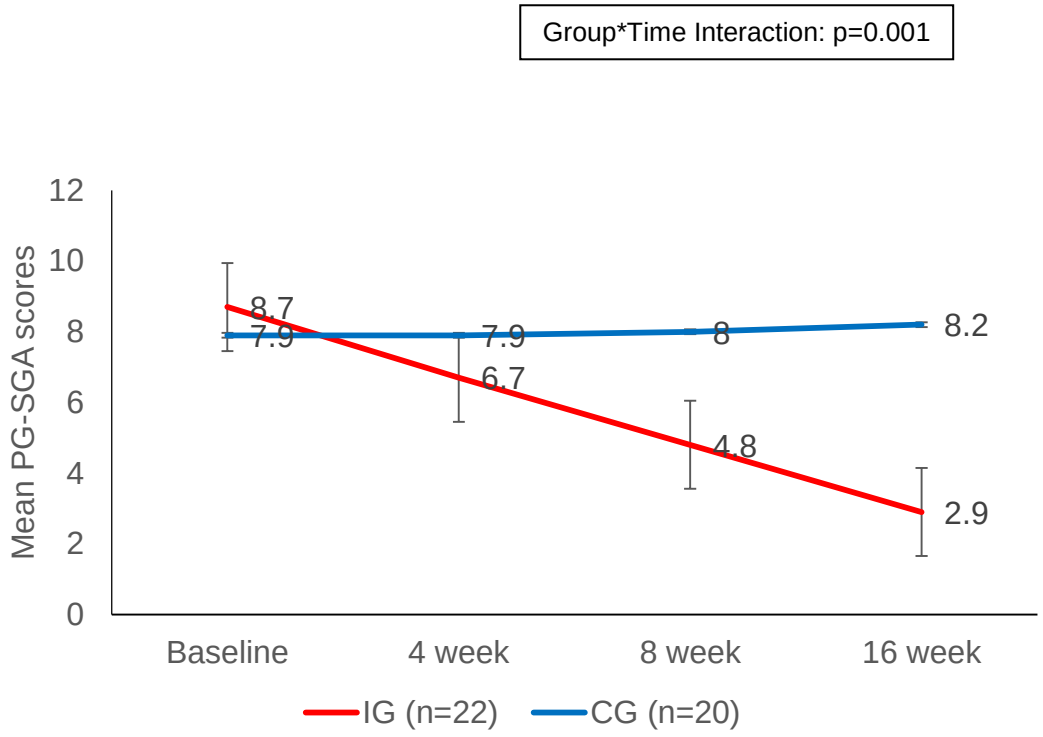


Figure 5.6. Mean (± SD) changes in PG-SGA scores from baseline to week 16 in the intervention group (IG) and control group (CG). *Significantly different from the CG group, with repeated measures analysis of variance with $p < 0.001$; **Statistical analyses were performed on log-transformed. *Note*: Higher score for the scored PG-SGA represents the greater the risk for malnutrition or indicated lower nutritional status of the patients

5.5.3.2 Anthropometric changes

As shown in Table 5.21, there was a statistically significant group*time interaction in the body weight, $F(3,120) = 8.218$, $p < 0.001$, partial Eta-square = 0.170. In addition, there was a statistically significant effect of group and time on waist circumference for the IG, $F(1,40) = 6.961$, $p < 0.012$, partial Eta-squared = 0.48; $F(3,63) = 5.803$, $p < 0.001$, partial Eta-squared = 0.217. The mean waist circumference in the IG increased at week 4 and remained steady but there were no change in the CG. There was no significant change in.percent.body.fat.in.either.group.

Table 5.21. Comparisons of anthropometric measurement of the participants in the intervention group (IG) and control group (CG) over 16 weeks

Anthropometric measurement	IG (n=22) Mean ± SD				CG (n=20) Mean ± SD				*p* value[1]		
	Baseline	4 week	8 week	16 week	Baseline	4 week	8 week	16 week	Group	Time	Time* group
Body weight (Sung et al.)	55.6 ± 10.5	56.2 ± 10.8	56.4 ± 10.8	56.5 ± 10.7	59.8 ± 12.4	59.8 ± 12.4	59.4 ± 12.3	59.4 ± 12.3	0.516	0.289	0.001
Waist (cm)	82.1 ± 6.2	82.4 ± 6.6	82.4 ± 6.7	82.4 ± 6.7	84.9 ± 8.4	84.9 ± 8.4	84.9 ± 8.4	84.9 ± 8.4	0.411	< 0.001	0.024
Percent body fat (%)	22.90 ± 4.81	22.90 ± 4.81	22.90 ± 4.81	22.90 ± 4.81	22.40 ± 4.61	22.40 ± 4.61	22.40 ± 4.61	22.40 ± 4.61	0.810	1.000	1.000

[1]Repeated measures analysis of variance

Figure 5.7 shows the mean differences in weight from baseline in each group at each time point - within the IG, there was a statistically significant increase in mean body weight of close to 1 kg by weeks 8 and 16 whereas within the CG, the mean body weight decreased (non-significantly) from baseline by close to 1/3 of a kg by week 16.

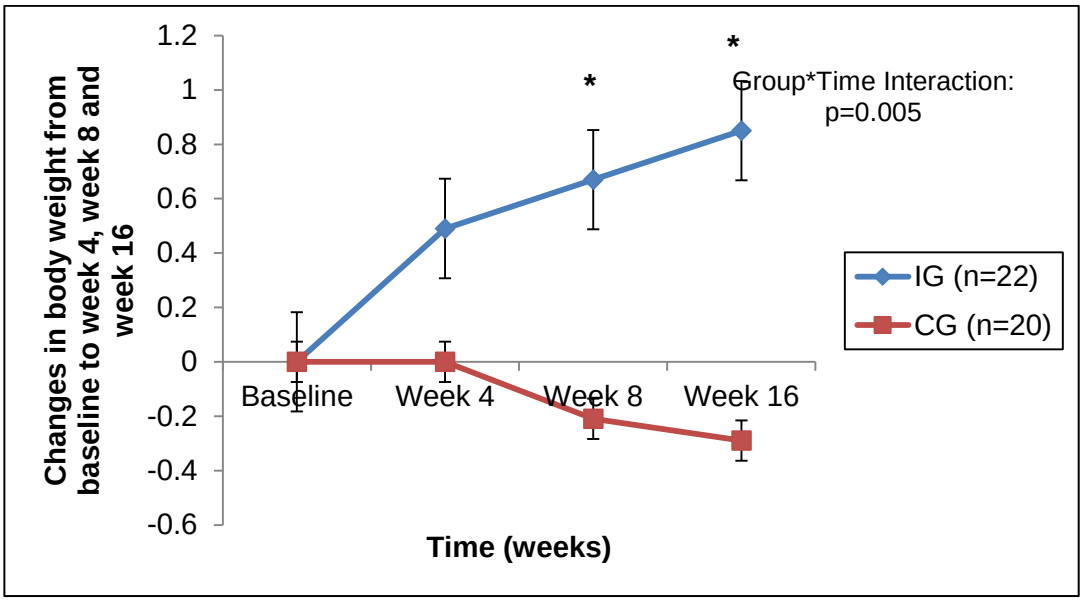


Figure 5.7. Mean (± SD) changes in body weight from baseline to week 16 in the intervention group (IG) and control group (CG). *Significantly different from the CG group, with Independent T-Test with $p < 0.001$.

5.5.3.3 Dietary changes

Table 5.22 shows the effects of 8 weeks of intensive individualised dietary counselling and lifestyle intervention on dietary intake of the participants. The mean values for nutrient intake (± SD) were calculated at baseline (from one 24-hour dietary recall) and at week 4, week 8, and week 16 (from 2-day 24-hour dietary records). At baseline, both the IG and CG participants had comparable energy and protein intakes. Post hoc tests using the Bonferonni correction revealed that energy intake slightly increased in IG from week 8 to week 16 (1344 ± 257 kcal/day or 5630 ± 1078 kJ/day vs 1365 ± 263 kcal/day or 5707 ± 1165 kJ/day, respectively), which was not statistically significant (p=1.000). At week 16, the participants in the IG and CG consumed 1365 ± 263 kcal/day or 5707 ± 1165 kJ/day and 1289 ± 320 kcal per day or 5787 ± 1529 kJ/day respectively. Although the mean values for energy and protein intake for the IG and CG did not differ significantly, during the 16-week study the IG increased energy and protein intake during the first 4 week of treatment and then maintained an intake similar to that consumed at baseline and had only a small effect size (partial Eta Squared = 0.07) and (partial Eta Squared = 0.06). In contrast, the CG had a steady decrease in energy and protein intake, which only started to increase at week 16, when it was still 93 kcal/day and 5 g/day less than at baseline. Over the 16 weeks, the only significant dietary changes were seen with estimated daily fibre intake where the IG increased their fibre intake and the CG decreased fibre intake.

Table 5.22. Comparisons of nutrient intake (mean ± SD) calculated from two-day food records of the participants in the intervention group (IG) and control group (CG) over 16-weeks

Nutrient intake per day	IG (*n* = 22)				CG (*n* = 20)				*p* value[1]		
	Baseline	4 week	8 week	16 week	Baseline	4 week	8 week	16 week	Group	Time	Time* group
Energy, kcal	1363 ± 278	1364 ± 187*	1344 ± 257	1365 ± 263	1382 ± 365	1258 ± 330*	1328 ± 366	1289 ± 320	0.598	0.374	0.580
Energy, kJ	5707 ± 1165	5636 ± 784	5630 ± 1078	5715 ± 1104	5787 ± 1529	5270 ± 1383	5560 ± 1534	5396 ± 1339	0.598	0.374	0.580
Protein, g	51 ± 14	51 ± 11	48 ± 12	53 ± 12	52 ± 15	44 ± 10*	44 ± 9	47 ± 21	0.08	0.825	0.127
Carbohydrate, g	175 ± 27	187 ± 18	184 ± 27	189 ± 27	176 ± 43	162 ± 32	176 ± 58	164 ± 46	0.179	0.065	0.385
Fat, g	50 ±18	43 ± 13	46 ± 17	44 ± 15	52 ± 16	47 ± 18	47 ± 17	47 ± 18	0.562	0.098	0.948
[2]Fibre, g	4.8 ± 3.3	12.8 ± 6.2	12.9 ± 7.0	12.3 ± 5.7	5.5 ± 4.3	5.8 ± 4.0	5.5 ± 4.3	4.5 ± 2.4	0.000	0.001	0.007

[1]Repeated measures analysis of variance

[2]Statistical analyses were performed on log-transformed data

*****p<0.05 significantly different from baseline within a group with Paired T-Test

5.5.3.4 Quality of life changes

During the 16 weeks of the study, the IG had significantly better mean global status health QOL ($p < 0.012$), less fatigue ($p < 0.001$) and increased appetite level ($p < 0.01$). In addition, the size of the effect global status health increased by >20 points which is large clinical effect. The remaining function scales scores did not change significantly (Table 5.23).

This study examined the additional benefits of using the EORTC QLQ-CR29 as a supplement to the EORTC QLQ-C30 in CRC patients. Each of participants was asked to complete the questionnaires at the time of the clinic visit. As shown in Table 5.25, there was a statistically significant group interaction and time interaction in the functioning scales domain i.e. anxiety ($p < 0.016$ and $p < 0.024$). While there was a statistically significant time interaction in symptom scales on dry mouth and trouble with taste ($p < 0.011$ and $p < 0.029$).

Many participants were reluctant to complete the questions relating to sexual functions or were, unable to answer, making any results relating to sexual functions unreliable.

Table 5.23. Comparisons of EORTC QLQ-C30 (mean ± SD) of the participants in the intervention group (IG) and control group (CG) over 16 weeks

QOL	IG (*n* = 22)				CG (*n* = 20)				*p* value		
	Baseline	4 week	8 week	16 week	Baseline	4 week	8 week	16 week	Group	Time	Group* Time
Global health status/QOL	56.8 ± 9.8	68.9 ± 5.8	72.7 ± 8.2	78.7 ± 7.5	63.3 ± 6.8	66.6 ± 0.00	66.6 ± 0.00	67.0 ± 3.7	0.001	0.001	0.012
Functional scales											
Physical functioning	79.3 ± 3.5	79.0 ± 3.1	45.7 ± 3.1	46.9 ± 3.2	79.0 ± 3.2	79.3 ± 2.05	46.3 ± 1.5	46.3 ± 1.5	0.982	0.455	0.291
Role functioning	54.5 ± 21.9	68.1 ± 7.1	37.8 ± 10.5	40.9 ± 13.3	55.0 ± 16.3	67.5 ± 3.7	34.1 ± 3.7	34.1 ± 3.7	0.243	0.566	0.103
Emotional functioning	99.2 ± 3.5	100.0 ± 0.0	66.6 ± 0.0	66.6 ± 0.0	99.1 ± 3.7	99.5 ± 1.8	66.6 ± 0.0	66.2 ± 1.8	0.459	0.310	0.585
Cognitive functioning	97.7 ± 5.8	100.0 ± 0.0	66.6 ± 0.0	65.9 ± 3.5	100.0 ± 0.0	99.1 ± 3.7	66.6 ± 0.0	66.6 ± 0.0	0.278	0.264	0.288
Social functioning	72.7 ± 16.7	75.0 ± 14.3	42.4 ± 15.1	42.4 ± 15.1	65.0 ± 7.4	66.6 ± 0.0	33.3 ± 0.0	33.3 ± 0.0	0.100	0.310	0.460

Table 5.24. Continued. Comparisons of EORTC QLQ-C30 (mean ± SD) of the participants in the intervention group (IG) and control group (CG) over 16 weeks

QOL	IG (*n* = 22)				CG (*n* = 20)				*p* value		
	Baseline	4 week	8 week	16 week	Baseline	4 week	8 week	16 week	Group	Time	Group* Time
Symptoms scales/items											
Fatigue	18.1 ± 12.1	9.0 ± 9.4	5.5 ± 8.2	5.0 ± 8.2	27.2 ± 11.6	17.2 ± 8.4	14.4 ± 8.1	14.4 ± 8.9	0.060	0.030	0.001
Nausea & vomiting	18.9 ± 11.8	8.3 ± 9.6	3.7 ± 8.8	2.2 ± 5.8	20.8 ± 9.1	10.8 ± 8.1	7.5 ± 8.5	10.0 ± 8.3	0.604	0.610	0.604
Pain	18.9 ± 7.7	13.6 ± 6.5	14.3 ± 5.8	13.6 ± 6.5	15.0 ± 7.4	13.3 ± 6.8	15.0 ± 5.1	14.1 ± 6.1	0.330	0.331	0.400
Appetite loss	40.9 ± 20.3	24.2 ± 15.1	19.6 ± 16.7	13.6 ± 16.7	38.3 ± 19.5	25.0 ± 14.8	15.0 ± 17.0	20.0 ± 16.7	0.040	0.010	0.010

NS – not significant

[1]Statistical analyses were performed on log-transformed data

[2]Repeated measures analysis of variance

Note:

Higher score for global health status/QOL represents a high QOL

Higher score for functional scale represents a high/healthy level of functioning

Higher score for symptom scale/item represents a high level of symptomatology/problems

Table 5.25. Comparisons of EORTC QLQ-CR29 of the participants in the intervention group (IG) and control group (CG) over 16 weeks

QOL	IG (n=22)				CG (n=20)				p value[1]		
	Baseline	4 week	8 week	16 week	Baseline	4 week	8 week	16 week	Group	Time	Time*group
Functional scales[2]											
Body image	99.4 ± 2.3	98.9 ± 4.7	100.0 ± 0.0	98.9 ± 4.7	98.3 ± 4.0	98.8 ± 3.4	98.8 ± 3.4	98.8 ± 3.4	0.566	0.384	0.384
Anxiety	68.1 ± 21.7	78.7 ± 16.4	78.7 ± 16.4	78.7 ± 16.4	65.0 ± 7.4	65.0 ± 7.4	66.6 ± 0.0	66.6 ± 0.0	0.016	0.024	0.134
Weight	93.9 ± 13.1	98.4 ± 7.1	98.4 ± 7.1	98.4 ± 7.1	95.0 ± 12.2	93.3 ± 13.6	93.3 ± 13.6	95.0 ± 12.2	0.297	0.297	0.297
Symptoms scales[2]											
Dry mouth	36.3 ± 17.5	25.7 ± 14.2	22.7 ± 15.8	24.2 ± 15.1	35.0 ± 13.1	30.0 ± 10.2	28.3 ± 12.2	26.0 ± 13.6	0.329	0.011	0.329
Trouble with taste	36.3 ± 14.2	25.7 ± 14.2	24.2 ± 15.1	21.2 ± 16.4	35.0 ± 7.4	30.0 ± 10.2	31.6 ± 7.4	31.6 ± 7.4	0.182	0.029	0.182

[1]Repeated measures analysis of variance

[2]Statistical analyses were performed on log-transformed data

Note:

Higher score for functional scales represents a better level of functioning

Higher score for symptom scales represents more symptoms (more problems)

5.5.3.5 Physical activity changes

Throughout this study, participants were encouraged to engage in regular exercise during and after treatment based on the recommendation (Doyle et al., 2006). During the 16 week study both groups showed significantly increased active engagement in physical activity during the first 8 weeks of treatment and which then reduced at week 16. When examined for main effect of group and main effect of time, there was a statistically significant higher measures of mild exercise minutes, moderate exercise minutes and strenuous plus moderate exercise minutes in the IG compared to the CG ($p < 0.001$) (Table 5.26). All of the participants in IG (100%) were meeting the public health guidelines throughout the intervention and at the 16 week follow-up visit (Table 5.26).

Table 5.26. Comparisons of exercise behaviours (means of estimated accumulated minutes per week) of the participants in the intervention group (IG) and control group (CG) over 16 weeks

Weekly exercise (in minutes)	IG (n=22)				CG (n=20)				p value[1]		
	Baseline	4 week	8 week	16 week	Baseline	4 week	8 week	16 week	Group	Time	Time* group
Mild[2]	115.9 ± 121.8	477.2 ± 127.9*	606.8 ± 108.3	450.0 ± 0.0	127.5 ± 100.6	97.5 ± 73.4	195.0 ± 138.5	165.0 ± 67.0	0.001	0.001	0.001
Moderate[2]	109.0 ± 68.3	150.0 ± 0.0 *	252.2 ± 71.5	238.6 ± 75.4	30.0 ± 61.5	67.5 ± 76.5	180.0 ± 61.5	97.5 ± 73.4	0.320	0.001	0.01
Strenuous + moderate[2]	109.0 ± 68.3	218.1 ± 76.4a*	375.0 ± 76.7	313.6 ± 14.5	30.0 ± 61.5	67.5 ± 76.5	232.5 ± 113.8	142.5 ± 123.8	0.448	0.010	0.045
% Meeting public health guidelines	0.0	100.0	100.0	100.0	0.0	45.0	100.0	65.0			

[1]Repeated measures analysis of variance

[2]Statistical analyses were performed on log-transformed data

a*$p < 0.001$ significantly different from baseline within a group with Paired T-Test

5.5.3.6 The stage of behaviour change

The stages of behaviour change of the participants in IG and CG are presented in Figure 5.8 and Figure 5.9 respectively. At baseline, the majority of the participants from both groups (IG = 63.6%, CG =70%) were in the contemplation stage. Less of the participants from both groups were in the action stage (IG = 18.2%, CG = 15%) and maintenance stage (IG = 4.5%, CG = 10%).

At weeks 4 and 8, the majority of the participants from IG (95.5% and 90.9%) were in the action stage. None of the participants were in pre-contemplation and contemplation stage. However in week 16, that number was reduced by half from week 4 and 8 (59.1%) in action stage with a major percentage progressing to the maintenance stage (40.1%) (Figure 5.8).

In contrast, all time points (weeks 4, 8 and 16), the majority of the participants from CG (90%, 70% and 70%) remained in the contemplation stage. By week 16, 30% of CG were in the action stage, and none of the participants were in pre-contemplation, or the maintenance stage (Figure 5.9).

These results demonstrate that the IG participants progressed further along the readiness to change model than the CG participants.

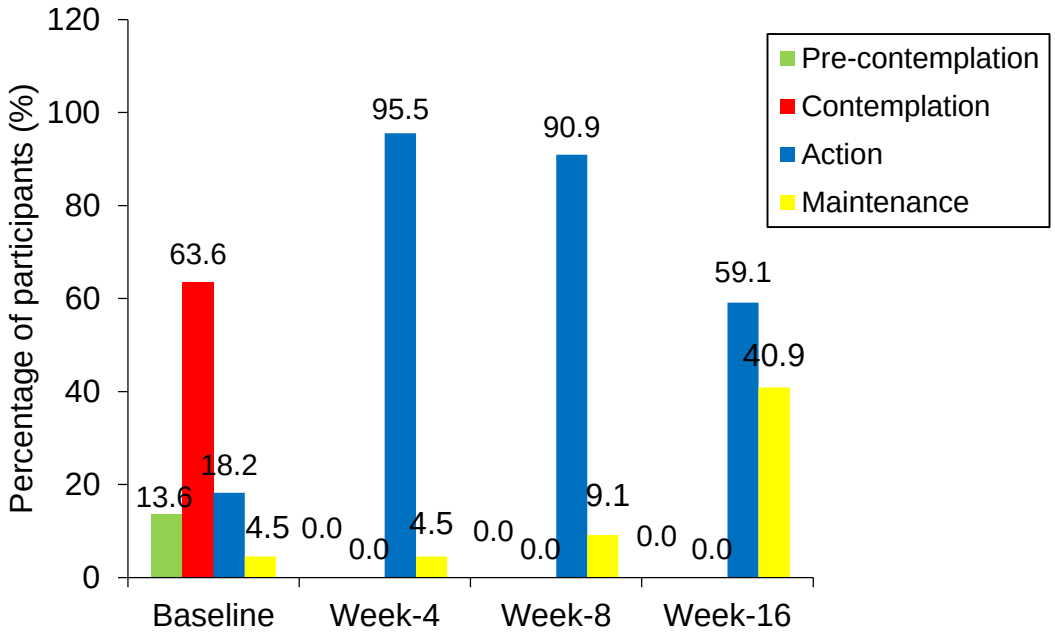


Figure 5.8. The stage of behaviour change of the participants in the intervention group (IG).

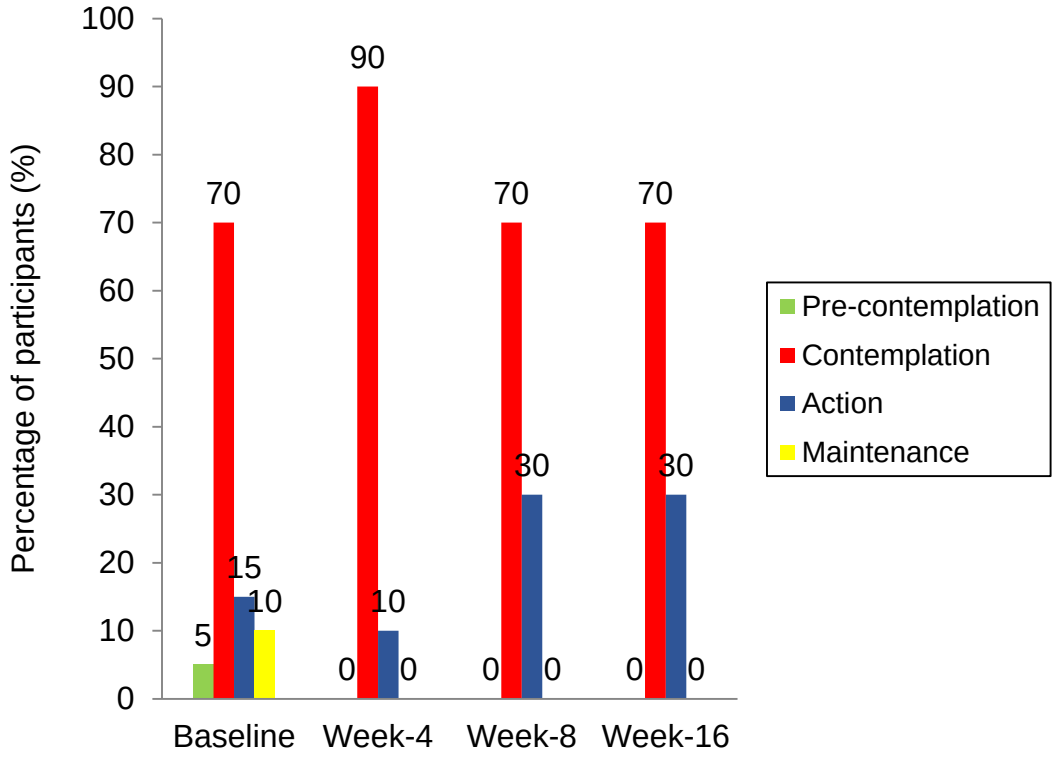


Figure 5.9. The stage of behaviour change of the participants in the control group (CG).

5.5.3.7 The confidence level under several specific situations

5.5.3.7.1 Physical activity

The mean changes in the confidence level on remaining physically active under several specific situations of the participants between IG and CG with different level of the stage of behaviour change over 16 weeks are presented in Figure 5.10. At baseline, the majority of the IG participants were in the contemplation stage and reporting high levels of confidence to remain physically active (Figure 5.10). Those in the action and maintenance stages reported higher levels of confidence than those in the contemplation and pre-contemplation stages. At weeks 4, 8 and 16, the mean confidence level had reduced from baseline (6.5 ± 3.8 from baseline to 12.8 ± 3.6 at weeks 16) even though all of the IG had shifted to either action or maintenance stages of behaviour change. By week 16, the confidence levels were starting to increase.

At baseline, the majority of the CG participants were also in the contemplation stage reporting lower levels of confidence but not significant ($p > 0.05$) when compared to IG to remain physically active. Similarly to the IG, at weeks 4, 8 and 16, the mean confidence level also reduced from baseline but remained lower.

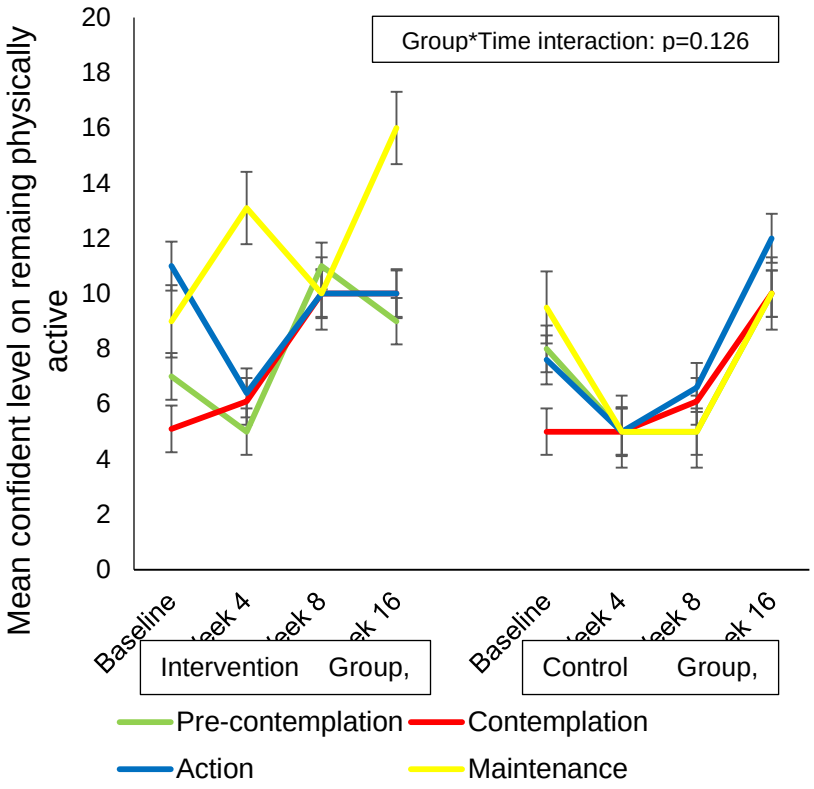


Figure 5.10. The mean in the confident level on remaining physically active under several specific situations of the participants between IG and CG groups with different level of the stage of behaviour change over 16 weeks.

5.5.3.7.2 Balanced diet

As shown in Figure 5.11, for both the IG and CG, the level of confidence of maintaining a healthy balanced diet was much higher than that reported for remaining physically active. The mean confidence levels (IG, 34.8 ± 0.8 vs. CG, 33.2 ± 3.1) relating to consuming a healthy balanced diet showed little differences according to the stage of behaviour change and was not statistically different between groups ($p > 0.05$).

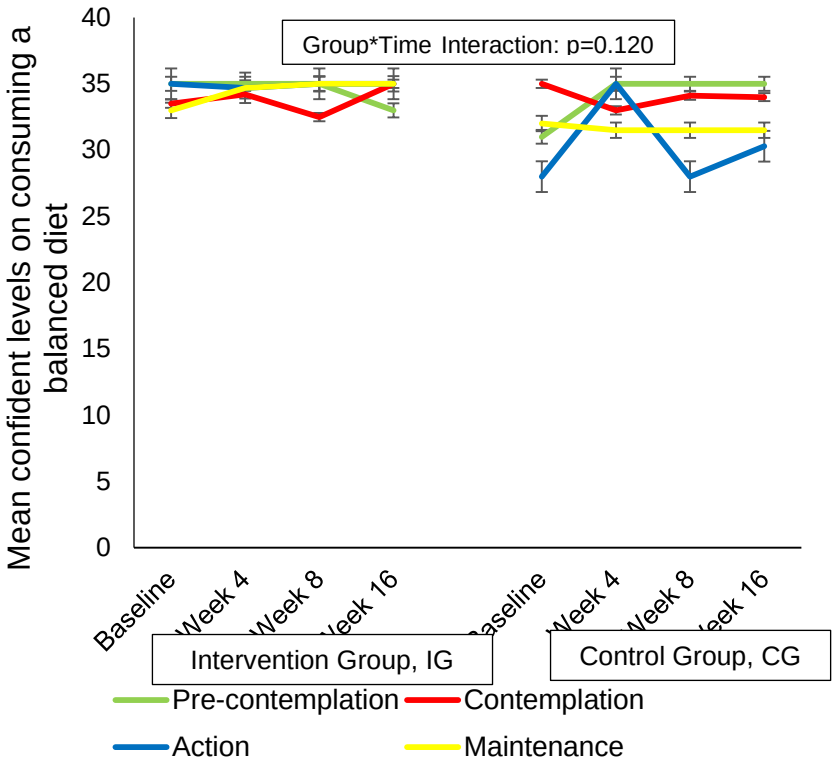


Figure 5.11. The mean in the confidence levels on consuming a balanced diet under several specific situations of the participants between IG and CG groups mapped with the different levels of the stage of behaviour change over 16 weeks.

5.5.3.8 Changes of belief on the effect of exercise and diet on overall health

The mean beliefs on the effect of exercise and diet on overall health of the participants in both groups are tabulated in Table 5.27. The mean beliefs on the effect of exercise of the participants in both groups were comparable, and increased significantly over the 16 weeks in both groups. IG participants had statistically significant higher beliefs in the effect of diet for overall health status than the CG participants ($p < 0.05$), and beliefs in the role of diet on overall health increased with time in both groups.

As shown in Table 5.27, there was not a statistically significant difference between the group*time interaction on beliefs of the effect of exercise and diet in both groups.

Table 5.27. Comparison the scores of beliefs on the effect of exercise and diet on overall health of the participants in the intervention group (IG) and control group (CG) over 16 weeks

Characteristics	IG (n=22)				CG (n=20)				p value[1]		
	Baseline	4 week	8 week	16 week	Baseline	4 week	8 week	16 week	Group	Time	Time*group
Beliefs about the effect of exercise[2]	3.6 ± 1.1	4.7 ± 0.6	4.8 ± 0.3	4.7 ± 0.4	3.7 ± 0.6	4.8 ± 0.3	4.7 ± 0.4	4.7 ± 0.4	0.616	0.001	0.347
Beliefs about the effect of diet[2]	4.1 ± 0.8	4.9 ± 0.2	4.7 ± 0.4	4.7 ± 0.4	3.8 ± 0.6	4.9 ± 0.3	4.7 ± 0.4	4.7 ± 0.4	0.004	0.001	0.929

[1]Repeated measures analysis of variance

[2]Statistical analyses were performed on log-transformed data

Higher score indicates high level of belief on the effect of exercise and diet on overall health

5.6 Discussion

This chapter showed that compared to usual care in a Malaysian clinical setting, an intensive dietary counselling intervention improved the nutritional status of CRC patients after 8 weeks of starting their chemotherapy. There were also large differences (>20 points) leading to improvements in the QOL. The IG had higher levels of physical activity and higher intakes of fibre. Both the IG and CG felt they had a greater confidence to follow a healthy diet compared to maintaining their physical activity over the study period. Changes in behaviours in the IG appeared to be sustained over an 8 week follow-up, and this was supported by the notable shift in the IG towards the action and maintenance stages of behavioural change.

5.6.1 Baseline comparisons

As this is a small study, it may not be representative of the whole CRC population in Malaysia. However, the baseline characteristics suggest that our findings may be generalisable, at least to some extent. The average mean age of 59 years for our study participants (Table 5.6) is similar with other studies (Natrah et al., 2012; Wan Puteh et al., 2013). About 66.7% of the participants in our study were between 30 and 64 years, while 33.3% were over 65 years. This is in agreement with studies from Western countries, such as study by Braun et al. (2011) from USA (Braun, Gupta, Grutsch, & Staren, 2011) and by Engel et al. (2003) from Germany (Engel et al., 2003); however, Tsunoda et al. (2005) from Japan (Tsunoda et al., 2005) showed that the majority (43.0%) of their subjects were older than 70 years due to the ageing effect of the population.

Although the incidence of CRC increases with age, there is a shift towards a younger age (Kuriki & Tajima, 2006). Even though this study is not a national survey of CRC in this country, it shows that a younger generation of the population in Malaysia is acquiring CRC. This might be due to the globalisation effect of our population, including unhealthy lifestyle and eating habits, and poor screening uptake, which has had a significant effect on many of the younger generation (Wan Puteh et al., 2013). Smoking, alcohol

consumption, less physical activity leading to obesity, lower intake of fibre and greater intake of red processed meat are all factors that can contribute to the development of CRC (World Cancer Research Fund/American Institute for Cancer Research, 2011).

The majority of CRC participants in our study were male (Table 5.6) and this is comparable to the report of the National Cancer Registry which has shown that the incidence of CRC in 2007 was slightly higher among Malaysian males compared to females (Zainal & Nor Saleha, 2011). There are three main ethnic groups in the country which are Malay, Chinese and Indian. Majority of the subjects from both of our study groups (IG= 82%, CG=60%) were Chinese (Table 5.6). Findings from our study are consistent with report from National Cancer Registry (Zainal & Nor Saleha, 2011), which indicated that Chinese have the highest incidence of CRC compared to other ethnic groups.

Most of the participants for both groups were from the low- and middle-income bracket (Table 5.8). These findings are similar with study by Pandey et al. (2011), which showed that majority of participants were in low-income status. Over the past several decades, research has indicated that social status such as socio-economic class of the areas in which the individuals lives, has a direct effect on health outcomes (Kong, Roslani, Law, Diana, & Law, 2010). In fact the prevalence of malnutrition also appears to be dependent upon the healthcare system and the economic situation of the country where the study was conducted (D. L. Waitzberg, Caiaffa, & Correia, 2001).

As Young indicated that once histological diagnosis (newly diagnosed patients) has been made, the majority of patients proceed to potentially curative surgery for excision of the primary tumour after having had a staging computed tomography (CT) scan (G. P. Young & Le Leu, 2002). The CRC patients in our study were presenting for surgery before continuing their cancer treatment of chemotherapy (Table 5.7).

Table 5.8 shows that half of participants in both groups were smoking in the past and most had quit smoking after CRC diagnosis. Similarly, a study

conducted by Schnoll at al. (2011) in newly diagnosed patients with cancer reported that the percentage of patients who were actively smoking in the past (former smoking) (66%) was higher as compared to the number of subjects who were currently smoking (34%). These numbers are also consistent with the Blanchard et al. (2003) study which found that 9.6% of their all types of cancer survivors were current smokers.

Our results show that both groups stopped consuming alcoholic drinks after they had advice from the doctor (Table 5.9). A study conducted by Jerjes et al. (2012) among patients who were diagnosed with oral squamous cell carcinoma has shown that health professionals can play a role in the prevention of the cancer recurrence by advising the patients to reduce tobacco used and alcohol intakes. Based on this study, 12 chronic smokers reduced their smoking habits to less than 5 cigarettes/day and 13 chronic smokers stopped smoking after diagnosis. While 15 chronic drinkers reduced their alcohol intake to less than 10 units/week and 9 patients stopped completely after being diagnosed (Jerjes et al., 2012).

Both groups had a mean BMI within the normal range (Table 5.14). This is similar to a study in 346 advanced cancer patients by Sarhill et al. (2003) who indicated that most of the patients had normal and high BMI values (87%). The previous study also had identified that patients has severe weight loss even though most patients had normal BMI which explained significant post-illness weight loss suggesting pre-illness obesity (Sarhill et al., 2003). This may be caused in part by the surgery being performed; extensive resection of the small bowel can lead to malabsorption of many nutrients.

However, in the study conducted by Isenring et al. it was reported that the BMI for both subjects from intervention and control group (25.2 vs. 26.4 kg/m^2) were slightly overweight (E. A. Isenring et al., 2007). As well, in a study by Um et al. in 87 cancer patients undergoing radiotherapy, at baseline, approximately 74.6% were classified as either overweight or obese (Um et al., 2014). The fact that our study participants are of normal BMI may be due to the criteria of participants; from the previous study the participants were cancer patients undergoing radiotherapy while in our current study the

participants were those from post-operative CRC patients due to undergo chemotherapy. The higher body weights could be partially explained by taking into account the results of a study by Bye et al. (2013) who demonstrated that an increase in extra cellular water is frequent in the patients and weight gain may be explained by ascites and oedemas rather than an increase in fat or muscle mass.

The present study showed a slightly higher percent body fat in male for both groups, while females in both groups have a normal percent body fat. On the other hand, both groups has a normal BMI (Table 5.14). Previous studies had showed that the BMI is a reasonable indicator for percent body fat, however, the relationship between BMI and percent body fat is dependent on age, gender, dietary pattern, physical activity level and ethnic group. Ethnic difference may be explained by differences in frame size and relative leg length. Even within apparently equal ethnic groups such as Singaporean Chinese, Malay and Indian men and women, relatively large differences exist (Deurenberg, Deurenberg-Yap, & Guricci, 2002).

The prevalence of malnutrition varies depending upon the clinical setting as well as the assessment techniques (J. Bauer et al., 2002). Previous studies carried out exclusively on oncology patients using the PG-SGA have reported 42.4–76% to be malnourished or at risk of malnutrition (J. Bauer et al., 2002; Heredia et al., 2008; Jane A. Read et al., 2006; Segura et al., 2005). Studies by Bauer et al. (2002) and Pirlich et al. (2006) reported that among hospitalised inpatients in general, cancer patients have the highest rates of malnutrition. Malnutrition or suspected malnutrition appeared to be highly prevalent in this group of patients, with 28 (66.7%) patients in our study presenting with malnutrition or being suspected of malnutrition (Table 5.10). These results are not surprising and appear to be similar to other studies looking at the nutritional status of cancer patients (Heredia et al., 2008; Jane A. Read et al., 2006). Although the prevalence of malnutrition in CRC patients varied between studies, this nevertheless demonstrates that malnutrition is likely to be a common occurrence amongst CRC patients in Malaysia.

Even though this study was conducted among patients with CRC

which is considered as not a very cachectic tumour (Mary M & Susan R, 2010), the fact that the majority of participants (66.7%) were suffering from some kind of malnutrition (PG-SGA category B and C) before starting chemotherapy has been gaining considerable attention because it is known that patients receiving chemotherapy may have several toxic side effects that could negatively influence the nutritional status of the patients by interfering with the ability to eat (Santarpia et al., 2011) (Table 5.10). Identifying patients at risk for malnutrition and optimising symptom management to reverse or prevent malnutrition is an essential part of patient care (Watterson et al., 2009).

A study by Heredia et al. (2008) identified 54.5% of patients with cancer were in need of some sort of nutritional intervention which is much lower than the 76.2% in this study. However, Segura et al. (2005) have identified 97.6% of cancer patients needed nutritional intervention which is much higher than in our current study. Although the need of nutritional intervention in CRC patients varied between studies, this may be due to the possibility of underestimating the extent of malnutrition among cancer patients and hence, the correlation between the patients evaluated subjectively and the recommendations for nutritional intervention required by the patients would be poor (Segura et al., 2005). Even though 23.8% of our study patients were currently not in need of any nutritional intervention, they are still required to undergo routine and regular reassessment during the course of the treatment since dietary intervention must not only be individualised but also should be continuously evaluated and revised accordingly to the patient's needs and the ability to eat (Dudek, 1997).

As malnutrition is common in CRC patients undergoing chemotherapy, with majority requiring improved symptom management and/or nutrition intervention, an appropriate malnutrition assessment tool needs to be used. The scored PG-SGA is a validated nutrition assessment tool (Kubrak & Jensen, 2007) that enables malnourished oncology patients to be identified and triaged for nutrition support. It is suitable for use as an outcome in clinical nutrition practice (E. Isenring et al., 2003). It also deemed to be the 'gold standard' for oncology patients (Leuenberger et al., 2010). It has 98% sensitivity and 82% specificity based on study by Baeur et al 2002 (J. Bauer

et al., 2002)

Malnutrition can be difficult to identify. The majority of our participants were rated as at risk of malnutrition or severely malnourished even though their BMI were in the normal category based on the World Health Organization's (WHO) age- and sex-adjusted criteria (World Health Organization, 1995) (Table 5.13). It may have been difficult for staff to identify malnutrition in this group because 7.1% were overweight or obese and only 26.3% were underweight. Although low BMI and malnutrition are associated, 23 participants in the normal or overweight or obese ranges were at risk of malnutrition or severely malnourished (Table 5.13).

The high proportion of patients in non-underweight BMI categories highlights the increasing difficulty in identifying those in need of dietetic interventions. Overweight and obese patients may be pleased with inadvertent weight loss during treatment and, therefore, may be less inclined to report it as a concern. Clinicians and patients need to be aware of the effects malnutrition may have on patient outcomes (Watterson et al., 2009), particularly in those receiving chemotherapy, as changes in nutritional status have been associated with changes in the absorption, metabolism, and elimination of chemotherapy drugs (Vandebroek & Schrijvers, 2008).

There is a limitation of using BMI as the sole anthropometric criteria to measure nutritional status in patients with cancer. Pirlich and colleagues (2006) reported that BMI alone is not an accurate indicator of nutritional status among cancer patients. Malnutrition is often overlooked in patients who still fall within the normal weight (J. Bauer et al., 2002; Wigmore et al., 1997) in spite of having lost as much as 10–20 per cent weight in the previous six months (Wigmore et al., 1997) or be in the overweight category because of body fat masking loss of lean body tissue.

Another earlier study by Read et al. (2006a) demonstrated that at the mean 1-month history of weight loss of each BMI category, similar amounts of weight loss occurred in patients who were underweight (BMI < 20 kg/m^2), when compared to those who were within the normal weight range (BMI 20–25 kg/m^2), or overweight (BMI > 25 kg/m^2). This indicates that patients within

various BMI categories may have lost significant amounts of weight, and have a degree of malnutrition, which would not be detected by measuring BMI alone (Jane A. Read et al., 2006). This reinforces the importance of carefully monitoring all patients' weights, even if they are overweight, and intervening appropriately before weight loss becomes significant. It also reinforces that BMI alone is not an accurate indicator of nutritional status among cancer patients (Pirlich et al., 2006). This supports the observations made in the advanced cancer setting, where Segura et al. found 70% of patients had lost weight, but only 6.5% were categorised as underweight using BMI cut-off of 18 kg/m^2 (Segura et al., 2005).

The energy and protein intake were within the recommended limits but fibre intake was relatively low in both groups (Table 5.15). This result is comparable with a study by Lua et al. (2012) among breast cancer patients and receiving chemotherapy although the intake of protein in the breast cancer study were higher than our current study and was above the recommendation.

In general, the overall global health status (M. R. Keighley et al.) in this study was comparable to other studies conducted in developed countries i.e. a study by Thoresen et al. (2012) among patients with stage IV colorectal adenomas, Braun et al. (2011) among stage III and IV CRC patients and Engel et al. (2003) among patients with rectal cancer, and a Philippines study among cancer patients receiving chemotherapy (Vergara et al., 2013).

Although comparable, our GHS results were slightly higher than studies by Braun et al. (2011), Blanchard et al. (2003), and Engel et al. (2003), but comparable to study by Wan Puteh et al. (2013) and Thoresen et al. (2012) . This might be that the participants in our study were mainly patients due to undergo treatment at tertiary level hospitals, which provide better outpatients and inpatients services including palliative care and pain care management. Hence, the results are reflective of the QOL of patients who are still being influenced by hospital surroundings as compared to other studies (Braun et al., 2011; Engel et al., 2003) in which questionnaires were mailed to participants at home within family and community environments. There are certain characteristics at home for health care/patients living in

community that influenced patients' perceptions of their health and treatment outcome (Ellenbecker, Samia, Cushman, & Alster, 2008).Colorectal cancer and its treatment can have an adverse effect on social functioning, including work and productive life; relationships with friends, relatives; and other social activities and interests. In addition, CRC patients both stoma and non-stoma are troubled by frequent bowel movements, diarrhoea, flatulence and fatigue and often have to follow dietary restrictions (M. A. Sprangers, Taal, Aaronson, & te Velde, 1995). These conditions may affect their QOL. However, cultural factors, such as societal stigma, physical appearance and societal beliefs can reduce patients' perception towards their QOL. Another reason for differences in QOL might be the method of data collection in our current study, i.e. the participants were interviewed by a researcher instead of self-filled questionnaires (as was the case in the other two studies which makes them more willing to forward their grouses and grievances). In this case, participants tend more to mark-up their score to impress the researcher as in the Hawthorne effect (Wan Puteh et al., 2013).

It is not unexpected that activity levels would be below and not meeting recommended levels in this population (Table 5.18). This finding is consistent with a study conducted by Lynch et al. (2007) among patients diagnosed with CRC which showed that physical activity levels during post-diagnosis were low, and there were 21% fewer subjects achieving sufficient physical activity (at least 150 min per week) post-diagnosis than there were pre-diagnosis. Peddle et al. (2008) found that only 9% of a large sample of CRC survivors (60% Stage II or IV disease) reported sufficient activity levels during treatment, which increased to only 25% post-adjuvant therapy.

Similarly, recent American and Australian studies have reported that only 32–54% of CRC survivors meet physical activity guidelines (both during and post-treatment survivor samples) (C. M. Blanchard, Courneya, & Stein, 2008; A.L. Hawkes, Gollschewski, Lynch, & Chambers, 2009; James et al., 2006; B. M. Lynch, Cerin, Owen, & Aitken, 2007). Even though these studies used slightly different guidelines for minimum activity levels (i.e., > 150 minutes of moderate activity per week) than the present study, it is apparent that activity levels are consistently reported as insufficient in CRC patients. This finding is consistent with previous studies which indicate that most

cancer patients will not likely exercise during treatment without some structured intervention (K. Courneya & C. Friedenreich, 1997; K. S. Courneya & C. M. Friedenreich, 1997; Jones & Courneya, 2002a). This factor should be taken into consideration, to recommend a better and effective exercise intervention for cancer patients.

Outcomes from the study by Grimmett et al. (2011) among CRC survivors demonstrated that smoking and heavy drinking were relatively infrequent, intake of fruit and vegetables was low, and prevalence of overweight was high. Even though physical activity was low from that study population it was higher than the participants in the current study (Table 5.18).

Comparing physical level and fibre intake recommendations of the participants which is consistent with previous studies (Bellizzi, Rowland, Jeffery, & McNeel, 2005; Coups & Ostroff, 2005; Eakin et al., 2007). The prevalence estimates for these two lifestyle behaviours are below those found in the healthy population where 48.7% of adults are meeting the physical activity recommendation and 23.8% are meeting the fruit and vegetable consumption (5-A-day) recommendation (Centers for Disease Control and Prevention, 2005) whereas the opposite was true for smoking cessation.

Specifically the majority of participants were meeting the recommendations to not smoke and stopped smoking (85.7%) which is actually better than the national average healthy adults (79.5% are non-smoker) (Centers for Disease Control and Prevention, 2005). This may suggest that a cancer diagnosis portrayed greater potential to be a ‘teachable moment’ across several cancer groups in terms of changing smoking behaviour, but it may be less effective in modifying for physical activity and fibre intake. Additionally, this outcome is significant in that physical activity and nutrition may play a significant role in reducing cancer recurrence and mortality (J.A. Meyerhardt et al., 2006; Meyerhardt et al., 2009; Jeffrey A. Meyerhardt et al., 2006) and may combine to achieve an even greater effect (Pierce et al., 2007).

There was a statistically significant association between nutritional status and QOL (Table 5.19). This study is in agreement with Ravasco and colleagues (2005a). They conducted a study among 111 consecutive CRC ambulatory patients referred for radiotherapy. They found that there was a significant correlation between PG-SGA score and QOL score which means that malnutrition was significantly associated with a poorer QOL (Ravasco, Monteiro-Grillo, et al., 2005). This result is line with a study conducted by Tong and colleagues in 219 medical oncology patients who had commenced chemotherapy in the past month. They reported that patients with higher PG-SGA score and higher nutritional symptoms such as constipation, diarrhoea, vomiting and bad taste in the mouth, had lower QOL and life satisfaction score (Tong, Isenring, & Yates, 2009).

5.6.2 Effects of intensive individualised dietary counselling and lifestyle intervention

Previous studies carried out exclusively on oncology patients using the PG-SGA have reported 42.4–76% of these patients to be malnourished or at risk of malnutrition (J. Bauer et al., 2002; Heredia et al., 2008; Jane A. Read et al., 2006; Segura et al., 2005). Our results (Table 5.20) are not surprising and appear to be similar to other studies looking at the nutritional status of cancer patients (J. Bauer et al., 2002; Jane A. Read et al., 2006). Although the prevalence of malnutrition in CRC patients varied between studies, this nevertheless demonstrates that malnutrition is a common occurrence amongst cancer patients. Studies by Bauer et al. (2002) and Pirlich et al.(2006) reported that among hospitalised inpatients in general, cancer patients have the highest rates of malnutrition.

Even though this study was conducted among patients with CRC which is considered not a very cachectic tumour, the fact that majority of subjects (67%) were suffering from some kind of malnutrition (PG-SGA category B and C) before starting chemotherapy is a matter of concern and advocates the urgency of early nutritional assessment and nutritional intervention wherever appropriate. Similar results have been found in the study of oncology outpatients where there was a higher prevalence of

malnutrition before patient treatment (Jane A. Read et al., 2006). Therefore, identifying patients at risk of malnutrition and optimising symptom management to reverse or prevent malnutrition is an essential part of patient care (Watterson et al., 2009).

Our findings suggest that the effect of early intensive nutrition intervention improves nutritional status among CRC patients when compared to usual nutritional care (Figure 5.6). Furthermore, the benefits of early intensive nutrition intervention have been demonstrated in several studies (E. A. Isenring et al., 2007; E. A. Isenring et al., 2004; Um et al., 2014) but has not yet been reported in CRC patients about to undergo chemotherapy following surgery for CRC. Individualised dietary counselling was shown to be effective in improving and maintaining patient's nutritional status, dietary intake and quality of life (E. A. Isenring et al., 2007; Ravasco, Monteiro-Grillo, et al., 2005).

A study by Isenring et al. (2007) in 60 oncology outpatients receiving radiotherapy to the gastrointestinal or head and neck area who received nutrition intervention had improved dietary intake and quality of life, and less deterioration in nutritional status, when compared with usual care. These results were supported by a study by Ravasco et al. (2012) on 89 CRC ambulatory patients undergoing neoadjuvant radiotherapy found that individualised nutrition intervention had improved nutritional intake and status, and sustained QOL.

Van den Berg and colleagues have suggested that it is important to maintain an optimal nutritional status for participants with cancer through nutritional intervention during their oncological treatment because it can promote better patient outcome (van den Berg et al., 2010). In addition, the results from the Isenring and colleagues study confirms that dietetic intervention in the early stages of cancer diagnosis and during treatment is thought to have a positive impact on patient outcomes, including patient's tolerance of therapeutic regimes, minimise the progression and effects of malnutrition in the participants, decreased morbidity and improved quality of life (E. A. Isenring et al., 2004).

Overall the global QOL increased in the IG but there was no real change in CG (Table 5.23). The global QOL increased by >20 points in the IG, making it a large clinical effect. The results of this study were consistent with a previous study conducted by Thoresen and colleagues on 50 patients with stage IV colorectal carcinoma (Thoresen et al., 2012). The patients were referred to oncology clinic for consideration undergoing chemotherapy. They assessed the quality of life of the patients at baseline and after the 3 month follow-up. Their baseline results showed lower scores in symptoms scales and highest scores in functional scales and global health status. As compared to after 3 month follow-ups, there was slightly reducing scores in physical functioning, fatigue and diarrhoea, whereas insomnia and appetite somewhat better. Therefore, the changes of QOL data between the baseline and after 3 month follow-ups revealed that patients who lost weight had a statistically significant worsening on several QOL scores.

Some aspects to take into consideration was the difficulty in determining how cancer patients respond to nutritional interventions is that the metabolic changes induced by the disease make it difficult to value weight gain or improvement in the physical condition of these patients (Borges, Paiva, Silveira, Assunção, & Gonzalez, 2010). However, the results of this study show that the use of QOL assessment may constitute an alternative and more sensitive tool for assessing the benefits of such interventions. A number of studies have assessed how nutritional interventions influence QOL. One study involving 125 radiotherapy patients concluded that nutritional counselling had a positive impact on various QOL aspects in cancer patients (Ravasco et al., 2003).

Cancer can have profound effects on nutritional status. Patients diagnosed with cancer may experience unintentional weight loss more likely of progressive tissue depletion caused by altered metabolism, increased resting energy expenditure resulting from tumour-induced changes, the stress response caused by anxiety related to the illness, and decreased nutrient intake because of side effects of treatment or the disease itself. In addition, chronic and pathologic starvation caused by debilitating chronic illness or cancer may alter healthy bodily function (Mattox, 2005). Therefore, tumour, treatment, altered metabolism and psychological stress contribute to

weight loss and cancer cachexia in patients with CRC (Lund, Belshaw, Elliott, & Johnson, 2011; Mattox, 2005).

Nonetheless, risk of CRC recurrence, all-cause mortality, and CRC-specific mortality has been found to be elevated for patients who are underweight as well as for those who are overweight before or at time of diagnosis, as extensively reviewed (Siegel et al., 2010; Vrieling & Kampman, 2010). Recent analyses in the Cancer Prevention Study nutrition cohort for these end points confirmed these findings (Campbell et al., 2012). On the other hand, higher BMI post-diagnoses did not affect survival outcomes in that study (Campbell et al., 2012), as is observed in most (Vrieling & Kampman, 2010), but not all, studies (Sinicrope, Foster, Sargent, O'Connell, & Rankin, 2010).

Even though there were no statically significant changes in energy and protein intakes between groups there were minor differences, suggestive of trends. Energy intake was generally maintained across the 16 weeks in the IG but decreased in the CG, and protein intake increased in IG and decreased in CG. (Table 5.22). The participants were surveyed during chemotherapy and might have required diet alterations towards a low residue diet if they were experiencing chemotherapy-related symptoms such as diarrhoea, which might account for some of the lower than recommended intakes, including fibre (Van Loon et al., 2013). Furthermore, Read and colleagues demonstrated that acute side effects during chemotherapy begin at first and fourth cycles of chemotherapy commencement at the end of weeks 3 and 9 which influence negatively in food intake patterns of the patients (Read et al., 2007). Therefore, the change in nutrition intake followed the natural progression in side effects for patients undergoing chemotherapy.

The trends in energy and protein intakes from this study are consistent with a previous study that indicated both energy and protein intake is significantly increased in nutrition intervention group when compared with standard practice group during the first 4 weeks and maintained intake for the remainder of the study (E. A. Isenring et al., 2007). The previous study also explained that, dietary intake was found to be negatively influenced by the side effects of the treatment. Even though the finding in the current study did

not find that statistically increased energy intake necessarily led to weight gain or stabilisation but body weight in IG slightly continue to increase as well as increasing energy intake.

Timing of nutritional advice is likely to be important. Increasing dietary intake just before treatment may also not be acceptable to patients undergoing chemotherapy. Studies have been shown in mice and in cell culture that short-term fasting (48 hours) can protect normal cells but not cancer cells from chemotherapy agents (Raffaghello et al., 2010). However, the situation in patients undergoing radiotherapy might be different from that in those with chemotherapy in head and neck cancer patients where several trials found an improvement in dietary intake (E. A. Isenring et al., 2007), quality of life (E. Isenring et al., 2004), and nutritional status (van den Berg et al., 2010).

The increase in fibre intake seen in the IG (Table 5.22) is consistent with a previous study suggesting that 40% of colon cancer patients make one or more healthy dietary change(s) after diagnosis (Patterson et al., 2003) and a significant amount of patients increase vegetable and fruit or fruit juice consumption after diagnosis (Satia et al., 2004).

Physical activity levels increased in the IG and was sustained. Previous research indicates that most cancer survivors will not likely exercise during treatment without some structured interventions (K. S. Courneya & C. M. Friedenreich, 1997; Jones & Courneya, 2002b) (Table 5.26). In an earlier study, nearly twice as many adults decreased the amount of exercise they did after cancer diagnosis than increased (Chris M. Blanchard et al., 2003). Apparently, cancer survivors can be motivated for behaviour change after their diagnosis as reported by Demark-Wahnefried et al. (2000) and Jones & Courneya (2002b) (W. Demark-Wahnefried et al., 2000; Jones & Courneya, 2002b).

A study by Jones & Courneya (2002a) indicated that 84% of cancer survivors preferred or maybe preferred to receive exercise counselling at some point during their cancer experience. While study by Demark-Wahnefried et al. (2000) reported that half of cancer patients preferred to

receive exercise counselling during their treatment. Therefore, the high level of interest in exercise counselling supports a strong rationale for providing exercise counselling services as part of the standard of care in a comprehensive cancer centre. However, the findings by Demark-Wahnefried et al. (2000) would suggest a preference for exercise counselling to be modified according to cancer site and age.

Recently, the American Cancer Society recommended that cancer survivors be encouraged to exercise regularly (J. K. Brown et al., 2003). Like most behavioural interventions, the benefits of exercise can be realised only through regular participation (K. S. Courneya & Friedenreich, 1999). Therefore, the effectiveness of exercise depends to a large extent on the motivation and adherence of participants (Jones & Courneya, 2002b). Despite this recommendation, there is no doubt that exercise adherence will be a challenge for healthy adults and is likely to be even more difficult for cancer survivors especially after a cancer diagnosis and during intensive medical treatment (K. S. P. Courneya et al., 2005; Jones & Courneya, 2002b). Not surprisingly, previous research has shown that cancer survivors experience a significant decline in exercise during treatment and remains so even years after treatment is completed (K. Courneya & C. Friedenreich, 1997; K. S. Courneya & C. M. Friedenreich, 1997).

Previous studies have found that only 37% of patients with CRC and 28% of patients with breast cancer reported regular exercise during treatment (K. Courneya & C. Friedenreich, 1997; K. S. Courneya & C. M. Friedenreich, 1997). In addition, only 16% of older cancer survivors (mean age of 72 years) were active during treatment as reported in another study (Wyatt, Friedman, Given, Given, & Beckrow, 1999). Nonetheless, research suggests that exercise has numerous QOL benefits such as reduced fatigue, pain, anxiety, and depression in adult cancer survivors and should therefore be promoted in this population (Chris M. Blanchard et al., 2003). Evidence suggests that exercise may enhance physical fitness and has emerged as an important QOL modifier in cancer survivors both during and after treatment (K. S. Courneya, 2003). Broadly, the findings of these studies demonstrate that respondents who met physical activity recommendations (the relevant amounts varied between studies, but were generally equivalent to 150

minutes of moderate-intensity activity per week) had higher QOL scores.

Also, a number of the studies described physical activity at different time points across the cancer experience, and indicated that physical activity levels tended to decrease following diagnosis, and then increase following treatment; however, they did not always return to pre-diagnosis levels. This pattern of activity change seems to be consistent across cancer groups (J. K. Brown et al., 2003; Kuiper et al., 2012; Schmitz et al., 2010). Pattern of change in activity has also been associated with QOL following diagnosis (J. K. Brown et al., 2003; Jones & Courneya, 2002b). In addition, those who increased levels pf physical activity after diagnosis and compared with those who did not change, may decreased their cancer-specific mortality and overall mortality (Denlinger & Engstrom, 2011).

The study by Segal et al. (2001) in women with stage I and II breast cancer indicates that the key to success for sedentary cancer patients is to provide reassurance that exercise is a safe and beneficial modality for them. In line with to prescribe an exercise program that builds their confidence by slowly increasing the level of exercise intensity. In others words, future research should attempt to design a safe and effective exercise program for patients with CRC.

Higher self-confidence to undertake changes in behaviour is likely to lead to greater success in achieving changes to CRC risk factors. A study by Al-Otaibi et al. (2013) in 242 subjects from eight health centers in Saudi Arabia showed that males had higher mean scores of self-efficacy and self-efficacy categories as compared to females. They are more confident to set time when they are under stress or feeling sad, and can exercise with greater social and family demands. Even though our current study did not highlight the comparison between genders (Figure 4.8 and 4.9), there were quite a number of participants from IG in contemplation stage who changed to the action stage and maintenance stages of behavioural change stages unlike CG where the majority stayed in the contemplation stage. As well, the higher mean scores of self-efficacy of confidence in their ability to be active and consuming healthy diet when they were faced with certain constraints in IG. Thus intensive dietary counselling may help participants to increase their

confidence level and modified/changed behaviour to healthy lifestyle.

In this study, we expected that most of our study participants would have confidence and belief in the effect of exercise and healthy diet for overall health status, and they would start to follow a healthier lifestyle following cancer diagnosis (Table 5.27). However, based on their dietary intake, a sizeable portion of the participants were still not following these recommendations even before their diagnosis. These findings are in line with previous reports from other parts of country (Turhal et al., 2013; Yilmaz, Sanli, Ucgun, Kaya, & Tokem, 2013). Our participants had a much higher belief in the role of diet than they did for physical activity. This may be enhanced by promoting awareness and highlighting practical ways to integrate specific about the type of activity they should be performing, also increase the likelihood of physical activity engagement (Vidrine et al., 2013).

This present study examined how CRC patients adapt to current information on exercise and diet during their disease. It emerged that most of IG participants changed their physical activity level and some dietary habits in the belief that this would help to fight the disease and to promote cure as well as overall health status. This finding is in line with a previous study (Salminen et al., 2000). The interest in dietary and lifestyle modification increased with the help of intensive dietary counselling by the dietitian whereby they more motivated and growing their belief towards overall healthy lifestyle.

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5.7 Strengths and limitations of the study

Generally, this study has important strengths and limitations. The RCT adapted for the present intervention is considered the best design in measuring the efficacy of any intervention (Jansman et al., 2007). It was also sufficiently powered to detect a large effect of the intervention treatment, compared with the control group, if a difference did actually exist.

The recruitment of the participants was through referral by the

physicians who was aware of the inclusion and exclusion criteria, even though they did not participate directly in the recruitments activities, their show of support by referring patients to the study had a significant impact on the ability to reach the target for the number of participants and also improved response rate. In addition, this study shows a good response rate and no drop-outs from the participants.

There was one researcher/dietitian in charge for data collection, which may useful to standardise the assessment and intervention process and outcomes. This study also provided a follow-up to investigate if behavioural changes were sustained 8 weeks after the initial intervention. The use of validated the scored PG-SGA and QOL questionnaires are additional strengths. The scored PG-SGA is validated for nutritional assessment in patients with cancer (Leuenberger et al., 2010).

Also the QOL questionnaires has been used widely in many international trials and research on cancer (M. A. G. Sprangers et al., 1999). The questionnaires have been translated and validated in Europe and other parts of the world and it had been considered as the strength of this study.

On the other hand, the limitations in this current study are that there are small numbers which may limit the generalisation of the findings to other clinical settings. It may not be representative of Malaysian CRC populations. The questionnaire did not ask about any nutritional supplements used in participants, so reflects the dietary intake only. Also, The American Dietetic Association Medical Nutrition Therapy (ADA MNT) protocol for cancer patients was used for nutritional prescriptions for the participants, as in Malaysian there was no specific MNT cancer guidelines for reference during the time of the study. An update has since been published on 2013 (Tah et al., 2013).

Another limitation of this study is the use of universal BMI cut-off points and the relationship between body fat per cent which may not be appropriate in Asian populations especially different ethnic groups. The high body fat per cent at low BMI can be partly explained by differences in body build, which were differences in trunk-to-length ratio and also differences in

slenderness, and muscularity (Deurenberg et al., 2002). This should be taken into consideration when percentage fat is measured and the BIA technique is applied in clinical trials. The Godin Leisure-Time Exercise Questionnaire has not been used validated in a Malaysian population

In addition, this study was focused on the intensive dietary and lifestyle counselling for improving nutritional status and QOL of the CRC patients. Therefore, the data of the amount or treatment cycle of chemotherapy, co-morbidity or medication information were not collected from the participants. However, collection of more clinical details surrounding cycles of treatment, actual chemotherapy regimens, comorbidities and medication would have provided additional information and context in which to interpret results.

Even though intensive individualised dietary and lifestyle counselling may be seen as the best intervention for improving nutritional status of CRC patients, the implications for dietitian services and resources available in clinical settings need to be thought through.

5.8 Conclusion

Intensive individualised D&L counselling compared to usual care is effective in CRC patients undergoing chemotherapy for first time. It indicates improvements in nutritional status, QOL, physical activity levels, some improvements in dietary intake and greater progression along readiness to change. As this is the first RCT of its type to be conducted in Malaysia where CRC is increasing, these findings would need to be confirmed by other RCTs in different clinics in Malaysia.

Chapter 6. General Discussion of the Studies - Conclusion, Limitations and Recommendations for the Future Research

6.1 Thesis summary

Colorectal cancer is common worldwide with a high prevalence rate in many developed countries such as Australia and it is increasing in many developing countries, including Asian countries such as Malaysia (Torre et al., 2015). CRC is the third leading cause of cancer death in Australia (Australian Institute of Health and Welfare & Registries., 2012) and also in Malaysia (Zainal & Nor Saleha, 2011).

Colorectal cancer has a significant health burden on individuals and is a costly disease to treat and manage (Jansman et al., 2007), so there are strong health and economic reasons to increase our understanding of risk factors that can be altered to modify the risk of CRC developing in the first place in order to prevent the disease from occurring or delaying its onset.

Diet and lifestyle are modifiable risk factors that can help to mitigate the risk of developing CRC. The specific D&L factors examined in this thesis are as follows: obesity, abdominal fat, physical activity, fibre and alcohol intakes, intakes of red and processed meat and smoking (World Cancer Research Fund/American Institute for Cancer Research, 2011).

But the roles of D&L factors are not restricted to preventing or delaying CRC, they can also play an important role during the treatment of the disease and assist with the management of disease symptoms (Chan et al., 2011; Magalhães et al., 2012). In addition, it is becoming increasingly recognised that D&L may also play a role in preventing the recurrence of cancer in cancer survivors. Colorectal cancer survivors are considered to be at higher risk of developing CRC.

The association between IBD and CRC has been recognised for almost a century (Andersen & Jess, 2013). The sub-groups of IBD patients with severe disease and those with long term IBD carry a greater risk of developing CRC (Andersen & Jess, 2013).

In our studies we found that in those at higher risk of developing CRC generally there was a high prevalence of risk factors that increased the risk of CRC and a lower prevalence of risk factors that reduced the risk of CRC,

although this was not consistent across all three studies. There were differences in risk factors and behaviours between sub-groups of those at higher risk, suggesting the need to better understand the needs of the sub-groups so that tailored interventions can be designed for the needs of the sub-groups and hopefully result in better health outcomes compared to a more generic 'one-size-fits-all' interventions.

We also found that malnutrition is prevalent in CRC patients undergoing chemotherapy in Malaysia and an intensive D&L counselling intervention significantly improved the nutritional status and QOL of patients undergoing chemotherapy (as a single therapy following surgery) when compared to a usual nutrition care group.

6.2 Prevalence of diet and lifestyle risk factors in high colorectal cancer risk groups

Given the role of D&L practices in mitigating CRC risk, it is important to understand the knowledge, attitudes and behaviours of individuals and groups who have had cancer and who are at higher risk of developing CRC. Once we have a better understanding of their D&L, it would be possible to start tailoring interventions for those with a higher risk. There are however, different sub-groups who are at higher risk of developing CRC such as those with long term IBD and those with a family history of cancer.

In this thesis we hypothesised that those with CRC would have a higher awareness of dietary and lifestyle risk factors compared to those with IBD. In the Flinders study the prevalence rates of D&L risk factors were examined in those with CRC, with long-term IBD and those with an initial diagnosis of CRC prior to presenting for gastrointestinal surgery. Our hypothesis was not supported as the prevalence of D&L factors in the CRC patients were found to be higher, they had relatively low knowledge scores and lower agreement on making D&L changes compared to the IBD group. The IBD group had lower prevalence of some risk factors and better knowledge of some risk factors than the CRC patients.

In the Newcastle study we examined the question of whether dietary and lifestyle risk factors differed according to BMI status in those with an initial diagnosis of CRC prior to presenting for gastrointestinal surgery. The key findings of this study were that there were very few differences in the prevalence of risk factors according to whether participants were normal weight, overweight or obese. There were however, significant differences between men and women, regardless of their weight status. Women tended to report that they adopted a healthier lifestyle than men.

This may suggest the need for better dissemination of information on the role of D&L risk factors to those at higher risk of developing CRC, for better success in health outcomes, that is, engage with the treating physician, use behavioural change models to understand readiness to change, and target specific education for different high risk groups according to their needs.

6.3 Impact of a diet and lifestyle intervention on CRC patients commencing chemotherapy

Malnutrition is common in patients with cancer and it is associated with negative health outcomes of the patients (Capra, Bauer, Davidson, & Ash, 2002). Generally, cancer patients undergoing chemotherapy have a high risk of malnutrition secondary to both the disease and the treatment. It is important to maintain good nutritional status of the patients to improve the effects and minimise the side effects of cancer treatment (Wie et al., 2010). In addition, a good nutritional status should be maintained for patients through nutritional intervention during cancer treatment (van den Berg et al., 2010).

Colorectal cancer treatment varies according to the stage, size, location of the tumour and whether or not there are metastases. In general most undergo gastrointestinal surgery followed by either chemotherapy or radiotherapy or both. Each type of treatment can have different side effects. Malnutrition is relatively high in CRC patients (Lopes, de Castro Cardoso Pereira, dos Reis Baltazar Vicente, Bernardo, & de Mesquita, 2013). It

appears that there are no published studies on intense dietary counselling vs. usual dietary care RCTs on nutritional status and QOL in CRC patients undergoing chemotherapy alone. Furthermore there are no such RCTs undertaken in Malaysia, a country where CRC is increasing. It is therefore important to undertake a RCT of a dietary and lifestyle counselling intervention compared to usual care in CRC patients commencing chemotherapy conducted in a Malaysian clinical setting

In this study, intensive D&L counselling improved nutritional status, QOL, physical activity levels, some improvements in dietary intakes and greater progression along readiness to change among CRC patients undergoing chemotherapy compared to a usual care group. In this study, 67% of CRC patients had some level of malnutrition. In the IG the prevalence of malnutrition dropped from 72.7% at baseline to 27.3% 8 weeks after the intervention and the QOL global health scored improved by >20 points which is a large shift that is clinically meaningful. The CG still had 75% of patients with malnutrition or at risk of malnutrition at week 16 and the QOL global health score only improved by 4 points.

6.4 Overall strengths and limitations

The current studies have some important strengths and limitations.

Overall, the strengths of the studies in this thesis were that all of the participants were clinically well-characterised in Study 1 and 2, physicians supported the studies, validated assessment dietary intake and physical activity tools were utilised and one researcher collected the data, thereby minimising measurement variance and error. In the Newcastle and Intervention studies, actual height and weight were used to determine weight and BMI status, overcoming the errors that can occur when relying on self-reported height and weight. The Intervention study, although it was small, had sufficient power to detect clinically meaningful changes and the response rate was high.

The key limitations of the two survey studies presented here were that

the sample sizes were small and the response rates were low which may limit the generalisability of the findings to other CRC and IBD patient populations. In both the Flinders and the Newcastle study, recruitment of participants through physicians was slow; and the researcher had limited time available to extend the recruitment, particularly for the Flinders study.

In the Newcastle study, although all had the initial diagnosis of CRC prior to presenting for gastrointestinal surgery, some were subsequently diagnosed as not having CRC and so this mixed population may not represent the CRC population. However, we found that whether or not cancer was present and the actual stage of cancer did not predict the key D&L variables, so we analysed all who provided sufficient data.

Throughout the thesis, validated assessment tools were used but they differed between the studies. Two different food frequencies were used in the two surveys. In the Flinders study the Victorian Cancer Council FFQ was chosen because it had been widely validated and had been developed for use in studies of diet and cancer. The Newcastle study used the Blue Mountains Eye Study because this had also been validated but it had also been widely used in older patients. As two different tools were used, the absolute intakes are not directly comparable across the two studies. The Intervention study used food recalls and records which is more appropriate to measure shorter term changes in dietary intakes.

Different tools were also utilised to assess physical activity. The Flinders Study used a short 8 question validated instrument that had been used by the Australian Institute of Health and Welfare in a number of Australian studies. This was used to minimise respondent burden. The Newcastle Study used the validated long form IPAQ which has 27 questions. This was chosen by the primary researchers from Newcastle University and CSIRO as being the most appropriate tool to use to allow international comparisons to be made. Finally the Intervention Study used Godin Leisure-Time Exercise Questionnaire which is a short 3 question instrument as this had been used previously in a Malaysian setting, and it was short to minimise respondent burden. As for the dietary measures, the physical activity measures are not directly comparable across the three studies in this thesis.

Self-reported data may likely to be limited somewhat by recall error, perceived social desirability, information bias and other biases e.g. self-reported physical activity. As well those with diet-related CRC prevention beliefs/knowledge were perhaps more likely also to report healthy eating patterns, expressing a bias based on belief in the benefits. In addition, self-reported changes measure only the behaviour changes that patients indicate they have made and may not perfectly match their actual behavioural changes (Zaharek-Girgasky, Wolf, Zybert, Basch, & Basch, 2014).

6.5 Future directions

Despite the limitations of the present studies, the findings highlight potential future research areas. These include the following:

1. These studies showed that the prevalence of dietary and lifestyle risk factors for developing CRC is relatively high among high risk populations and those with CRC. The knowledge and awareness of risk factors was low (overall knowledge score was close to 50% based on 15 questions) among CRC and high risk of CRC patients. Also the risk-mitigating behaviours were not widely adopted. Therefore, tailor made strategies of CRC awareness campaigns or preventive programmes should be planned and implemented to the each of the sub-groups.

2. The Newcastle study conducted in older patients presenting for gastrointestinal surgery demonstrated that there were no consistent differences in risk factors according to BMI status but there were significant differences between men and women, with the women generally adopting a healthier lifestyle. Other studies should be conducted to confirm these findings and consideration should be given to D&L programs for older groups at risk of CRC so that they may be have a better nutritional status when they present for treatment following an initial diagnosis or even to prevent or delay the onset of CRC in the first place.

3. The findings of the intervention study need to be confirmed in larger studies and in different clinical settings in Malaysia and other countries where CRC is high or rapidly increasing. The study presented in this thesis demonstrated clinically meaningful results in the two primary outcome variables of nutritional status and QOL but additional studies need to be undertaken to see if the approach of intensive dietary counselling is translatable to other oncology units. In addition the implications of such an intense approach of individualised counselling on clinical dietetic resources needs be better understood to see if this approach can be more widely adopted.

4. The sample size was relatively small and limited the generalisation to the effect of dietary counselling on improving dietary intake and nutritional status of CRC cancer patients in other oncology care within the country, but sufficiently powered to detect the effects of the intervention treatment, compared with the control group, if differences actually exist. Therefore, future studies should overcome this limitation to obtain a larger sample size and to allow for statistical comparisons and associations to be made.

5. The findings might not be representative as only two hospitals took part in the study and convenience sampling was employed. Therefore, future studies are encouraged and focused on approaching multi-centres to acquire bigger sample size and to represent the effects of intensive individualised dietary counselling on patients with CRC cancer.

6. The majority of patients had received diagnoses of stage II and III disease, therefore, the dietary and exercise counselling of patients in this study may not reflect to the patients with more advanced disease. Therefore, future studies should be undertaken to determine if exercise counselling is feasible or useful in patients with later stage CRC and whether there are differences in efficacies of interventions according to cancer site and age.

7. Most of the patients had not been seen by a dietitian. Nutrition screening and assessment is not routinely used in the clinical setting in Malaysia Therefore, recommendations for future research should be the implementation of a routine nutrition screening and assessment using a validated nutrition assessment tool such as the scored PG-SGA in these populations to support referral to a dietitian or for appropriate nutrition support including dietary counselling on high-energy and protein diet, modified texture, supplementation, or consideration of tube feeding if required.

8. This present study has provided useful data on stages of change and self-confidence (self-efficacy) for modifying risk factors such as increasing the physical activity and changing dietary intake across adults and specifically cancer patients. In this study we found that the patients were more self-confident about changing their diet than they were about changing their physical activity levels. The self-confidence in changing physical activity dropped markedly at the commencement of chemotherapy. Therefore, future research should tailor strategies and intensive lifestyle counselling aiming at increasing physical activity levels and consuming balanced and healthy diet according to self-efficacy and to the barriers detected. This would be applicable when undertaking D&L interventions, when developing strategies for those at higher risk of developing CRC as well as population strategies for preventing many chronic diseases such as certain types of cancer, and recurrence of cancer.

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Appendices

Appendix A – PhD research project letter of invitation (Flinders Study)

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Dear .....

PhD Research Project Letter of Invitation

We are conducting a research survey into diet and lifestyle knowledge, attitudes and behaviours in people at increased risk of developing colorectal cancer. This research project forms part of the requirements for a PhD degree for Mrs Zalina Abu Zaid. Her chief supervisor is Dr Kathryn Jackson, from the School of Medicine, Department of Nutrition and Dietetics at Flinders University.

Your name has been selected from our data-bases at the Repatriation General Hospital and Flinders Medical Centre and we invite you to take part in our survey.

The attached Participant Information Sheet explains the aims and details of our research project.

This research survey has been reviewed and approved by the Southern Adelaide Clinical Human Research Ethics Committee which includes Flinders Medical Centre and the Repatriation General Hospital (Document no 366.13).

By participating in this survey you will be providing valuable information to help us develop suitable nutrition programs for people with higher than usual risk of developing cancer. If you agree to take part we require you to read and then sign an attached consent form. However, you are under no obligation whatsoever to participate in this project and your usual clinical care will not be affected in any way.

If you would like take part in this survey, you may choose to complete the survey questionnaires either online or on paper. If you prefer to answer the questionnaires online, we will email you the link and special password to the survey. For those who prefer a printed copy, we will send you two questionnaires in the post immediately upon receipt of your consent form.

We ask that you complete the questionnaires within two weeks of receiving them, if possible, and return to us via return email or reply paid post, depending upon how you elected to receive the questionnaires. If we do not receive your questionnaire after this period we may contact you to remind you to complete them. When we have received your questionnaires, we may telephone you within a fortnight at a pre-agreed time, should any clarification of information be required.

If you have any enquiries about this project, please contact us in a way that is convenient to you using the contact details shown.

Yours sincerely,

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inspiring achievement

If you agree to take part in the project, we require you to read and then sign the attached consent form.

Also to indicate whether you prefer to complete the questionnaires online or as a printed copy, please tick one box and send this back to us together with your consent form, in the reply paid envelope provided:

☐ I prefer to complete the questionnaires on paper.

☐ I prefer to complete the questionnaires by email.

Your email address: _____

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Appendix B – PhD research project letter of introduction (Flinders Study)

Dr Kathryn Jackson
Lecturer
Nutrition and Dietetics
Flinders Clinical and Molecular Medicine
School of Medicine

Rm 7E-105, Level 7, Flinders Medical Centre
GPO Box 2100
Adelaide SA 5001

Telephone: +61 8 8204 6978
Facsimile: +61 8 8204 6406
Email: katrhyn.jackson@flinders.edu.au
www.flinders.edu.au/medicine/sites/nutrition-and-dietetics/

Dear.....

PhD Research Project Letter of Introduction

The letter is to introduce Mrs Zalina Abu Zaid, who is completing her PhD at Flinders University. Zalina is supervised by Dr Kathryn Jackson from School of Medicine, Department of Nutrition and Dietetics at Flinders University and Professor Lynne Cobiac, Professorial Research Fellow at Flinders University.

In part of fulfilment of Zalina's PhD candidature, she is required to complete this research project through Flinders University-associated medical clinics at the Repatriation General Hospital Surgery Clinic, Flinders Medical Centre (FMC) Colorectal Unit Clinic and FMC Gastroenterology (Luminal) Clinic.

Zalina would be most grateful if you would volunteer to assist in her research project by completing 2 confidential questionnaires. She will collect diet and lifestyle information by self-administered questionnaire and will seek your written consent to participate, on the attached form. This research has been approved by the Southern Adelaide Clinical Human Research Ethics Committee (Document no: 366.13). All of your responses will remain confidential, and your identity will only be known by the chief supervisor (Dr Kathryn Jackson) and the PhD candidate (Mrs Zalina Abu Zaid). The only time your identity will be used is the initial contact we make with you and should we need clarification of any of your answers once you have completed your questionnaires.

Any enquiries you may have concerning this research project can be directed to the PhD candidate (Mrs Zalina Abu Zaid), or to Zalina's chief supervisor Dr Kathryn Jackson. Contact details are shown below.

You will find the following enclosed with this Letter of Introduction:

1. A Letter of Invitation
2. A Consent Form
3. A Participant Information Sheet explaining this research project in more detail.

We look forward to hearing from you.

Yours sincerely,

Dr Kathryn Jackson
Lecturer
Telephone: (08) 8204 6978
Mobile: 0411 181 246
Email: kathryn.jackson@flinders.edu.au

Zalina Abu Zaid
PhD Candidate
Telephone: (08) 8204 7076
Mobile: 0410 334 637
Email: zalina.abuzaid@flinders.edu.au

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Appendix C – Participant information sheet (Flinders Study)

APPENDIX C

Flinders UNIVERSITY

Nutrition and Dietetics
School of Medicine

PARTICIPANT INFORMATION SHEET

Knowledge, attitudes and behaviours related to diet and lifestyle in a population at above average risk of colorectal cancer

Researchers:

Professor Lynne Cobiac (CSIRO Preventive Health Flagship, National Research Flagship, Adelaide, South Australia)

Dr Kathryn Jackson (Dept. Nutrition and Dietetics, Flinders University)

Professor Carlene Wilson (Flinders Centre for Innovation in Cancer, School of Medicine, Flinders University)

Dr Paul Hollington (Flinders Clinical and Molecular Medicine, Surgery, School of Medicine, Flinders University)

Associate Professor Chris Karapetis (Flinders Clinical and Molecular Medicine, Surgery, School of Medicine, Flinders University)

Associate Professor Peter Bampton (Flinders Clinical and Molecular Medicine, Gastroenterology and Hepatology, School of Medicine, Flinders University)

Mrs Zalina Abu Zaid (Dept. Nutrition and Dietetics, Flinders University)

This research study is being undertaken as part of the requirements of a PhD for Zalina Abu Zaid under the supervision of Dr Kathryn Jackson at Flinders University and Professor Lynne Cobiac at CSIRO Preventive Health Flagship, National Research Flagship, Adelaide.

Invitation to participate:

You are invited to take part in this research study which aims to investigate the dietary and lifestyle knowledge, attitude and behaviour in a population at increased risk of developing colorectal cancer. Before you decide, please take time to read the following information carefully and discuss it with others if you wish. If there is anything that is not clear to you or if you would like more information, please contact us using the details provided below.

Selection:

You are selected from our data-base kept at the Repatriation General Hospital and Flinders Medical Centre.

Aims of the project:

Colorectal cancer (CRC) is the most common cancer and the sixth leading cause of death in Australia. Approximately 15-20% of individuals will develop CRC within their lifetime, and about half of them will die from this disease. There is overwhelming evidence to indicate that a vast majority of these cases and associated death could be reduced if diagnosed early or prevented with health promotion intervention. The key to achieve a successful targeted health promotion begins with assessing the needs of this population. Therefore, the purpose of this study is to investigate the knowledge of, attitude to and behaviours, relevant to dietary and lifestyle changes for reducing risk of developing colorectal cancer.

Summary of procedures:

If you agree to take part in the study, we will firstly ask you to sign the attached consent form. You will be asked to choose to complete the questionnaires by mail or online.

If you choose to complete the questionnaires by mail, a package containing: a food frequency questionnaire, a socio-demographic questionnaire and a knowledge, attitude and behaviour questionnaire will be posted to your address. Once completed, you need to return all 3 questionnaires using the postage paid envelope provided.

If you choose to complete the questionnaires online, a food frequency questionnaire, a socio-demographic questionnaire and a knowledge, attitude and behaviour questionnaire will be sent to you via email.

You will need to complete the questionnaires within two weeks of receiving the questionnaires. If we do not receive your questionnaire after this period we may contact you to remind you to complete the questionnaires.

There will be a follow up telephone call from the researcher approximately two weeks after the return of the questionnaires if we need to clarify any responses.

Your medical record will be accessed to gain information about your medical history relevant to colorectal cancer if necessary.

Commitments:

You will be asked to complete the questionnaires as given. This will take about 50 to 70 minutes.

You will be contacted by telephone if clarification of responses is required. This will take about 15 to 30 minutes.

Benefits:

We cannot guarantee that you will directly benefit from participating in this study. However, your participation in this study may provide us with valuable information to help us to develop targeted health promotion strategies that may be beneficial and to raise awareness in this population group who are at an increased risk of developing colorectal cancer.

What will happens to me at the end of the study:

Your treatment will continue as usual and will not be affected in any way.

Risks:

We do not foresee any other risks or any disadvantages except for the time commitment required of you in taking part in this study.

Compensation:

Participants in the study are insured under Flinders University's insurance program.

Confidentiality:

All records containing personal information will remain confidential and no information which could lead to your identification will be released, except as required by law.

Publication:

The results of this study will be published in scientific journals at a later date. Please be assured that you will not be identified in any report from this study. The records dealing with your participation will be kept under secured storage for 5 years after completion of the study.

Withdrawal:

Your participation in this study is entirely voluntary and you have the right to withdraw from the study at any time without giving a reason. If you decide not to participate in this study or if you withdraw from the study, you may do this freely, without affecting the standard care or treatment you will receive.

Outcomes:

We will provide you with a summary of the findings upon completion of the study.

Contact:

Any enquiries you may have concerning this study should first be directed to the student researcher (Mrs Zalina Abu Zaid) by email zalina.abuzaid@flinders.edu.au of by telephone 08 8204 7076 or 0410 334 637

Alternatively, you can contact the chief supervisor, Dr Kathryn Jackson, by telephone on 08 8204 6978 or email kathryn.jackson@flinders.edu.au

Complaints:

This study has been reviewed by the Southern Adelaide Clinical Human Research Ethics Committee (document no 366.13). If you wish to discuss the study with someone not directly involved, in particular in relation to policies, your rights as a participant, or should you wish to make a confidential complaint, you may contact the Executive Officer on 08 8204 6453 or email to research.ethics@health.sa.gov.au

Appendix D – Consent form (Flinders Study)

Flinders UNIVERSITY

Nutrition and Dietetics
School of Medicine

CONSENT FORM FOR PARTICIPANTION IN RESEARCH

I,

.....

(first or given name) *(last name)*

give consent to my involvement in the research project: "Knowledge, attitudes and behaviours related to diet and lifestyle in population at above average risk of colorectal cancer".

I acknowledge the nature, purpose and contemplated effects of the research project, especially as far as they affect me, have been fully explained to my satisfaction by

.....

(first or given names) *(last name)*

and my consent is given voluntarily.

I acknowledge that the detail(s) of the following has/have been explained to me, including indications of risks; any discomfort involved; anticipation of length of time; and the frequency with which they will be performed:

1. Questionnaire(s) about my usual daily intake (approx 20 – 30 minutes).
2. Questionnaire(s) about my usual physical activity (approx 15 – 20 minutes).
3. Questionnaire(s) about my knowledge, attitude and behaviour on dietary and lifestyle changes (approx 15 – 20 minutes).
4. A telephone interview to clarify information from the questionnaires (approx 15 – 30 minutes).
5. My medical record will be accessed to gain information about my medical history relevant to colorectal cancer if necessary.

I have understood and I am satisfied with the explanations that I have been given.

I have been provided with a written information sheet.

I understand that my involvement in this research project may not be of any direct benefit to me and that I may withdraw my consent at any stage without affecting my rights or the responsibilities of the researchers in any respect.

I declare that I am over the age of 18 years.

I acknowledge that I have been informed that should I receive an injury as a result of taking part in this study, I may need to start legal action to determine whether I should be paid.

Signature of Research Participant: .....

Date: .....

I, ... have described to .....

the research project and nature and effects of procedure(s) involved. In my opinion he/she understands the explanation and has freely given his/her consent.

Signature: .....

Date: .....

Status in Project:.....

Appendix E – A reminder letter for questionnaire return (Flinders Study)

Dr Kathryn Jackson
Lecturer
Nutrition and Dietetics
School of Health Sciences
Faculty of Medicine, Nursing and Health Sciences
Rm 7E-105, Level 7, Flinders Medical Centre
GPO Box 2100, Adelaide SA 5001
Telephone: +61 8 8204 6978
Facsimile: +61 8 8204 6406
Email: kathryn.jackson@flinders.edu.au

Dear

PhD Research Project
"Knowledge, attitudes and behaviours related to diet and lifestyle"

REMINDER

Thank you once again for agreeing to participate in Zalina's PhD research project. Your participation is greatly appreciated, and your identity and responses will be kept confidential.

This letter is a gentle reminder to complete the two surveys we sent to you recently, about your general lifestyle (Knowledge, Attitudes and Behaviours Survey) and food intake (Dietary Questionnaire).

If you have misplaced the original surveys, please feel free to contact Dr Kathryn Jackson via telephone (8204 6978 or 0411 181 246) or via email kathryn.jackson@flinders.edu.au and replacements can be posted out to you.

Yours sincerely,

Dr Kathryn Jackson
Lecturer
Telephone: (08) 8204 6978
Mobile: 0411 181 246
Email: kathryn.jackson@flinders.edu.au

Zalina Abu Zaid
PhD Candidate
Telephone: (08) 8204 7076
Mobile: 0450 833 373
Email: zalina.abuzaid@flinders.edu.au

Appendix F – A reminder letter to check patients interest in participating in the study (Flinders Study)

Dr Kathryn Jackson
Lecturer
Nutrition and Dietetics
School of Health Sciences
Faculty of Medicine, Nursing and Health Sciences
Rm 7E-105, Level 7, Flinders Medical Centre
GPO Box 2100, Adelaide SA 5001
Telephone: +61 8 8204 6978
Facsimile: +61 8 8204 6406
Email: kathryn.jackson@flinders.edu.au

Dear .....

PhD Research Project
"Knowledge, attitudes and behaviours related to diet and lifestyle"

REMINDER

This letter is a gentle reminder for you to respond to our invitation to participate in the research project **"Knowledge, attitudes and behaviours related to diet and lifestyle".**

We understand that you might be busy, or may have been on holidays, but it is not too late as we are still accepting volunteers into this research project.

If you would still like to participate, please read the enclosed information sheet, complete the consent forms, and return them in the reply paid envelope provided.

If you do not wish to participate, we completely understand and will not follow up with any further reminder letters.

Yours sincerely,

Dr Kathryn Jackson
Lecturer
Telephone: (08) 8204 6978
Mobile: 0411 181 246
Email: kathryn.jackson@flinders.edu.au

Zalina Abu Zaid
PhD Candidate
Telephone: (08) 8204 7076
Mobile: 0450 833 373
Email: zalina.abuzaid@flinders.edu.au

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Appendix G – Ethics approval from the Southern Adelaide Clinical Human Research Ethics Committee (Application number: 366.13, Flinders Study)

Government of South Australia

Southern Adelaide Health Service

Southern Adelaide Clinical Human Research Ethics Committee

Ethics application approval

You are reminded that this letter constitutes ethical approval only. You must not commence this research project at a SA Health site until separate authorisation from the Chief Executive or delegate of that site has been obtained.

08 October 2013

Dear Professor Cobiac

This is a formal correspondence from the Southern Adelaide Clinical Human Research Ethics Committee (SAC HREC EC00188). This committee operates in accordance with the "National Statement on Ethical Conduct in Human Research (2007)." No hard copy correspondence will be issued.

Application Number: 366.13

Title: Knowledge, attitudes and behaviours related to diet and lifestyle in a population at above average risk of colorectal cancer

Chief investigator: Professor Lynne Cobiac

SA health site/s approved:
Flinders Medical Centre
Repatriation General Hospital

The Issue: The Southern Adelaide Clinical Human Research Ethics Committee (SAC HREC) have reviewed and approved the above application. The approval extends to the following documents/ changes:

SAC HREC general research application form V2.0 dated 02 October 2013. Cover letter dated 04 July 2013.
SA Health Indemnity provided by Steve Semmler, Insurance Officer 17 January 2013.
Patient information sheet and consent form V1.0 dated 09 July 2013
Letter of invitation V1.0 dated 09 July 2013.
Letter of reminder V2.0 dated 02 October 2013.
Socio-demographic questionnaire V2.0 dated 02 October 2013.
Australian Institute of Health and Welfare – Active Australia Survey V2.0 dated 02 October 2013.
Knowledge, attitudes and behaviours survey part one and part two V1.0 dated 09 July 2013.

Approval Period: 02 October 2013 to 01 October 2016

Please retain a copy of this approval for your records.

TERMS AND CONDITIONS OF ETHICAL APPROVAL
Final ethical approval is granted subject to the researcher agreeing to meet the following terms and conditions.

As part of the Institution's responsibilities in monitoring research and complying with audit requirements, it is essential that researchers adhere to the conditions below.

Researchers have a significant responsibility to comply with the *National Statement 5.5.* in providing the SAC HREC with the required information and reporting as detailed below:

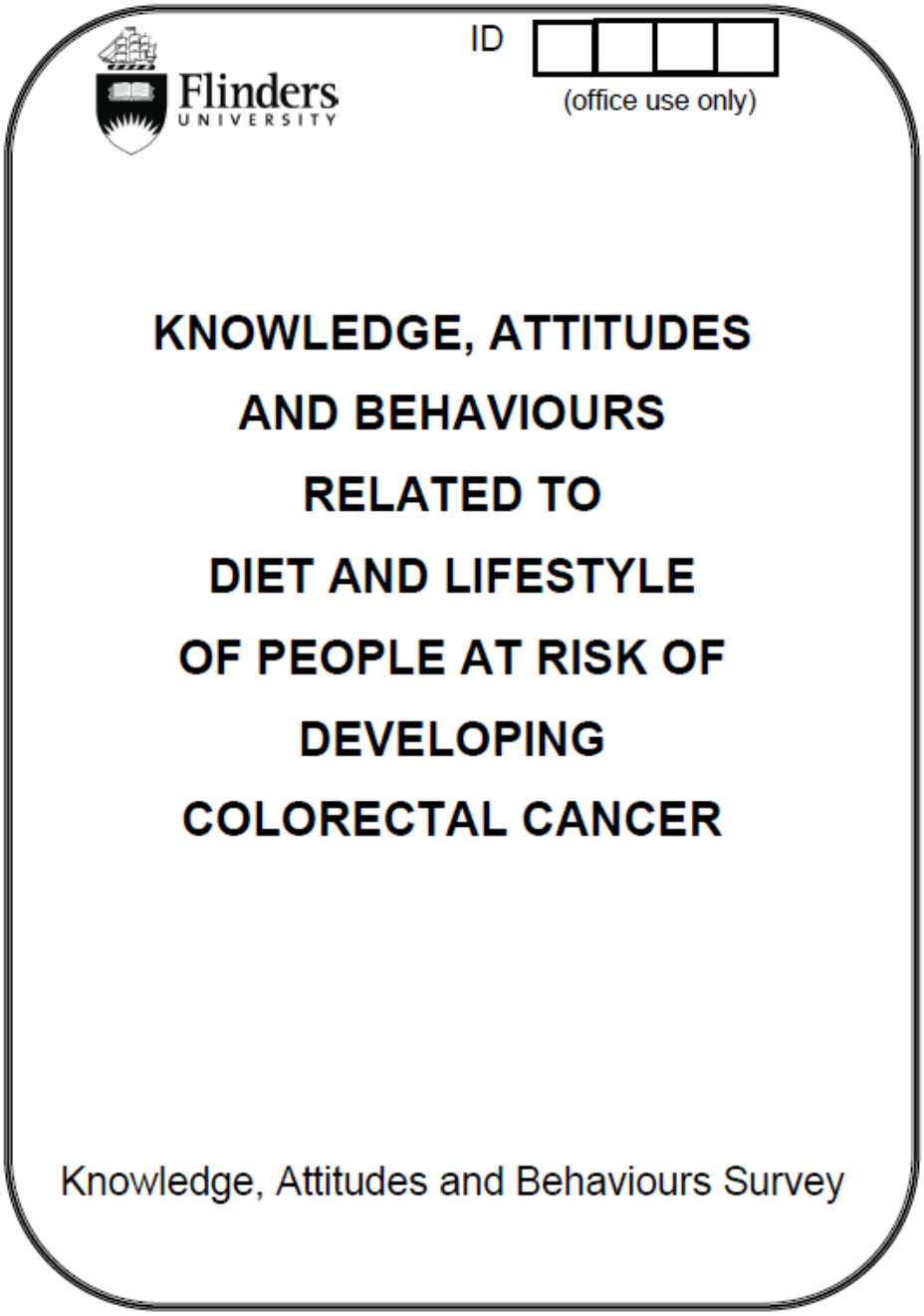
1. **The approval only covers the science and ethics component of the application.** A SSA will need to be submitted and authorised before this research project can commence at any of the SA Health sites identified in the application.
2. **Compliance** with the *National Statement on Ethical Conduct in Human Research* (2007) & the *Australian Code for the Responsible Conduct of Research* (2007).
3. To **immediately report to SAC HREC** anything that may change the ethical or scientific integrity of the project.
4. **Report Significant Adverse events (SAE's)** as per SAE requirements available at our website.
5. **Submit an annual report on each anniversary of the date of final approval** and in the correct template from the SAC HREC website.
6. **Confidentiality** of research participants MUST be maintained at all times.
7. A copy of the **signed consent form** must be given to the participant unless the project is an audit.
8. Any **reports or publications derived from the research** should be submitted to the Committee at the completion of the project.
9. All requests for **access to medical records** at any SAHS site must be accompanied by this approval email.
10. To **regularly review the SAC HREC website** and comply with all submission requirements, as they change from time to time.
11. The researchers agree to use **electronic format** for all correspondence with this department.

Kind Regards

Rhiannon Kitik
Administration Officer
SAC HREC

Flinders Medical Centre
The Flats G5 – Rooms 3 and 4
Flinders Drive,
Bedford Park SA 5042
T: 08 8204 6453 F: 08 8204 4586
E:Research.ethics
@health.sa.gov.au

Appendix H – The structure questionnaire on knowledge, attitude and behaviour (Flinders Survey)



This survey is divided into third main parts:

- The first section asks about general health related information
- The second section asks questions regarding your knowledge, attitudes and behaviours about dietary and lifestyle changes
- The third section asks questions about the foods you typically eat

Please read the instructions each section carefully before completing each of the questionnaires.

Sometimes a question may be asked in more than one way. This is because the questionnaires will be analysed separately. Please answer all the questions wherever possible.

Finally, please remember that we are interested in **YOUR** diet and opinion, not that of someone else in your household/residence.

If you have any questions relating to this study please contact:

Mrs Zalina Abu Zaid, PhD Nutrition and Dietetic Student, Flinders University 08 8204 7076

Dr Kathryn Jackson, Chief Supervisor, Nutrition and Dietetic Lecture, Flinders University 08 8204 6978

Professor Lynne Cobiac, Deputy Director, CSIRO Preventive Health Flagship, National Research Flagship 08 8303 8855

PART 1: General Information

We also require some general information about you. This information is important to allow us to assess whether people of different backgrounds have different food intakes and knowledge, attitudes and behaviours about diet and lifestyle changes in developing colorectal cancer.

Please fill in the blanks whenever needed and tick on the relevant boxes.

1.Name:	
2. Address:	
3. Contact no:	Mobile: Home phone: Work phone: Email address:
4. Date of birth: (dd/mm/yyyy)	
5. Age:	_____ years old
6. Gender:	☐ Male ☐ Female

7. Marital status:	☐ Married ☐ Single (never married) ☐ Other
8. Your highest education level:	
9. Occupation:	

10. Are you a …… (please tick one)

☐ Smoker

☐ Ex-smoker ----- *(please go straight to question 13)*

☐ Non-smoker ----- *(please go straight to question 16)*

11. If you currently smoke, how often do you smoke?

☐ Less than once a month ----- *(please go straight to question 16)*

☐ Once a month or more

12. If you currently smoke more than a month, how many cigarettes do you smoke?

☐ Cigarettes per day **OR**

☐ Cigarettes per week **OR** ----- *(please go straight to question 16)*

☐ Cigarettes per month

13. If you are ex-smoker, how many cigarettes did you smoke in the past? ☐ Cigarettes per day **OR** ☐ Cigarettes per week **OR** ☐ Cigarettes per month
14. When did you quit smoking? _____
15. Why did you quit smoking? _____
16. How tall are you (without shoes)? _____ cm
17. How much do you weigh (without shoes and in light clothings)? _____ kg

The next questions are about any <u>physical activities</u> that you may have done in the <u>last week</u>:

1. In the last week, how many times have you walked continuously, for at least 10 minutes, for recreation, exercise or to get to or from places?

   ☐☐ times

2. What do you estimate was the total time that you spent walking in this way in the last week?

In hours and/or minutes

☐☐☐ minutes

☐☐ hours

3. In the last week, how many times did you do any vigorous gardening or heavy work around the yard, which made you breathe harder or puff and pant?

☐☐ times

4. What do you estimate was the total time that you spent doing vigorous gardening or heavy work around the yard in the last week?

In hours and/or minutes

☐☐☐ minutes

☐☐ hours

The next questions exclude household chores, gardening or yard work:

5. In the last week, how many times did you do any vigorous physical activity which made you breathe harder or puff and pant? (e.g. jogging, cycling, aerobics, competitive tennis)

☐☐ times

6. What do you estimate was the total time that you spent doing this vigorous physical activity in the last week?

In hours and/or minutes

			minutes

		hours

7. In the last week, how many times did you do any other more moderate physical activities that you have not already mentioned? (e.g. gentle swimming, social tennis, golf)

		times

8. What do you estimate was the total time that you spent doing these activities in the last week?

In hours and/or minutes

			minutes

		hours

PART 2: Knowledge, attitude and behaviour about diet and lifestyle

This section is about your knowledge, attitudes and behaviours on diet and lifestyle changes in developing CRC.

Please circle the relevant number that indicate your knowledge related to specified diet and lifestyle factors on risk of colorectal cancer. Please answer all the questions yourself by circling the number that best applies to you. There are no 'right' or 'wrong' answers.

		Increases risk of CRC	Reduces risk of CRC	No effect	Don't know
1.	Being obese	1	2	3	4
2.	Being overweight	1	2	3	4
3.	Engage to regular physical activity	1	2	3	4
4.	Drinking alcohol	1	2	3	4
5.	Cigarette smoking	1	2	3	4
6.	Your overall diet	1	2	3	4
7.	Eating red and processed meat everyday	1	2	3	4
8.	Eating 2 serves of fruit and 5 serves of vegetables daily	1	2	3	4

9.	Low fibre intake	1	2	3	4
10.	High intake of dietary fat	1	2	3	4
11.	Dietary protein intake	1	2	3	4
12.	Dietary iron intake	1	2	3	4
13.	Dietary selenium intake	1	2	3	4
14.	Dietary folate intake	1	2	3	4
15.	Dietary calcium intake	1	2	3	4

The next questions are about your <u>attitudes</u> to dietary and lifestyle changes:

Please tick on the relevant boxes that best fits your answer:

1. What I eat is one of the most important things for my health.

☐ Agree

☐ Disagree

☐ Neither agree nor disagree

2. There are no barriers to me following a healthy diet.

☐ Agree

☐ Disagree

☐ Neither agree nor disagree

3. Healthy diet is boring

☐ Agree

☐ Disagree

☐ Neither agree nor disagree

4. I like eating a lot of fruit and vegetables.

☐ Agree

☐ Disagree

☐ Neither agree nor disagree

5. It is hard for me to buy fruit and vegetables where I live.

☐ Agree

☐ Disagree

☐ Neither agree nor disagree

6. I don't like eating a lot of high fat foods.

☐ Agree

☐ Disagree

☐ Neither agree nor disagree

7. My diet is already very healthy.

☐ Agree

☐ Disagree

☐ Neither agree nor disagree

8. I don't like to exercise.

☐ Agree

☐ Disagree

☐ Neither agree nor disagree

9. Exercise is tiring.

☐ Agree

☐ Disagree

☐ Neither agree nor disagree

10. It is hard to find a time to exercise.

☐ Agree

☐ Disagree

☐ Neither agree nor disagree

The next questions are about your <u>behaviours</u> to dietary and lifestyle changes:

Please tick on the relevant boxes and fill in the blank whenever needed that best fits your answer:

1. In the last year have you modified your dietary habits for fear of contracting CRC?

   ☐ YES ☐ NO *(Go to question 3)*

2. If YES, how you modified your dietary habits?

   _____

   _____

3. In the last year have you modified your physical activity for fear of contracting CRC?

   ☐ YES ☐ NO *(Go to question 5)*

4. If YES, how you modified your physical activity?

_____

_____

5. If you are a smoker, in the last year have you tried to quit smoking cigarette?

☐ YES ☐ NO *(Go to question 7)*

☐ NOT APPLICABLE/ I AM NOT A SMOKER *(Go to question 7)*

6. If YES, why?

_____

_____

7. If you consume alcohol drinks, in the last year have you reduced your alcohol consumption?

☐ YES ☐ NO

8. If YES, why?

_____

_____

9. Have you ever participated in nutrition health promotion activities on CRC?

☐ YES (which activity/ies_____
Organised by_____)

☐ NO

The next questions are information that you want to know about CRC :

1. From which of the following sources do you receive information about CRC? (**mark one or more**)

☐ None ☐ Scientific journals

☐ Mass-media (e.g. television, radio) ☐ Educational courses

☐ Physician, doctors ☐ Dietitians/Nutritionists

☐ Nurses ☐ Other

2. Do you feel you need information or any dietary and lifestyle advice about CRC?

☐ YES ☐ NO

3. If YES, how would you like to receive this advice? (**mark one or more**)

☐ Don't know	☐ Face to face
☐ Written information	☐ Medical centre
☐ Media	☐ Internet
☐ Other	

****

We realise that you had to give up some of your time to answer these questions. We appreciate your help.

Please remember to mail this survey along back to us in the pre-addressed envelope provided.

As we have previously mentioned, we wish to call you to speak to check/clarify information from your questionnaire

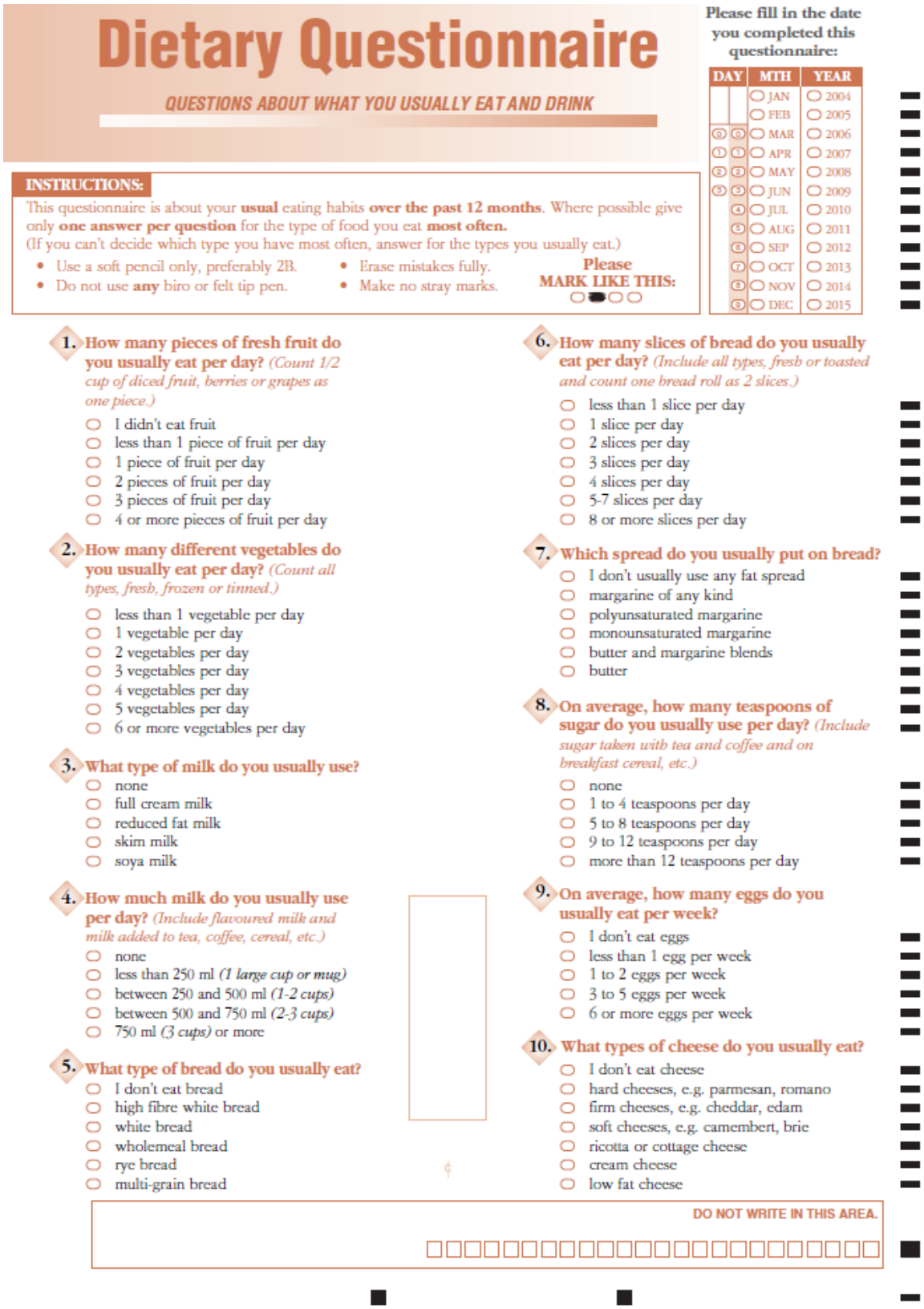
Preferred contact number: ___ ___ ___ ___ ___ ___ ___ ___ ___ ___

Preferred contact time (please tick available times):

☐	☐	☐	☐	☐	☐	☐
Anytime	9am-11am	11am-1pm	1pm-3pm	3pm-5pm	5pm-7pm	7pm-9pm
	(during work hours Mon-Fri)				(after work hours Mon-Fri)	

ID ☐☐☐☐
(office use only)

Appendix I – The validated Victorian Cancer Council Food Frequency Questionnaire—Dietary Questionnaire for Epidemiological Studies Version 2 (DQES v2)



Dietary Questionnaire

QUESTIONS ABOUT WHAT YOU USUALLY EAT AND DRINK

Please fill in the date you completed this questionnaire:

DAY	MTH	YEAR
	JAN	2004
	FEB	2005
0 0	MAR	2006
1 1	APR	2007
2 2	MAY	2008
3 3	JUN	2009
4	JUL	2010
5	AUG	2011
6	SEP	2012
7	OCT	2013
8	NOV	2014
9	DEC	2015

INSTRUCTIONS:

This questionnaire is about your **usual** eating habits **over the past 12 months**. Where possible give only **one answer per question** for the type of food you eat **most often.**
(If you can't decide which type you have most often, answer for the types you usually eat.)

- Use a soft pencil only, preferably 2B.
- Do not use **any** biro or felt tip pen.
- Erase mistakes fully.
- Make no stray marks.

Please MARK LIKE THIS: ○●○○

1. How many pieces of fresh fruit do you usually eat per day? *(Count 1/2 cup of diced fruit, berries or grapes as one piece.)*

- ○ I didn't eat fruit
- ○ less than 1 piece of fruit per day
- ○ 1 piece of fruit per day
- ○ 2 pieces of fruit per day
- ○ 3 pieces of fruit per day
- ○ 4 or more pieces of fruit per day

2. How many different vegetables do you usually eat per day? *(Count all types, fresh, frozen or tinned.)*

- ○ less than 1 vegetable per day
- ○ 1 vegetable per day
- ○ 2 vegetables per day
- ○ 3 vegetables per day
- ○ 4 vegetables per day
- ○ 5 vegetables per day
- ○ 6 or more vegetables per day

3. What type of milk do you usually use?

- ○ none
- ○ full cream milk
- ○ reduced fat milk
- ○ skim milk
- ○ soya milk

4. How much milk do you usually use per day? *(Include flavoured milk and milk added to tea, coffee, cereal, etc.)*

- ○ none
- ○ less than 250 ml *(1 large cup or mug)*
- ○ between 250 and 500 ml *(1-2 cups)*
- ○ between 500 and 750 ml *(2-3 cups)*
- ○ 750 ml *(3 cups)* or more

5. What type of bread do you usually eat?

- ○ I don't eat bread
- ○ high fibre white bread
- ○ white bread
- ○ wholemeal bread
- ○ rye bread
- ○ multi-grain bread

6. How many slices of bread do you usually eat per day? *(Include all types, fresh or toasted and count one bread roll as 2 slices.)*

- ○ less than 1 slice per day
- ○ 1 slice per day
- ○ 2 slices per day
- ○ 3 slices per day
- ○ 4 slices per day
- ○ 5-7 slices per day
- ○ 8 or more slices per day

7. Which spread do you usually put on bread?

- ○ I don't usually use any fat spread
- ○ margarine of any kind
- ○ polyunsaturated margarine
- ○ monounsaturated margarine
- ○ butter and margarine blends
- ○ butter

8. On average, how many teaspoons of sugar do you usually use per day? *(Include sugar taken with tea and coffee and on breakfast cereal, etc.)*

- ○ none
- ○ 1 to 4 teaspoons per day
- ○ 5 to 8 teaspoons per day
- ○ 9 to 12 teaspoons per day
- ○ more than 12 teaspoons per day

9. On average, how many eggs do you usually eat per week?

- ○ I don't eat eggs
- ○ less than 1 egg per week
- ○ 1 to 2 eggs per week
- ○ 3 to 5 eggs per week
- ○ 6 or more eggs per week

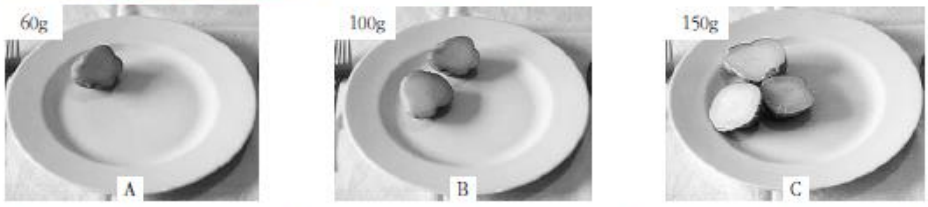
10. What types of cheese do you usually eat?

- ○ I don't eat cheese
- ○ hard cheeses, e.g. parmesan, romano
- ○ firm cheeses, e.g. cheddar, edam
- ○ soft cheeses, e.g. camembert, brie
- ○ ricotta or cottage cheese
- ○ cream cheese
- ○ low fat cheese

DO NOT WRITE IN THIS AREA.

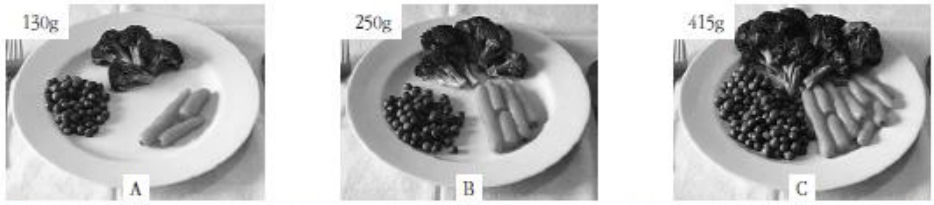
For each food shown on this page, indicate ***how much on average you would usually have eaten at main meals during the past 12 months.*** *When answering each question, think of the* ***amount*** *of that food you usually ate, even though you may rarely have eaten the food on its own.*
If you usually ate more than one helping, fill in the oval for the serving size closest to the ***total amount*** *you ate.*

11. When you ate potato, did you usually eat: ○ I never ate potato



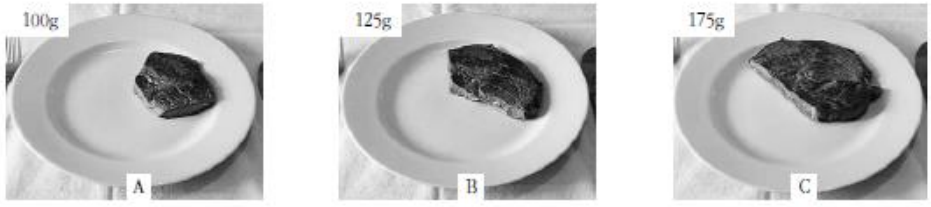
○ Less than A ○ A ○ Between A & B ○ B ○ Between B & C ○ C ○ More than C

12. When you ate vegetables, did you usually eat: ○ I never ate vegetables



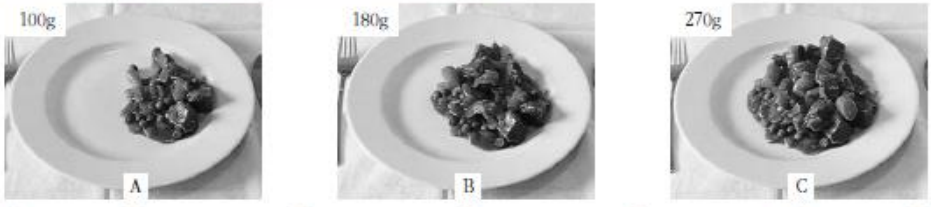
○ Less than A ○ A ○ Between A & B ○ B ○ Between B & C ○ C ○ More than C

13. When you ate steak, did you usually eat: ○ I never ate steak



○ Less than A ○ A ○ Between A & B ○ B ○ Between B & C ○ C ○ More than C

14. When you ate meat *or* vegetable casserole, did you usually eat: ○ I never ate casserole



○ Less than A ○ A ○ Between A & B ○ B ○ Between B & C ○ C ○ More than C

15. **Over the last 12 months, on average, *how often* did you eat the following foods?** *Please completely fill one oval in every line.* Please MARK LIKE THIS: ○●○○ NOT LIKE THIS: ✔ ✘ ⊖ ◯

Times You Have Eaten		NEVER	less than once	1 to 3 times	1 time	2 times	3 to 4 times	5 to 6 times	1 time	2 times	3 or more times
			per month		per week				per day		
CEREAL FOODS, SWEETS & SNACKS											
All Bran™	A1	○	○	○	○	○	○	○	○	○	○
Sultana Bran™, FibrePlus™, Branflakes™	A2	○	○	○	○	○	○	○	○	○	○
Weet Bix™, Vita Brits™, Weeties™	A3	○	○	○	○	○	○	○	○	○	○
Cornflakes, Nutrigrain™, Special K™	A4	○	○	○	○	○	○	○	○	○	○
Porridge	A5	○	○	○	○	○	○	○	○	○	○
Muesli	A6	○	○	○	○	○	○	○	○	○	○
Rice	A7	○	○	○	○	○	○	○	○	○	○
Pasta or noodles (include lasagne)	A8	○	○	○	○	○	○	○	○	○	○
Crackers, crispbreads, dry biscuits	A9	○	○	○	○	○	○	○	○	○	○
Sweet biscuits	A10	○	○	○	○	○	○	○	○	○	○
Cakes, sweet pies, tarts and other sweet pastries	A11	○	○	○	○	○	○	○	○	○	○
Meat pies, pasties, quiche and other savoury pastries	A12	○	○	○	○	○	○	○	○	○	○
Pizza	A13	○	○	○	○	○	○	○	○	○	○
Hamburger with a bun	A14	○	○	○	○	○	○	○	○	○	○
Chocolate	A15	○	○	○	○	○	○	○	○	○	○
Flavoured milk drink (cocoa, Milo™, etc.)	A16	○	○	○	○	○	○	○	○	○	○
Nuts	A17	○	○	○	○	○	○	○	○	○	○
Peanut butter or peanut paste	A18	○	○	○	○	○	○	○	○	○	○
Corn chips, potato crisps, Twisties™, etc.	A19	○	○	○	○	○	○	○	○	○	○
Jam, marmalade, honey or syrups	A20	○	○	○	○	○	○	○	○	○	○
Vegemite™, Marmite™ or Promite™	A21	○	○	○	○	○	○	○	○	○	○
DAIRY PRODUCTS, MEAT & FISH											
Cheese	B1	○	○	○	○	○	○	○	○	○	○
Ice-cream	B2	○	○	○	○	○	○	○	○	○	○
Yoghurt	B3	○	○	○	○	○	○	○	○	○	○
Beef	B4	○	○	○	○	○	○	○	○	○	○
Veal	B5	○	○	○	○	○	○	○	○	○	○
Chicken	B6	○	○	○	○	○	○	○	○	○	○
Lamb	B7	○	○	○	○	○	○	○	○	○	○
Pork	B8	○	○	○	○	○	○	○	○	○	○
Bacon	B9	○	○	○	○	○	○	○	○	○	○
Ham	B10	○	○	○	○	○	○	○	○	○	○
Corned beef, luncheon meats or salami	B11	○	○	○	○	○	○	○	○	○	○
Sausages or frankfurters	B12	○	○	○	○	○	○	○	○	○	○
Fish, steamed, grilled or baked	B13	○	○	○	○	○	○	○	○	○	○
Fish, fried (include take-away)	B14	○	○	○	○	○	○	○	○	○	○
Fish, tinned (salmon, tuna, sardines, etc.)	B15	○	○	○	○	○	○	○	○	○	○
FRUIT											
Tinned or frozen fruit (any kind)	C1	○	○	○	○	○	○	○	○	○	○
Fruit juice	C2	○	○	○	○	○	○	○	○	○	○
Oranges or other citrus fruit	C3	○	○	○	○	○	○	○	○	○	○
Apples	C4	○	○	○	○	○	○	○	○	○	○
Pears	C5	○	○	○	○	○	○	○	○	○	○
Bananas	C6	○	○	○	○	○	○	○	○	○	○
Watermelon, rockmelon (cantaloupe), honeydew, etc.	C7	○	○	○	○	○	○	○	○	○	○
Pineapple	C8	○	○	○	○	○	○	○	○	○	○
Strawberries	C9	○	○	○	○	○	○	○	○	○	○
Apricots	C10	○	○	○	○	○	○	○	○	○	○
Peaches or nectarines	C11	○	○	○	○	○	○	○	○	○	○
Mango or paw paw	C12	○	○	○	○	○	○	○	○	○	○
Avocado	C13	○	○	○	○	○	○	○	○	○	○

Times You Have Eaten CONTINUED

		NEVER	less than once per month	1 to 3 times per month	1 time per week	2 times per week	3 to 4 times per week	5 to 6 times per week	1 time per day	2 times per day	3 or more times per day
VEGETABLES (INCLUDING FRESH, FROZEN AND TINNED)											
Potatoes, roasted or fried (include hot chips)	D1	○	○	○	○	○	○	○	○	○	○
Potatoes cooked without fat	D2	○	○	○	○	○	○	○	○	○	○
Tomato sauce, tomato paste or dried tomatoes	D3	○	○	○	○	○	○	○	○	○	○
Fresh or tinned tomatoes	D4	○	○	○	○	○	○	○	○	○	○
Peppers (capsicum)	D5	○	○	○	○	○	○	○	○	○	○
Lettuce, endive, or other salad greens	D6	○	○	○	○	○	○	○	○	○	○
Cucumber	D7	○	○	○	○	○	○	○	○	○	○
Celery	D8	○	○	○	○	○	○	○	○	○	○
Beetroot	D9	○	○	○	○	○	○	○	○	○	○
Carrots	D10	○	○	○	○	○	○	○	○	○	○
Cabbage or Brussels sprouts	D11	○	○	○	○	○	○	○	○	○	○
Cauliflower	D12	○	○	○	○	○	○	○	○	○	○
Broccoli	D13	○	○	○	○	○	○	○	○	○	○
Silverbeet or spinach	D14	○	○	○	○	○	○	○	○	○	○
Peas	D15	○	○	○	○	○	○	○	○	○	○
Green beans	D16	○	○	○	○	○	○	○	○	○	○
Bean sprouts or alfalfa sprouts	D17	○	○	○	○	○	○	○	○	○	○
Baked beans	D18	○	○	○	○	○	○	○	○	○	○
Soy beans, soy bean curd or tofu	D19	○	○	○	○	○	○	○	○	○	○
Other beans (include chick peas, lentils, etc.)	D20	○	○	○	○	○	○	○	○	○	○
Pumpkin	D21	○	○	○	○	○	○	○	○	○	○
Onion or leeks	D22	○	○	○	○	○	○	○	○	○	○
Garlic (not garlic tablets)	D23	○	○	○	○	○	○	○	○	○	○
Mushrooms	D24	○	○	○	○	○	○	○	○	○	○
Zucchini	D25	○	○	○	○	○	○	○	○	○	○

16. Over the last 12 months, how often did you drink beer, wine and/or spirits?

Times That You Drank

		NEVER	less than once a month	1-3 days per month	1 day per week	2 days per week	3 days per week	4 days per week	5 days per week	6 days per week	every day
Beer (low alcohol)	1	○	○	○	○	○	○	○	○	○	○
Beer (full strength)	2	○	○	○	○	○	○	○	○	○	○
Red wine	3	○	○	○	○	○	○	○	○	○	○
White wine (include sparkling wines)	4	○	○	○	○	○	○	○	○	○	○
Fortified wines, port, sherry, etc.	5	○	○	○	○	○	○	○	○	○	○
Spirits, liqueurs, etc.	6	○	○	○	○	○	○	○	○	○	○

When answering the next two questions, please convert the amounts you drank into glasses using the examples given below. For spirits, liqueurs, and mixed drinks containing spirits, please count each nip (30 ml) as one glass.

1 can or stubby of beer = 2 glasses
1 large bottle beer (750 ml) = 4 glasses
1 bottle wine (750 ml) = 6 glasses
1 bottle of port or sherry (750 ml) = 12 glasses

17. Over the last 12 months, on days when you were drinking, how many glasses of beer, wine and/or spirits altogether did you *usually* drink?

TOTAL NUMBER OF GLASSES PER DAY	1	2	3	4	5	6	7	8	9	10 or more
	○	○	○	○	○	○	○	○	○	○

18. Over the last 12 months, what was the *maximum* number of glasses of beer, wine and/or spirits that you drank in 24 hours?

MAXIMUM NUMBER OF GLASSES PER 24 HOURS	1-2	3-4	5-6	7-8	9-10	11-12	13-14	15-16	17-18	19 or more
	○	○	○	○	○	○	○	○	○	○

Thank You for completing this questionnaire

DO NOT WRITE IN THIS AREA.

□□□□□□□□□□□□□□□□□□□□□□□□□

Appendix J – Participant information sheet (Newcastle Study)

Professor Rodney Scott
Head of Discipline of Medical Genetics
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rodney.scott@newcastle.edu.au

Invitation to participate in the research project: Environmental factors and colon cancer

(Version 3 18-05-2011)

You are invited to participate in the research project *"Environmental factors and colon cancer"* a collaborative project conducted by the *CSIRO* Preventative Health National Research Flagship and *The University of Newcastle* School of Biomedical Sciences.

Pathology North (Hunter)
Locked Bag No. 1
Hunter Region Mail Centre NSW 2310
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Facsimile: +61 2 4921 4440
www.haps.nsw.gov.au
ABN 24 500 842 605

Participant information for the research project: Environmental factors and risk of colon cancer

(Version 3 18-05-2011)

About the investigators:

Principal Investigator:

- Professor Rodney Scott Professor of Genetics, University of Newcastle. Hunter Area Pathology Service, John Hunter Hospital, Lookout Rd, 2305 NSW.

Associate Researchers:

- Dr Desma Grice Postdoctoral Research Fellow, Genomics Program, Division of Food and Nutritional Sciences, Preventative Health National Research Flagship, CSIRO. Hunter Medical Research Institute University of Newcastle, Callaghan, 2308 NSW.
- Dr Garry Hannan Team Leader, Genomics Program, Division of Food and Nutritional Sciences and Project Leader, Preventative Health National Research Flagship, CSIRO. Riverside Life Sciences Centre, 11 Julius Avenue, North Ryde, 2113 NSW.
- Dr Konsta Duesing Research Scientist, Genomics Program, Division of Food and Nutritional Sciences, Preventative Health National Research Flagship, CSIRO. Riverside Life Sciences Centre, 11 Julius Avenue, North Ryde, 2113 NSW.

About the project

Project title:

Environmental factors and colon cancer

Project description and aim: Why is the research being done?

Colorectal (bowel) cancer is the second most common cancer in the Australian community and remains a major public health concern. Previous research has identified a range of environmental factors including diet, excess energy consumption, sedentary lifestyles, potentially even stress and the presence of some bacteria in the gut can be risk factors for colon cancer. The mechanism by which these environmental factors influence colon cancer is yet to be determined.

The aim of this research project is to recruit 500 study participants to investigate the role of each environmental factor in colon cancer.

This study is a joint project between The University of Newcastle and the CSIRO bringing together unique skills and molecular technologies to the investigation of environmental factors in colon cancer. Outcomes from this research may benefit the Australian community through the identification of risk profiles for colon cancer.

Who can participate in this research?

- We are inviting individuals diagnosed with colorectal cancer, scheduled to undergo surgery for tumour removal at the John Hunter Hospital or Newcastle Private Hospital, to participate in this research.

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What choice do you have?

- Participation in this study is *voluntary* and is entirely *your choice*. Only those people who give their *informed consent* will be included in the project. Whether or not you decide to participate, your decision will not disadvantage you in any way and will not affect your treatment and care.
- Participants who would like to discuss any of the information provided in this handout, would like additional information or have any questions can contact Desma Grice (CIBM, Hunter Medical Research Institute, University of Newcastle, Callaghan, NSW T+ 61 02 40420318 desma.grice@csiro.au)
- If you do decide to participate, you may withdraw from the project at any time without giving a reason. If you decide to withdraw from this project please contact Desma Grice (contact details listed above).
- If you become distressed when completing any of the surveys in this study we recommend you contact the Cancer Council NSW Helpline 13 11 20 or Lifeline Newcastle & Hunter 13 1114 independent support services.

What would you be asked to do?

If you agree to participate in this study:

Prior to surgery:

You will be asked to complete:

- A *consent form*. This is an essential requirement for your participation in this study. A signed consent from confirms your willingness to proceed and provides consent for the researchers access your medical records to obtain information from your medical records as necessary for the research.

A booklet of questions about your environment containing a:

- A *general questionnaire* about your medical history, family history and lifestyle which should take approximately 15 mins.
- A *food frequency questionnaire* about what you usually eat and drink which should take approximately 40 minutes.
- A *perceived stress questionnaire*. It contains questions to measure your perceived stress levels which should take approximately 10 min.
- A *physical activity questionnaire*. This will ask you questions about the time you spent being physically active over an average 7 day period in the past year which should take approximately 15 mins.

On the day of your surgery:

- As part of the regular surgery procedures, a nurse will collect a blood sample. The blood sample is for tests relating to your surgery and if participating in this study you will be asked to allow the nurse to collect an additional 40 mL sample (2 tablespoons) at the time for use in this study.

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- At the time of your surgery, again as part of the normal surgical procedure, the colon tumour is removed along with some surrounding normal colon tissue and fat tissue. Some of this tissue is used for diagnostic purposes. If you agree to participate in this study you will be asked to allow us to analyse some of this excess tissue plus any microbes that may be present in the tissues.

The collected tissue ***will not*** *be additional* to what is removed during surgery and collection of tissue samples ***will not*** *interfere* with diagnostic or therapeutic treatment.

What are the risks and benefits of participating?

- There are no additional risks to you from the collection of blood samples, as they will be collected at the same time as blood is collected for diagnostic purposes.
- There are no additional risks or post surgical discomforts from the collection of tissue samples. Samples will be collected from tissue removed at the time of your surgery, this is a normal part of your surgical procedure and will not be additional to what is removed during surgery.
- There are no direct benefits, financial or otherwise, to you associated with this study. However, there may be future benefits to the community by your participation in this study.

How will the information be used?

Results of specific or scientific significance may be published or communicated in the scientific or popular press. If the results of this study are published no reference will be made to individual participants.

How will your privacy be protected?

- Participant's personal information will be accessed, used and stored in accordance with Commonwealth Privacy Laws and the NSW Health Records and Information Privacy Act 2002.
- Participant's blood samples will be accessed, managed, used and stored in accordance with the NSW Human Tissue Act 1983.
- All records containing personal information will remain confidential and no information that could lead to your identification will be released.
- Participant information will be assigned a coded number by a member of the research team. This information will be stored in a separate database only accessible to members of the research team.
- The code and not your name will be used for all data analysis. Members of the research team will not be able to associate the specific number with your name.
- If you have consented to be contacted for participation in additional follow up studies, we will contact to ask you consent for participation.

When will the research project cease?

- The proposed research has funding for three years and additional funding with be sought through the duration of the project.
- Tissue samples and records will be destroyed at the cessation of the project or after 15 years.

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Project Funding

- This project is funded by an internal competitive grant at the CSIRO (The OCE post doctoral fellowship program).
- None of the members of the research team have any competing interests to declare.
- It is possible that this research may result in a commercial application for the identification of risk factors associated with colorectal cancer.

What are the ethical guidelines for this study?

- This project will be carried out according to the *National Statement on Ethical Conduct in Humans Research* (March 2007, with 2009 updates) developed jointly by the National Health and Medical Research Council of Australia and the Australian Research Council. This statement has been developed to protect the interests of people who agree to participate in human research studies.
- The ethical aspects of this research project have been approved by the Hunter New England Human Research Ethics Committee (EC00403) and the reference number AU-1-B2D8015.

Complaints about this research

- Should you have concerns about your rights as a participant in this research, or you have a complaint about the manner in which the research is conducted, it may be given to the researcher, or, if an independent person if preferred, to Dr Nicole Gerrand, Manager Research Ethics and Governance, Hunter New England Human Research Ethics Committee, Hunter New England Local Health Network, Locked Bag 1, New Lambton NSW 2305, telephone (02) 49214950, e-mail Hnehrec@hnehealth.nsw.gov.au

What do you need to do to participate?

- Please read this information handout and be sure you understand its contents before you consent to participate. If there is anything you do not understand, or you have questions, contact Desma Grice as indicated previously.
- If you would like to participate, please complete the attached consent form and general questionnaire and return it in the reply paid envelope provided or on the day of your surgery.

We will mail you the food frequency, physical activity and perceived stress questionnaire. These surveys can be completed and returned in the reply paid envelope or returned on the day of your surgery

Thank you for considering this invitation

Professor Rodney Scott
Head of Discipline of Medical Genetics, School of Biomedical Sciences

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Appendix K – Consent form (Newcastle Study)

Pathology North

HUNTER NEW ENGLAND
NORTH COAST
NORTHERN SYDNEY
CENTRAL COAST
NSW HEALTH

HAPS MNCPS PaLMS Pathology New England

Professor Rodney Scott
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Consent form to participate in the research project: Environmental factors and colon cancer (Version 2 2-05-2011)

In giving consent I agree to all aspects of the study as set out below.

I confirm that I have read and understood the participant information for the above study, have had the opportunity to ask any questions to my satisfaction and agree to complete the questionnaires required for this study..

I understand that study participation is voluntary and I am free to withdraw at any time with no consequences.

As described in the participant information, I consent to:

- *the **collection** and **storage** of a small sample of my blood.*
- *the **collection** and **storage** of excess tissue removed during surgery as part of the normal surgical procedure not required diagnostic purposes.*
- *the **extraction**, **storage** and **analysis** of DNA, RNA, protein, nutritional biomarkers and gut microbes.*
- *the **storage** and **analysis** of information provided in general, food frequency, physical activity and perceived stress questionnaires.*
- *to primary members of the investigative research team reviewing medical notes for information relevant to the study.*

I understand that samples and information collected during this study will be stored until the end of the study or for 15 years, whichever comes first, after which time they will be destroyed.

I understand that my personal information will remain confidential to the researchers.

I understand that no data or materials will be used for purposes other than that specified above.

Pathology North (Hunter)
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Hunter Region Mail Centre NSW 2310
Telephone: +61 2 4921 4444
Facsimile: +61 2 4921 4440
www.haps.nsw.gov.au
ABN 24 500 842 605

Name of Participant:..... Date:.....

Participant signature.....

Name of witness:..... Date:.....

Witness signature.....

I consent to being contacted to participate in follow-up studies that have the potential to benefit myself or the community.

Name of Participant:..... Date:.....

Participant signature.....

Name of witness:..... Date:.....

Witness signature.....

Appendix L – Questionnaire booklet for the research study: Environmental factors and colon cancer (Newcastle Study)

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Questionnaire Booklet for the Research Study: Environmental factors and colon cancer (Version 5 18-07-2012)

Date completed: .....day .....month .....year

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Table of Contents

This booklet contains six questionnaires:

1. Preliminary
2. Self Evaluation - how you felt over the last month
3. Self Evaluation - how you feel right now
4. Self Evaluation - how you generally feel
5. Physical Activity
6. Food Frequency

Please complete the questionnaires leaving no questions blank.

Part 1

Preliminary Questionnaire

Preliminary Questionnaire

In this form, we ask general questions about your health and some information about yourself. The information collected from this form is kept strictly confidential with only members of the research team having access to the locked study database.

DEMOGRAPHIC INFORMATION

Dr/Mr/Mrs/Miss/Ms.....

Surname Given Names

☐Male
☐Female

Address: .....

.....**Post code**.....

e-mail.....

Contact numbers - we may need to contact you by telephone. Please fill in your telephone numbers. Please tick (✓) the number at which we are most likely to contact you from Monday to Friday between 9-5pm.

☐ . . . . . Work ☐ . . . . . Mobile
☐ . . . . . Home

Emergency Contact. . . . . Name and relationship. . . . . .

Age - What is your age in years . . . . . .

Date of birth - What is your date of birth? . . . . . Day . . . . . Month . . . . . Year

Height - please indicate your height . . . . . cm **BMI** ..... *(Office use only)*

Weight - What is your weight? . . . . . Kg

Waist Circumference – What is the circumference of your waist.....cm

Usual occupation - if retired/not working please state previous occupation ....

Are you currently in any other research studies? Yes / No

If yes to the above question please list the most recent studies participated in below

Year	Study

MEDICAL INFORMATION

Do you take any medications (prescribed or over the counter)? Yes / No

If yes, list all medications taken **regularly**. Please check medication labels if necessary

Medication	Dose (eg 25mg)	How Often (eg twice daily)	Condition being treated

Which of the following **medical conditions** has been diagnosed by a **doctor**? Please tick (✓) all appropriate boxes

☐ High blood pressure	☐ Arthritis	☐ Gout	☐ Epilepsy
☐ Kidney or Liver disease	☐ Angina	☐ Hepatitis A/B/C	☐ HIV
☐ Pernicious anaemia	☐ Stroke	☐ Asthma	☐ Cancer
☐ High Cholesterol	☐ Thyroid	☐ Heart disease	☐ Migraine
☐ Inflammatory bowel disease	☐ Ulcerative colitis	☐ Chron's disease	☐ Metabolic disorder
☐ Celiac disease	☐ Autoimmune disease		

Do you have Type 1 diabetes Yes / No

Do you have Type 2 diabetes Yes / No

Other Medical Condition.....

Please list any known allergies.....

.....

If you've had **major surgery** please give details **and indicate year if known**.....

.....

Some of these conditions may interfere with study outcomes.

How many colonoscopies had you had **prior to your diagnosis** of colon cancer? .....

Women Only
Are you pregnant or planning to become pregnant in the next few months? Yes / No

How many times have you previously been pregnant?

Are you post menopausal? Yes / No

If yes, do you take HRT (Hormone replacement therapy) Yes / No
If taking HRT please make sure you have recorded it on the medication section.

Specific questions about cancer
A. Have any of your first degree relatives (parents, brothers, sisters, children) been diagnosed with cancer?

Please list them together with cancer type e.g. Brother, lung cancer

.....

.....

B. Have you ever been diagnosed with cancer, other than colon? Yes / No

Type:..... When diagnosed:.....

Currently undergoing treatment: Yes / No In remission: Yes / No

FAMILY HISTORY

Do any of your first degree relatives have colorectal cancer?.....

Do any of your first degree relatives have diabetes?.....

Are any of your first degree relatives overweight or obese?.....

What year was your Mother born?.....

What year was your Father born?.....

This is the end of the preliminary questionnaire, thank you for participating.
Please proceed to the next section.

Part 2

Self Evaluation Questionnaires

Self Evaluation (1) - over last month

The questions in this scale ask you about your feelings and thoughts **during the last month**. In each case, you will be asked to indicate by circling *how often* you felt or thought a certain way.

Name _____ Date _____

Age _____ Gender (*Circle*): **M F** Other _____

0 = Never 1 = Almost Never 2 = Sometimes 3 = Fairly Often 4 = Very Often

1. In the last month, how often have you been upset because of something that happened unexpectedly?	0	1	2	3	4
2. In the last month, how often have you felt that you were unable to control the important things in your life?	0	1	2	3	4
3. In the last month, how often have you felt nervous and "stressed"?	0	1	2	3	4
4. In the last month, how often have you felt confident about your ability to handle your personal problems?	0	1	2	3	4
5. In the last month, how often have you felt that things were going your way?	0	1	2	3	4
6. In the last month, how often have you found that you could not cope with all the things that you had to do?	0	1	2	3	4
7. In the last month, how often have you been able to control irritations in your life?	0	1	2	3	4
8. In the last month, how often have you felt that you were on top of things?	0	1	2	3	4
9. In the last month, how often have you been angered because of things that were outside of your control?	0	1	2	3	4
10. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?	0	1	2	3	4

ID:_____

Self Evaluation (2) – how you feel right now

A number of statements which people have used to describe themselves are given below. Please read each statement and then circle the number to the right of the statement to indicate how you **feel right now, at this moment**. There are **no** right or wrong answers. Don't spend too much time on any one statement but give the answer which seems to describe your **present feelings** best.

	Not at all	Somewhat	Moderately so	Very much so
1. Right now I feel calm	1	2	3	4
2. Right now I am tense	1	2	3	4
3. Right now I feel upset	1	2	3	4
4. Right now I am relaxed	1	2	3	4
5. Right now I feel content	1	2	3	4
6. Right now I am worried	1	2	3	4

ID:_____

Self Evaluation (3) – how you generally feel

A number of statements which people have used to describe themselves are given below. Please read each statement and then circle the number to the right of the statement to indicate how you **generally** feel. There are **no** right or wrong answers. Don't spend too much time on any one statement but give the answer which seems to describe how you **generally** feel.

		Almost never	Sometimes	Often	Almost always
1.	I feel pleasant	1	2	3	4
2.	I feel nervous and restless	1	2	3	4
3.	I feel satisfied with myself	1	2	3	4
4.	I wish I could be as happy as others seem to be	1	2	3	4
5.	I feel like a failure	1	2	3	4
6.	I feel rested	1	2	3	4
7.	I am "calm, cool and collected"	1	2	3	4
8.	I feel that difficulties are piling up so that I cannot overcome them	1	2	3	4
9.	I worry too much over something that really doesn't matter	1	2	3	4
10.	I am happy	1	2	3	4
11.	I have disturbing thoughts	1	2	3	4
12.	I lack self-confidence	1	2	3	4
13.	I feel secure	1	2	3	4
14.	I make decisions easily	1	2	3	4
15.	I feel inadequate	1	2	3	4
16.	I am content	1	2	3	4
17.	Some unimportant thought runs through my mind and bothers me	1	2	3	4
18.	I take disappointments so keenly that I can't put them out of my mind	1	2	3	4
19.	I am a steady person	1	2	3	4
20.	I get in a state of tension or turmoil as I think over my recent concerns and interests	1	2	3	4

This is the end of the self-evaluation questionnaires. Thank you for participating.
Please proceed to the next section.

8c

Part 3

Physical Activity Questionnaire

INTERNATIONAL PHYSICAL ACTIVITY QUESTIONNAIRE

We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. The questions will ask you about the time you spent being physically active in the **last 12 months** in an average **7 day period**. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

Think about all the **vigorous** and **moderate** activities that you did in the **last 12 months** in an average **7 day period**. **Vigorous** physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. **Moderate** activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal.

PART 1: JOB-RELATED PHYSICAL ACTIVITY

The first section is about your work. This includes paid jobs, farming, volunteer work, course work, and any other unpaid work that you did outside your home. Do not include unpaid work you might do around your home, like housework, yard work, general maintenance, and caring for your family. These are asked in Part 3.

1. Do you currently have a job or do any unpaid work outside your home?

   ☐ Yes

   ☐ No ▶ ***Skip to PART 2: TRANSPORTATION***

The next questions are about all the physical activity you did in the **last 12 months** in an average **7 day period** as part of your paid or unpaid work. This does not include traveling to and from work.

2. During the **last 12 months** in an average **7 day period**, on how many days would you do **vigorous** physical activities like heavy lifting, digging, heavy construction, or climbing up stairs **as part of your work**? Think about only those physical activities that you did for at least 10 minutes at a time.

   _____ **days per week**

   ☐ No vigorous job-related physical activity ▶ ***Skip to question 4***

3. How much time did you usually spend on one of those days doing **vigorous** physical activities as part of your work?

   _____ **hours per day**
   _____ **minutes per day**

4. Again, think about only those physical activities that you did for at least 10 minutes at a time. During the **last 12 months** in an average **7 day period**, on how many days would you do **moderate** physical activities like carrying light loads **as part of your work**? Please do not include walking.

   _____ **days per week**

   ☐ No moderate job-related physical activity ▶ ***Skip to question 6***

5. How much time did you usually spend on one of those days doing **moderate** physical activities as part of your work?

_____ hours per day _____ minutes per day

6. During the **last 12 months** in an average **7 day period**, on how many days would you **walk** for at least 10 minutes at a time **as part of your work**? Please do not count any walking you did to travel to or from work.

_____ days per week

☐ No job-related walking ▶ ***Skip to PART 2: TRANSPORTATION***

7. How much time did you usually spend on one of those days **walking** as part of your work?

_____ hours per day _____ minutes per day

PART 2: TRANSPORTATION PHYSICAL ACTIVITY

These questions are about how you traveled from place to place, including to places like work, stores, movies, and so on.

8. During the **last 12 months** in an average **7 day period**, on how many days would you **travel in a motor vehicle** like a train, bus, car, or tram?

_____ days per week

☐ No traveling in a motor vehicle ▶ ***Skip to question 10***

9. How much time did you usually spend on one of those days **traveling** in a train, bus, car, tram, or other kind of motor vehicle?

_____ hours per day _____ minutes per day

Now think only about the **bicycling** and **walking** you might have done to travel to and from work, to do errands, or to go from place to place.

10. During the **last 12 months** in an average **7 day period**, on how many days would you **bicycle** for at least 10 minutes at a time to go **from place to place**?

_____ days per week

☐ No bicycling from place to place ▶ ***Skip to question 12***

11. How much time did you usually spend on one of those days to **bicycle** from place to place?

_____ hours per day _____ minutes per day

12. During the **last 12 months** in an average **7 day period**, on how many days did you **walk** for at least 10 minutes at a time to go **from place to place**?

_____ days per week

☐ No walking from place to place ▶ ***Skip to PART 3***

13. How much time did you usually spend on one of those days **walking** from place to place?

_____ hours per day _____ minutes per day

PART 3: HOUSEWORK, HOUSE MAINTENANCE, AND CARING FOR FAMILY

This section is about some of the physical activities you might have done in the **last 12 months** in an average **7 day period** in and around your home, like housework, gardening, yard work, general maintenance work, and caring for your family.

14. Think about only those physical activities that you did for at least 10 minutes at a time. During the **last 12 months** in an average **7 day period**, on how many days would you do **vigorous** physical activities like heavy lifting, chopping wood, shoveling snow, or digging **in the garden or yard**?

_____ days per week

☐ No vigorous activity in garden or yard ▶ ***Skip to question 16***

15. How much time did you usually spend on one of those days doing **vigorous** physical activities in the garden or yard?

_____ hours per day _____ minutes per day

16. Again, think about only those physical activities that you did for at least 10 minutes at a time. During the **last 12 months** in an average **7 day period**, on how many days would you do **moderate** activities like carrying light loads, sweeping, washing windows, and raking **in the garden or yard**?

_____ days per week

☐ No moderate activity in garden or yard ▶ ***Skip to question 18***

17. How much time did you usually spend on one of those days doing **moderate** physical activities in the garden or yard?

_____ hours per day _____ minutes per day

18. Once again, think about only those physical activities that you did for at least 10 minutes at a time. During the **last 12 months** in an average **7 day period**, on how many days did you do **moderate** activities like carrying light loads, washing windows, scrubbing floors and sweeping **inside your home**?

_____ days per week

☐ No moderate activity inside home ▶ ***Skip to PART 4***

19. How much time did you usually spend on one of those days doing **moderate** physical activities inside your home?

_____ hours per day _____ minutes per day

PART 4: RECREATION, SPORT, AND LEISURE-TIME PHYSICAL ACTIVITY

This section is about all the physical activities that you did in the **last 12 months** in an average **7 day period** solely for recreation, sport, exercise or leisure. Please do not include any activities you have already mentioned.

20. Not counting any walking you have already mentioned, during the **last 12 months** in an average **7 day period**, on how many days would you **walk** for at least 10 minutes at a time **in your leisure time**?

_____ days per week

☐ No walking in leisure time ▶ ***Skip to question 22***

21. How much time did you usually spend on one of those days **walking** in your leisure time?

_____ hours per day _____ minutes per day

22. Think about only those physical activities that you did for at least 10 minutes at a time. During the **last 12 months** in an average **7 day period**, on how many days would you do **vigorous** physical activities like aerobics, running, fast bicycling, or fast swimming **in your leisure time**?

_____ days per week

☐ No vigorous activity in leisure time ▶ ***Skip to question 24***

23. How much time did you usually spend on one of those days doing **vigorous** physical activities in your leisure time?

_____ hours per day _____ minutes per day

24. Again, think about only those physical activities that you did for at least 10 minutes at a time. During the **last 12 months** in an average **7 day period**, on how many days did you do **moderate** physical activities like bicycling at a regular pace, swimming at a regular pace, and doubles tennis **in your leisure time**?

_____ days per week

☐ No moderate activity in leisure time ▶ ***Skip to PART 5: TIME SPENT SITTING***

25. How much time did you usually spend on one of those days doing **moderate** physical activities in your leisure time? **_____ hours per day _____ minutes per day**

PART 5: TIME SPENT SITTING

The last questions are about the time you spend sitting while at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading or sitting or lying down to watch television. Do not include any time spent sitting in a motor vehicle that you have already told me about.

26. During the **last 12 months** in an average **7 day period**, how much time did you usually spend **sitting** on a **weekday**?

_____ hours per day _____ minutes per day

27. During the **last 12 months** in an average **7 day period**, how much time did you usually spend **sitting** on a **weekend day**?

_____ hours per day _____ minutes per day

This is the end of the questionnaire, thank you for participating.

Part 4

Food Frequency Questionnaire

15

WE WOULD LIKE TO ASK YOU WHICH FOODS YOU EAT, AND HOW MUCH YOU EAT OF EACH.

On the next page you will see a list of foods with an amount written next to each food. For each food we would like you to indicate with a tick **how often**, on average, you have eaten the **given amount over the last twelve months**. This may vary from never to four or more times as much as the given amount per day.

To help get you started, here are some examples of what we mean. If you can take a few minutes to work through these examples, you will quickly get the idea.

EXAMPLE 1: How often do you drink 250 ml (8oz) of whole milk?

If you drink a 250 ml glass of whole milk every day, on average (including milk you use on cereal, or in tea or coffee), you would place a tick in the 1 per day column, like this:

		Number of times used this amount over last 12 months								
		Never	Less than 1 per month	1-3 per month	1 per week	2-4 per week	5-6 per week	1 per day	2-3 per day	4+ per day
Whole Milk	250 ml (8oz.) glass							• •		

If you drink **twice** this amount, that is a total of about **two** 8oz. glasses of whole milk every day, you would place a tick in the 2-3 **per day** column, like this:

Whole Milk	250 ml (8oz.) glass								• •	

EXAMPLE 2: How often do you eat 1/2 cup of green beans?

If you eat 1/2 cup of green beans every 2 weeks, on average, you would place a tick in the **1-3 per month** column, like this:

		Number of times used this amount over last 12 months								
		Never	Less than 1 per month	1-3 per month	1 per week	2-4 per week	5-6 per week	1 per day	2-3 per day	4+ per day
Green Beans	1/2 cup			• •						

If you eat 1 cup of green beans a **week**, on average, this is the same as eating 1/2 cup of green beans 2 times a week, so you would place a tick in the **2-4 per week** column, like this:

Green Beans	1/2 cup					• •				

If there are any foods that you never eat, please place a tick in the **NEVER** column. Do not leave it blank.

Q 1 Now, please look at the list of foods below. For **each** food listed indicate with a tick how often, on average, you have eaten this food, in the given amount, during the past year. Please try to think carefully about **each** food, and try not to leave any blank lines.

		Number of times used this amount over last 12 months									
DAIRY FOODS **Foods**	**Amount**	**Never**	**Less than 1 per month**	**1-3 per month**	**1 per week**	**2-4 per week**	**5-6 per week**	**1 per day**	**2-3 per day**	**4+ per day**	
Skim milk	**250 ml (8oz.) glass**										**6** _
Low fat milk	**250 ml (8oz.) glass**										_
Whole milk	**250 ml (8oz.) glass**										_
Cream e.g. thickened, pouring	**1 tblsp.**										_
Ice cream	**1/2 cup**										**10** _
Yoghurt, flav/plain	**1 small carton**										_
Yoghurt, low fat, flav/plain	**1 small carton**										_
Cottage or ricotta cheese	**1/2 cup**										_
Other cheese, e.g. Coon	**1 slice or 1 oz. serving**										_
Margarine, added to food or bread: Exclude use in cooking	**1 teasp.**										**15** _
Butter, added to food or bread: Exclude use in cooking	**1 teasp.**										_

Q 2 What form of margarine do you use most often for spreading on bread, adding to vegetables etc? (Exclude use in cooking) (Circle one)

1.	Cooking margarine	4.	Low fat margarine	
2.	Table margarine	5.	Do not use margarine	
3.	Polyunsaturated margarine	6.	Other, please specify_____	17 _

What brand do you use most often? _____ 18 _ _

Q 3 What form of butter do you use most often for spreading on bread, adding to vegetables etc? (Exclude use in cooking) (Circle one)

1.	Ordinary butter	4.	Dairy blend, reduced fat	
2.	Reduced fat butter	5.	Do not use butter	
3.	Dairy blend, regular			20 _

Q 4a. Do you usually add butter or margarine to your cooked vegetables before you eat them? (Circle one)

1.	Yes	2.	No	21 _

Q. 4b. What type of ice cream and other ice confection do you usually use? (Circle one)

1.	Regular ice cream	4.	Reduced fat frozen yoghurt
2.	Reduced fat ice cream	5.	Vitari, sorbet or other fruit ices
3.	Regular frozen yoghurt	6.	Other, please specify _____

Q. 4 c. What type of cheese do you usually have?

1. Cottage / ricotta
2. Traditional types (cheddar, tasty, processed, Camembert, etc.)
3. Fat modified/ reduced fat types
4. Don't know/ can't say

Q 5 SEASONAL FRUITS Please indicate how often on average you eat these fruits when they are in season. Foods	Amount	Number of times used this amount over last 12 months Never	Less than 1 per month	1-3 per month	1 per week	2-4 per week	5-6 per week	1 per day	2-3 per day	4+ per day	
Fresh peaches, apricots, plums or nectarines	1										22 _
Fresh grapes	small bunch (about 20)										_
Fresh strawberries	1/2 cup										_
Other fresh berries	1/2 cup										25 _
Fresh cantaloupe or rockmelon	1/4 melon										_
Fresh mangoes	1										_
Fresh paw-paw	1 slice										_
Fresh pineapple	1 slice										_
Watermelon	1 slice										30 _
Avocado	1/2 avocado										_

Q 5		Number of times used this amount over last 12 months								
OTHER FRUITS		Never	Less than 1 per month	1-3 per month	1 per week	2-4 per week	5-6 per week	1 per day	2-3 per day	4+ per day
Fresh apple or pear	1									
Fresh orange	1									
Fresh grapefruit	1/2									
Fresh banana	1									
Prunes	1/2 cup									
Dried apricots	4 - 5 halves									
Dried peaches	4 - 5 halves									
Other dried fruits	1 tblsp.									
Canned apricots or peaches	1/2 cup									
Other canned fruit	1/2 cup									

32 _
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35 _
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40 _
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Q 6 SEASONAL VEGETABLES (Please indicate how often on average you eat these vegetables when they are in season.) Foods	Amount	Number of times used this amount over last 12 months Never	Less than 1 per month	1-3 per month	1 per week	2-4 per week	5-6 per week	1 per day	2-3 per day	4+ per day	
Broccoli	1/2 cup										42 _
Cauliflower	1/2 cup										_
Spinach, Silverbeet, cooked	1/2 cup										_
Spring onions, shallots	1 medium										45 _

Q 6		Number of times used this amount over last 12 months								
OTHER VEGETABLES (fresh, frozen or canned) **Foods**	**Amount**	Never	Less than 1 per month	1-3 per month	1 per week	2-4 per week	5-6 per week	1 per day	2-3 per day	4+ per day
Potato, boiled or mashed	1 medium, 1/2 cup									
Potato, baked	1 medium									
Hot chips	1 cup									
Pumpkin, boiled or mashed	1 med. piece, 1/2 cup									
Pumpkin, baked	1 medium piece									
Sweet potato	1/2 cup									
Peas	1/2 cup									
Green beans	1/2 cup									
Cabbage	1/2 cup									
Brussel sprouts	3-5 fresh or frozen									
Carrots	1 medium whole or 1/2 cup cooked									

46 _
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50 _
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55 _
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Q 6		Number of times used this amount over last 12 months								
OTHER VEGETABLES (fresh, frozen or canned) Continued Foods	Amount	Never	Less than 1 per month	1-3 per month	1 per week	2-4 per week	5-6 per week	1 per day	2-3 per day	4+ per day
Sweet corn	1 cob or 1/2 cup frozen or canned									
Eggplant, zucchini or squash	1/2 cup									
Mushrooms	6-7 small									
Tomatoes	1									
Lettuce	2 medium leaves									
Coleslaw	1/2 cup									
Celery	10cm (4 inch) stick									
Bean sprouts	1/2 cup									
Baked beans	1/2 cup									
Soybeans	1/2 cup									
Other beans or lentils	1/2 cup									

60

65

Q 7 MEATS, FISH & EGGS Foods	Amount	Number of times used this amount over last 12 months Never	Less than 1 per month	1-3 per month	1 per week	2-4 per week	5-6 per week	1 per day	2-3 per day	4+ per day	
Beef, pork or lamb as main dish e.g. steak, roast	1 small t-bone or 3 slices										68 _
Beef, pork or lamb mixed dish e.g. stew, casserole	1/2 cup										_
Ham, beef, pork or lamb in sandwich	1 slice										70 _
Chicken with skin	1 drumstick or 2 slices										_
Chicken without skin	1 drumstick or 2 slices										_
Sausages	2 thick or 3 thin										_
Hamburger patty or rissole	1										_
Mince in tomato sauce e.g. spaghetti sauce	1 cup										75 _
Other mince meat dishes	1 cup										_
Bacon	2 slices										_

Q 7		Number of times used this amount over last 12 months								
MEATS, FISH & EGGS (continued) Foods	Amount	Never	Less than 1 per month	1-3 per month	1 per week	2-3 per week	5-6 per week	1 per day	2-3 per day	4+ per day
Liver	100 g (4 oz.)									
Meat pie	1									
Sausage roll	1									
Processed meats e.g. Devon, Chicken roll	1 piece or slice									
Frankfurt, saveloy	1 large or 3 small									
Boiled or poached egg	1									
Fried egg	1									
Scrambled egg or omelette	1									
Tuna canned in oil	1/2 cup									
Tuna, salmon canned in water	1/2 cup									
Sardines	1/2 cup									
Other fish (e.g. fried, baked)	1 small fillet									
Other seafood e.g. prawns, crabs scallops as a main dish	1/2 cup									

80 _

85 _

90 _

Q 8 BREAD, CEREALS, STARCHES Foods	Amount	Number of times used this amount over last 12 months Never	Less than 1 per month	1-3 per month	1 per week	2-4 per week	5-6 per week	1 per day	2-3 per day	4+ per day	
Cold breakfast cereal	1 cup										91 _
Cooked oatmeal	1 cup										_
White bread or toast	1 slice										_
Wholemeal/mixed grain bread or toast	1 slice										_
Scone, pikelet	1 scone, 3 pikelets										95 _
Brown rice	1 cup (cooked)										_
White rice	1 cup (cooked)										_
Pasta e.g. spaghetti, noodles, etc.	1 cup										_
Crispbread, cracker, etc.	1										_

Q9 What kind of breakfast cereal do you use most often (e.g. Uncle Toby's Toasted Muesli, Kellogg's Corn Flakes)
Please specify type(s) and brand(s):

1._____ 100 _ _

2._____ 102 _ _

Q 10a		Number of times used this amount over last 12 months									
BEVERAGES	Amount	Never	Less than 1 per month	1-3 per month	1 per week	2-4 per week	5-6 per week	1 per day	2-3 per day	4+ per day	
Orange juice	1 small glass										104 _
Pineapple juice	1 small glass										_
Grape juice	1 small glass										_
Tomato juice	1 small glass										_
Carrot juice	1 small glass										_
Other juice	1 small glass										_
Low calorie cola e.g. Diet Coke	1 can										110 _
Other low calorie soft drink e.g. Diet Solo	1 can										_
Coke, Pepsi or other cola	1 can										_
Other soft drink, e.g. Lemonade	1 can										_
Cordial	1 glass										_
Coffee	1 cup										115 _
Decaf Coffee	1 cup										_
Tea (not herbal teas)	1 cup										_
Herbal tea	1 cup										_

Q 10a		Number of times used this amount over last 12 months									
BEVERAGES WITH ALCOHOL	Amount	Never	Less than 1 per month	1-3 per month	1 per week	2-4 per week	5-6 per week	1 per day	2-3 per day	4+ per day	
Beer (ordinary or heavy)	1 stubbie, can										119 _
Beer (low alcohol)	1 stubbie, can										_
Red Wine	1 wine glass										_
White Wine or Champagne	1 wine glass										_
Sherry or Port	1/2 wine glass										_
Spirits (e.g. whiskey, gin)	1 drink or nip										_

Q.10 b. **What type(s) and brand(s) of fruit juice do you use?**

1. _____

2. _____

3. _____

Q 11 SWEETS, BAKED GOODS & SNACKS Foods	Amount	Number of times used this amount over last 12 months Never	Less than 1 per month	1-3 per month	1 per week	2-4 per week	5-6 per week	1 per day	2-3 per day	4+ per day
Custard	1/2 cup									
Cake	1 slice									
Tart or pie	1 slice									
Pastry, Pavlova, Cheesecake, etc	1 slice									
Sweet roll, bun	1									
Plain sweet biscuits, commercial	1									
Fancy biscuits, commercial, e.g. chocolate coated	1									
Chocolate	1									
Lollies	3-5									
Jam, marmalade, syrup or honey	1 tblsp.									
Peanut paste	1 tblsp.									
Vegemite or Marmite	1 teasp.									
Nuts	1 tblsp.									
Potato chips (crisps), corn chips, twisties etc.	1 small bag									

Q 11		Number of times used this amount over last 12 months								
OTHER FOODS Foods	Amount	Never	Less than 1 per month	1-3 per month	1 per week	2-4 per week	5-6 per week	1 per day	2-3 per day	4+ per day
Pizza	2 slices									
Olives/gherkins/pickled vegs	1/3 cup									
Cream soup	1 cup									
Oil and vinegar dressing, e.g. French	1 tblsp.									
Mayonnaise or other creamy salad dressing	1 tblsp.									

139 _
_
_
_
_

Q 12 Are there any other foods not listed above that you usually eat at least once per week?

Other foods that you usually use at least once per week	Usual serving size	Average use per week	
(a)			144 _ _ _ _
(b)			148 _ _ _ _
(c)			152 _ _ _ _

Q 13 How many teaspoons of sugar altogether do you add to your food and drink each day? (Include sugar added to your tea, coffee, cereal, fruit etc.)

Total _____ teasp **156** _ _

Q 14 What do you do with the visible fat on your meat? (Circle one)

1. Eat most of it
2. Eat some of it
3. Eat as little as possible
4. Don't eat meat

158 _

Q 15 What type of cooking oil is used <u>most often</u> in your home? (e.g. Bertolli olive oil, Meadow Lea sunflower oil)

Please specify type and brand _____ **159** _

Q 16 What kind of fat is used most often in your home for frying or roasting meat or vegetables?

1.	Butter	5.	Table margarine	
2.	Lard	6.	Vegetable oil	
3.	Cooking margarine	7.	Other, please specify	
4.	Polyunsaturated margarine /polyunsat. table margarine	8.	_____ None	160 _

Q 17 How often do you eat food that is fried at home? (Include any foods cooked in a pan or on a hot plate e.g. pan frying or dry frying) (Circle one)

1.	Less than once per week	4.	Daily	
2.	1 - 3 times per week	5.	2 or more times per day	
3.	4 - 6 times per week			161 _

Q 18 How often do you eat take-away that is fried food e.g. Chips, battered foods, chicken fried fish? (Circle one)

1.	Less than once a week	3.	4 - 6 times per week	
2.	1 - 3 times per week	4.	Daily	162 _

Q 19 Do you take vitamin pills (or liquid)? (Circle One)

1. Yes 2. No 157 _

If YES, do you regularly (in most weeks) take any of the vitamins listed below?

1. Yes 2. No 158 _

If YES, please look at the bottle to help answer the following:

Name of Vitamin	Brand Name	Used for how many years	No. of pills, capsules or teaspoons per day	Strength in mg or other units - see bottles	
Multi-vitamin					159 _ _ _ _ _ _
Vitamin A retinol					165 _ _ _ _ _ _ _ _ _ _
Beta - carotene					175 _ _ _ _ _ _ _ _ _ _
Vitamin C					185 _ _ _ _ _ _ _ _ _ _
Vitamin E					195 _ _ _ _ _ _ _ _ _ _

Q 20 Do you take other dietary supplements or minerals? (Circle one)

1. Yes 2. No 205 _

If YES, please specify for each supplement, the type, number or amount taken and how often taken.

Name of Supplement or Mineral	Brand Name	Used for how many years	Amount taken per day	If applicable - strength in mg or other units	
(a)					206 _ _ _ _ _ _ _ _ _ _
(b)					216 _ _ _ _ _ _ _ _ _ _
(c)					226 _ _ _ _ _ _ _ _ _ _
(d)					236 _ _ _ _ _ _ _ _ _ _
(e)					246 _ _ _ _ _ _ _ _ _ _

Q. 21. These are more detailed questions about meat Foods / Amount	Number of times used this amount over last 12 months Never	Less than 1 per month	1-3 per month	1 per week	2-4 per week	5-6 per week	1 per day	2-3 per day	4+ per day	
Beef or veal as main dish eg steak or roast — 1 small t-bone or 3 slices										250 _
Pork or ham as main dish eg chops or roast — 3 slices										_
Lamb as main dish eg chops or roast — 3 slices										252 _
Beef or veal mixed dish e.g. stew, casserole, stir fry — 1/2 cup										_
Pork or ham mixed dish e.g. stew, casserole, stir fry — 1/2 cup										254_
Lamb mixed dish e.g. stew, casserole, stir fry — 1/2 cup										_
Ham or pork in sandwich — 1 slice										256_
Beef or veal in sandwich — 1 slice										_
Lamb in sandwich — 1 slice										258_

Q.22 **For each of the following types of food I would like you to tell me about how often you usually eat the food at this time of year. For example, over the last 3 months have you eaten a particular food, once a day, twice a week, three times a month - whatever is easier. Think about all the food you eat - both at home and away from home.**

A. How often do you eat fried food with a batter or breadcrumb coating?

1. _____ per day
2. _____ per week
3. _____ per month
4. _____ rarely or never
5. _____ don't know / can't say

B. How often do you eat meat products such as sausages, frankfurters, belgium, devon, salami, meat pies, bacon or ham?

1. _____ per day
2. _____ per week
3. _____ per month
4. _____ rarely or never
5. _____ don't know / can't say

C. How often do you eat chips, french fries, wedges, fried potatoes or crisps?

1. _____ per day
2. _____ per week
3. _____ per month
4. _____ rarely or never
5. _____ don't know / can't say

D. How is your meat <u>usually cooked?</u>

1. fried
2. stewed/casserole
3. grilled/roasted with added fat or oil
4. grilled/roasted without added fat
5. Rarely or never eat meat
6. Don't know/can't say

E. What type of milk do you <u>usually have?</u>

1. regular milk (whole or full cream milk)
2. Life full cream
3. Lite white
4. Farmer's best
5. Life reduced fat
6. Shape
7. Skim milk
8. Other, please specify _____
9. Don't have milk
10. Don't know/can't say

F. Which <u>one</u> of the following <u>best</u> describes your usual way of eating?

1. no special way of eating
2. vegetarian
3. weight reduction diet
4. diabetic diet
5. fat modified diet to lower blood fat (cholesterol)
6. Other, please specify _____

Q. 23. How many serves of vegetables do you <u>usually</u> eat each day?

(a 'serve' = ½ cup of cooked vegetables or 1 cup of salad vegetables)

1. _____ serves per day (0,1,2,3, etc)
2. don't eat vegetables

Q.24 **How many serves of fruit do you <u>usually</u> eat each day?**
(a `serve' = 1 medium piece or 2 small pieces of fruit or 1 cup of diced pieces)

1. _____ serves per day (0,1,2,3, etc)
2. don't eat fruit

Q.25 **How many slices of bread do you <u>usually</u> eat each day?**
(A slice of bread is equal to 1 small bread roll or 1 bagel or ½ a large bread roll or ½ bread muffin or 1 scone or ½ a pita bread)

1. _____ slices per day (0,1,2,3, etc)
2. don't eat bread
3. don't know

Q.26 **How many cups of cooked pasta, rice, noodles, or other cooked cereals do you <u>usually</u> eat each <u>week</u>? (Not including cooked breakfast cereals). I am asking you about <u>per week</u> here!**

1. _____ cups per day (0,½ ,1,1½,2,2½,3, etc)
2. don't eat these foods
3. don't know

Q.27 **How many cups of breakfast cereal do you usually eat each day?**
(One cup is equal to 2 weetbix or ½ cup of cooked porridge or ⅓ of a cup of muesli or ½ cup of allbran)

1. _____ cups per day (0,½ ,1,1½,2,2½,3, etc)
2. don't eat breakfast cereals
3. don't know

Q. 28 a. **In the last 5 years, have you changed your eating habits in any way?**
1. Yes 2. No

If YES, how? _____

_____

Q.28 b. **Over the past 5 years, would you say you have increased, decreased, or not changed the amount you eat of the following foods and nutrients. (Please tick)**

Food	Increased	Decreased	Not Changed	Don't Eat
Salt				
Starches (eg, cereals, pasta, rice, bread, grains)				
Fibre				
Fruit				
Vegetables				
Total fat				
Saturated fats (eg fat in meat, milk, cheese, butter)				
Polyunsaturated fats (eg vegetable oils, polyunsaturated margarine)				
Monounsaturated fats (eg olive oil, canola oil or canola margarine)				
Cholesterol				
Alcohol				
Energy (kilojoules or calories)				

Q. 28c. **Do you think you will make any changes to your eating habits during the next five years?**
1. Yes 2. No

If YES, what changes? _____

_____

Q.29 How would you rate the amount you eat of each of these foods and nutrients? (Please tick)

Food	Too much	About right	Too little	Don't Eat
Salt				
Starches (eg, cereals, pasta, rice, bread, grains)				
Fibre				
Fruit				
Vegetables				
Total fat				
Saturated fats (eg fat in meat, milk, cheese, butter)				
Polyunsaturated fats (eg vegetable oils, polyunsaturated margarine)				
Monounsaturated fats (eg olive oil, canola oil or canola margarine)				
Cholesterol				
Alcohol				
Energy (kilojoules or calories)				

The next nine questions are about your body weight.

30. Do you consider yourself to be

1. Acceptable weight
2. Underweight
3. Overweight

31. How tall are you without shoes?

_____centimetres

OR

_____ feet _____inches

32. How much do you weigh without clothes or shoes?

_____kilograms

OR

_____stones _____pounds

33. Compared to the same time last year, has your weight:

1. Increased
2. Decreased
3. Stayed the same
4. Don't know

34. If your weight has changed, what do you think were the reasons for this weight change?

_____

_____

35. Have you tried to lose weight in the past 12 months?

1. Yes
2. No
3. Not sure

36. If you have tried to lose weight in the past 12 months, which weight loss methods have you used? (You can mark more than one response)

1. I dieted
2. I exercised
3. I used organised programs
4. I used vitamins
5. I used meal replacements
6. I used diet supplements
7. I used over-the-counter pharmaceutical products Eg. Diet pills or appetite suppressants
8. I had surgery, eg. Liposuction

If you circled 3, please specify program type

_____

If you circled 4, 5, 6 or 7, please specify type and brand:

_____

37. Which one of the following statements best describes you at the moment?

1. I am actively doing things to try to **gain** weight at the moment
2. I am actively doing things to **avoid gaining** weight at the moment
3. I am actively doing things to try to **lose** weight at the moment
4. I am **not doing anything** in particular for my weight at the moment

Q. 38 Here are a series of statements that people have made about their food situation. Please circle one response to each question, indicating whether the statement is often true, sometimes true or never true for your household or the individuals in your household.

A. I worry whether my food will run out before I get money to buy more.

1. often true 2. sometimes true 3. never true

B. I worry about whether the food that I can afford to buy for my household will be enough.

1. often true 2. sometimes true 3. never true

C. The food that I bought just didn't last, and I didn't have money to get more.

1. often true 2. sometimes true 3. never true

D. I ran out of the foods that I needed to put together a meal and I didn't have money to get more food.

1. often true 2. sometimes true 3. never true

E. We eat the same thing for several days in a row because we only have a few different kinds of food on hand and don't have money to buy more.

1. often true 2. sometimes true 3. never true

F. I am often hungry, but I don't eat because I can't afford enough food.

1. often true 2. sometimes true 3. never true

G. I eat less than I think I should because I don't have enough money for food.

1. often true 2. sometimes true 3. never true

H. **I can't afford to eat properly.**

1. often true 2. sometimes true 3. never true

I. **Sometimes people lose weight because they don't have enough to eat. In the past year, did you lose weight because there wasn't enough food?**

1. often true 2. sometimes true 3. never true

J. **In the past year, have you had hunger pangs but couldn't eat because you couldn't afford food?**

1. often true 2. sometimes true 3. never true

K. **In the last 12 months, were there times that your household ran out of food and there wasn't money to buy any more food?**

1. often true 2. sometimes true 3. never true

L. **In the last 12 months, has anyone in your household eaten less than they should because you couldn't afford enough food?**

1. often true 2. sometimes true 3. never true

This is the end of the food frequency questionnaire, thank you for participating.

We really appreciate the time and effort you have put into completing these questionnaires.

Appendix M – Participant information sheet (Intervention Study)

Flinders UNIVERSITY
Nutrition and Dietetics
School of Health Sciences

UPM
Nutrition and Dietetics
Faculty of Medicine & Health Sciences

PARTICIPANT INFORMATION SHEET

Effects of nutrition counselling and lifestyle intervention on nutritional status and quality of life in patients with colorectal cancer undergoing chemotherapy

You are invited to take part in this 20-week research study which aims to determine the effect of nutrition counselling on nutritional status and quality of life in patients with colorectal cancer undergoing chemotherapy. Before you decide, please take time to read the following information carefully and discuss it with others if you wish. If there is anything that is not clear to you or if you would like more information, please contact us using the details provided below.

What is the study about?

Malnutrition is a common feature among cancer patients undergoing chemotherapy and can impact on patients' overall health and how they feel and function. Untreated malnutrition has been associated with reduced response to treatment, poor survival and diminished quality of life. Thus, nutrition counselling can be beneficial to patients with colorectal cancer receiving chemotherapy who are at risk of malnutrition. The purpose of this study is investigate the effect of different types of nutrition counselling on patients' nutritional status and quality of life. We will also ask some questions about your beliefs on the effect of exercise and dietary on your overall health.

Who are the researchers?

Assoc. Prof. Mirnalini Kandiah (Nutrition and Dietetics, Universiti Putra Malaysia)
Mrs Zalina Abu Zaid (Nutrition and Dietetics, Flinders University)

This research study is being undertaken as part of the requirements of a PhD for Zalina Abu Zaid under the supervision of Professor Lynne Cobiac, Professor Carlene Wilson, at Flinders University and Associate Professor Mirnalini Kandiah, at Universiti Putra Malaysia.

Who funded the study?

This research study is funded by the Fundamental Research Grant Scheme, Malaysia.

What will I be asked to do?

If you agree to take part in the study, we will firstly ask you to sign the attached consent form. You will then be randomly assigned to one of two groups who will receive different types of nutrition counselling over a period of 8 weeks with a follow-up visit 12 weeks later. One group will receive more detailed advice on diet and lifestyle and the other will be provided with more general information. As allocation is of a random nature, we cannot guarantee which group you will be asked to follow. If you are assigned to the group receiving more detailed advice there will also be regular follow-up through phone calls. If at any time you are assigned as having lost too much weight or you are unable to eat enough food, you will be referred to see a dietitian.

You will be required to come to the clinic 4 times over a 20-week period for various measurements and procedures. Each visit will take between 20 minutes (for dietary counselling, 3 sessions) and 30 minutes (for measurements, 4 sessions).

We will collect 10 ml (equal to 2 teaspoon or 0.35 oz) fasting blood samples on 4 separate occasions for measuring of inflammation (for measuring CRP and IL-6):

- At baseline
- At Week 4
- At Week 8 and
- At the end of the trial at Week 20

We will also measure your weight, height, waist circumference, hip circumference and percent body fat during the clinic sessions. We will test your blood for measures of inflammation.

At baseline, during and at the end of the trial, we will ask how you feel you are managing lifestyle factors that may impact on your quality of life and whether you have made or feel that you could make behavioural changes. His will be done by face-to-face interview using validated and reliable questionnaires.

We will interview you using several questionnaires that are related to:

- Nutritional assessment (at baseline, at Week 4, Week 8 and at the end of the trial)
- Physical activity level (at baseline, at Week 4, Week 8 and at the end of the trial) and
- Quality of life (at baseline, at Week 4, Week 8 and at the end of the trial)

We will also ask you to tell us about your usual current diet at the beginning of the study. Three times during the study we will also ask you to provide information on 2 days of dietary intake which we will ask you to recall through an interview with the research dietitian I (one for weekday and one for weekend) at week 4, week 8 and at the end of the trial.

Will the study benefit me?

We cannot guarantee that you will directly benefit from participating in this study. However, your participation in this study may provide us with valuable information to help us develop a standardized medical nutrition therapy (MNT) that may be beneficial to patients with cancer.

Are there any risks?

There are minimal risks associated with taking part in this study.

The taking of blood samples may produce some mild pain or discomfort. If you have a tendency to feel dizzy or faint, we can take blood while you are lying down to avoid fainting. Some bruising may occur at the site of sampling which will usually disappear in a few days.

We do not foresee any other risks or any disadvantages except for the time commitment required of you in taking part in this study. If you do suffer an injury as a result of participation in this research, compensation might be paid without litigation. However, such compensation is not automatic and you may have to take legal action to determine whether you should be paid.

What about confidentiality?

All records containing personal information will remain confidential and no information which could lead to your identification will be released. Members of the Flinders Medical Centre Research, Universiti Putra Malaysia and Ethics Committee may need to access study and medical records for the purposes of audit. This will be done in a way that respects and protects your privacy.

What happens with the results of the study?

We will provide you with a summary of the findings upon completion of the study. The results of this study will be published in scientific journals at a later date. Please be assured that you will not be identified in any report from this study. The records dealing with your participation will be kept under secured storage for 7 years after completion of the study.

Can I withdraw from the study?

Your participation in this study is entirely voluntary and you have the right to withdraw from the study at any time. You may, if you wish also withdraw your consent for the use of your data in the study and request all samples and data to be destroyed. If you decide not to participate in this study or if you withdraw from the study, you may do this freely without giving any reasons and without any adverse consequences.

Will I be paid for being in the study?

You will not receive any payment for participation in this study apart. However, you will be compensated for reasonable travel costs (RM 20) for each visits (at baseline, at Week 4, Week 8 and at the end of the trial) made during the study.

How can I get more information about the study?

If you would like more information about this study, please feel free to contact:

Assoc Professor Dr Mirnalini Kandiah (03) 89472460 or
Mrs Zalina Abu Zaid on (03) 89472358 (013) 5135956

What if I have concerns for the study?

This study has been reviewed by the Southern Adelaide Health Service/Flinders University, Human Research Ethics Committee. If you wish to discuss the study with someone not directly involved, in particular in relation to policies, your rights as a participant, or should you wish to make a confidential complaint, you may contact

the Executive Officer, Southern Adelaide Health Service/Flinders University, Human Research Ethics Committee on (08) 8204 6453 or email research.ethics@health.sa.gov.au and Ministry of Health Research and Ethics Committee of Malaysia (MREC) Ethic Approval Secretary on (03) 22874032 or email nmr@nmrr.gov.my

Thank you for taking the time to consider this study.

If you wish to take part in it, please sign the attached consent form.

This information sheet is for you to keep.

Appendix N – Consent form (Intervention Study)

Flinders UNIVERSITY
Nutrition and Dietetics
School of Health Sciences

UPM
Nutrition and Dietetics
Faculty of Medicine & Health Sciences

"Effects of nutrition counselling and lifestyle intervention on nutritional status and quality of life in patients with colorectal cancer undergoing chemotherapy"

CONSENT TO PARTICIPATION IN RESEARCH

I, ... request and give consent
(first or given names) *(last name)*

to my involvement in the research project "Effects of nutrition counselling and lifestyle intervention on nutritional status and quality of life in patients with colorectal cancer undergoing chemotherapy".

I acknowledge the nature, purpose and contemplated effects of the research project, especially as far as they affect me, have been fully explained to my satisfaction by

(first or given names) ..... *(last name)*

and my consent is given voluntarily.

I acknowledge that the detail(s) of the following has/have been explained to me, including indications of risks; any discomfort involved; anticipation of length of time; and the frequency with which they will be performed:

1. Random allocation to 20-week of either an 'more detailed lifestyle counselling' or a 'more general counselling'
2. Four 30 minutes assessment sessions
   - 1st clinic visit: fasting blood samples, weight, height, waist and hip circumference, percent body fat, diet history and questionnaires about social demographic, nutritional assessment, physical activity, quaity of life and psychosocial factors.
   - 2nd clinic visit; fasting blood samples, weight, waist and hip circumference, percent body fat, 2-day 24 hours diet recall and questionnaires about nutritional assessment, physical activity and quaity of life.
   - 3rd clinic visit: fasting blood samples, weight, waist and hip circumference, percent body fat, 2-day 24 hours diet recall and questionnaires about nutritional assessment, physical activity and quaity of life
   - 4th clinic visit: fasting blood samples, weight, waist and hip circumference, percent body fat, 2-day 24 hours diet recall and questionnaires about nutritional assessment, physical activity, quaity of life and psychosocial factors.
3. Three dietary counselling sessions (up to 20 mins - 1st, 2nd, 3rd clinic visits)

4. Three recall information on 2-day 24 hours diet recall (one for weekday and one for weekend – 2nd, 3rd, 4th clinic visits)
5. Four blood samples (10 ml) will be taken for measuring of inflammation (1st, 2nd, 3rd, 4th clinic visits)

I have understood and I am satisfied with the explanations that I have been given.

I have been provided with a written information sheet.

I understand that my involvement in this research project may not be of any direct benefit to me and that I may withdraw my consent at any stage without affecting my rights or the responsibilities of the researchers in any respect.

I declare that I am over the age of 18 years.

I acknowledge that I have been informed that should I receive an injury as a result of taking part in this study, I may need to start legal action to determine whether I should be paid.

Signature of Research Participant : ..... Date: .....

I/C No : .....

I, ... have described to ..... the research project and nature and effects of procedure(s) involved. In my opinion he/she understands the explanation and has freely given his/her consent.

Signature of Researcher: ..... Date: .....

I/C No:.....

Appendix O – Sample of medication menu

Sample Menu

Sample menu of 1500 kcal and modification to increase calories to 1800 kcal & 2000 kcal

Calories / Meals	1500 kcal	1800 kcal	2000 kcal
Breakfast (8am)	1. Keow teow soup - 2/3 chinese bowl of keow teow (cut) - 1/2 cup of minced vegetables - 1 matchbox of minced lean meat - 1 tsp of oil 2. 1 cup of low fat milk - To add coffee/ tea / chocolate / malt as flavouring (optional)	<u>Modification:</u> 1. To add 2-3 pieces meat balls (1 exc) in keow teow soup 2. To add 3 tsp of sugar in low fat milk with coffee / tea	<u>Modification:</u> Nil
Lunch (12pm)	1. Tosai - 1 piece of tosai (cut) 2. Dhall curry - 1/2 cup of dhall - 1/2 piece of tau kua - 1/4 bowl of vegetables - 1 tsp of oil 3. Fruit juice (1 fruit)	<u>Modification:</u> Nil.	<u>Modification:</u> 1. To add 1 cup of low fat milk or ice cream for morning tea (around 10am and if possible to make breakfast earlier; 7am).
Afternoon Tea (3pm)	1. Blended fruit with yogurt - 1 fruit - 3/4 cup low fat yogurt 2. Bread - 1 piece of white	<u>Modification:</u> 1. To add 1 fried egg (1 tsp oil) for the bread or 2 tbsp of peanut	<u>Modification:</u> Nil

	bread	butter 2. To add 3 tsp of sugar in blended fruit yogurt.	
Calories / Meals	1500 kcal	1800 kcal	2000 kcal
Dinner (6pm) ● Early dinner so can have early supper	1. Rice - 2/3 chinese bowl of white soft rice 2. Kurma ayam - 1/2 drumstick (minced) - 1 hard boiled egg - 1/2 tsp of oil 3. Stir fried vegetables - 1/2 cup vegetables (cut) - 1/2 tsp of oil 4. Fruit juice (1 fruit)	Modification: Nil	Modification: 1. Nil
Supper (9pm) ● Early supper to avoid feeling fullness before sleep	1. Low fat milk - 1 cup of low fat milk - To add chocolate / malt as flavouring (optional)	Modification: Nil	Modification: 1. To add 3 rounded tablespoon of oats into low fat milk.

Note:

1. If patient has difficulty in chewing cut / minced food, then proceed to blended food.
2. If patient has difficulty to fulfil <75% of the dietary requirement, then consider nutritional support (ESPEN, 2006; FESEO, 2008).

Table 9: Examples of modification for different food groups

Modification for porridge:

To increase protein and calories:

-egg (as whole or plus oil and beaten then mix well with porridge)

-fried tofu (dice)

-minced / blend fish / chicken / meat (with oyster or soy sauce as to cover the metallic taste)

-fried anchovies (small pieces)

-serve with baked beans

-add nuts / coconut milk (e.g. bubur lambuk)

To increase vegetables intake:

-soft vegetable (dice) :cauliflower, tomato / capsicum without skin, canned corn, French beans, carrot, potato, celery, spinach etc.

Modification for fruits:

To increase protein and calories:

- soft fruits (cut) + yogurt + cheese + raisin + mayonnaise / salad dressing

- fruit juice + milk + sweeten jelly

- fruit juice + milk (ice cube) / honey

- fruit (dice) + ice cream + chocolate chips / nuts (flake)

- fruit (mango/ honeydew/ watermelon etc) (cut) + sago + coconut milk

-fruits dip into chocolate

Modification for milk:

To increase protein and calories:

- add chocolate / malted / coffee / tea (variety of taste)

- add cereal / baby cereal / oats / cornflakes + raisin / soft fruits / honey

- add into jelly / pudding

Modification of gravy:

To increase calories:

- more oil and sugar

- thicken with corn flour

- add milk / yogurt / coconut milk

- add blended potato

Generally to increase protein and calories:

- milk / cheese / yogurt

- soy bean milk / tofu

- egg

-nuts / legume

- coconut milk

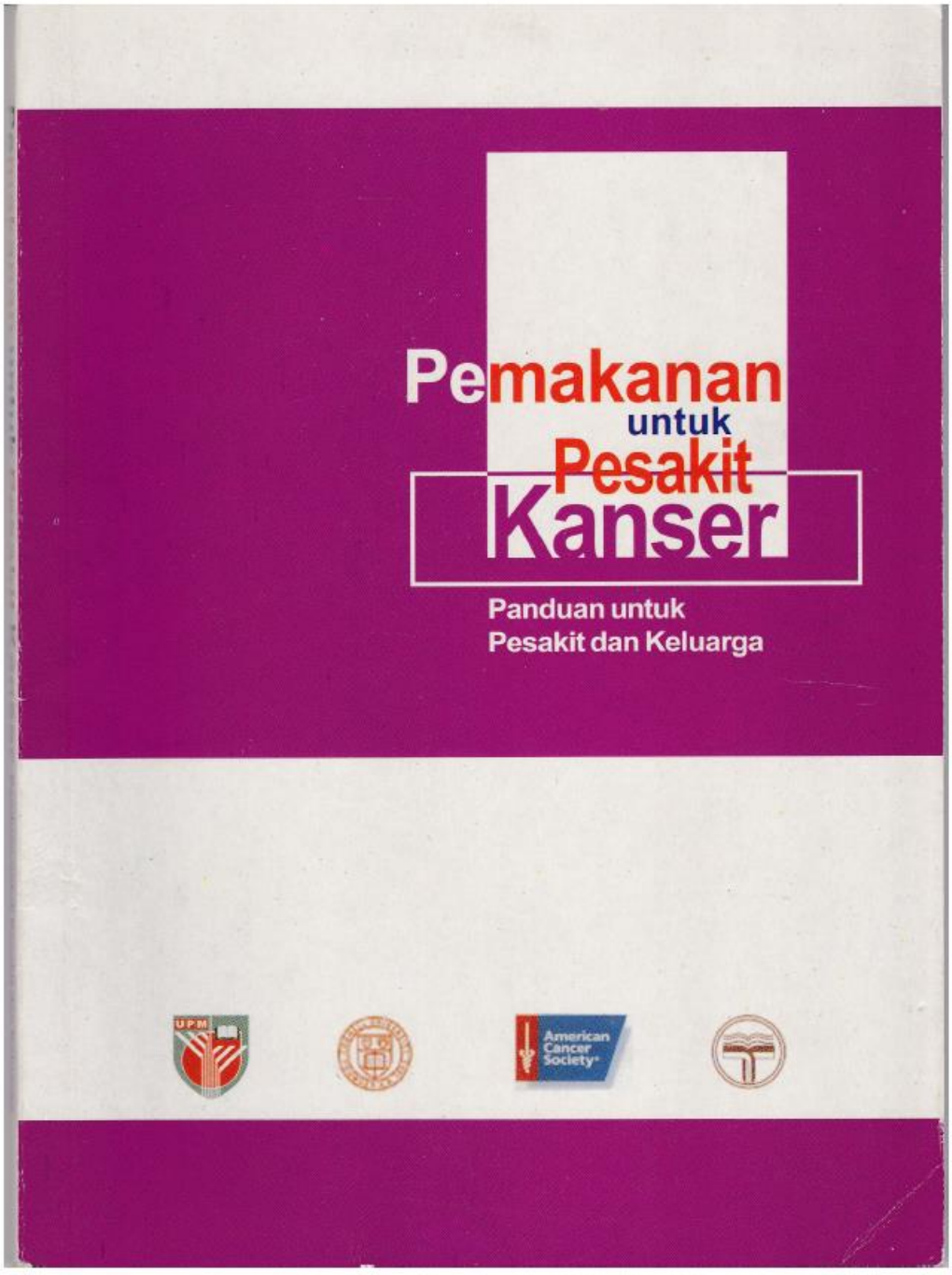
- oil / butter

- sugar / jam / honey

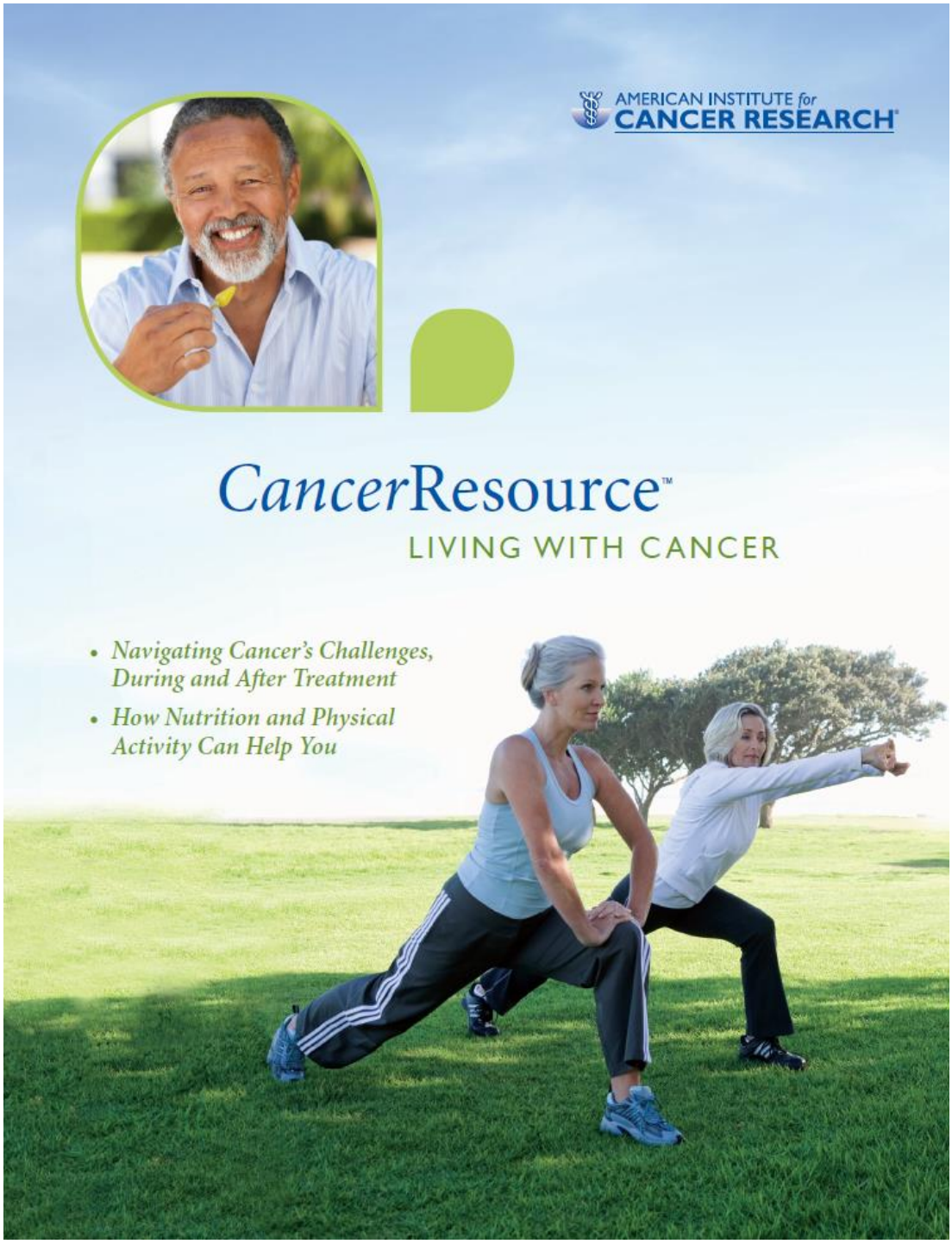
Note:

1. Marinate fish with juice for improve toleration of bitter taste.
2. If honey / milk and milk products to be used do choose pasteurized or use it in cooking.
3. Ensure clean and fully cooked food to avoid contamination

Appendix P – Intervention booklet in Malay Language (Pemakanan untuk Pesakit Kanser)



Appendix Q – Intervention booklet in English language (*Cancer* Resource™ Living with cancer)



Appendix R – The Scored Patient-Generated Subjective Global Assessment (PG-SGA)

Patient ID Information

Scored Patient-Generated Subjective Global Assessment (PG-SGA)

History (Boxes 1-4 are designed to be completed by the patient.)

1. Weight *(See Worksheet 1)*

In summary of my current and recent weight:

I currently weigh about _____ pounds
I am about _____ feet _____ tall

One month ago I weighed about _____ pounds
Six months ago I weighed about _____ pounds

During the past two weeks my weight has:
☐ decreased (1) ☐ not changed (0) ☐ increased (0)

Box 1

2. Food Intake: As compared to my normal intake, I would rate my food intake during the past month as:
☐ unchanged (0)
☐ more than usual (0)
☐ less than usual (1)
I am now taking:
☐ *normal food* but less than normal amount (1)
☐ little solid food (2)
☐ only liquids (3)
☐ only nutritional supplements (3)
☐ very little of anything (4)
☐ only tube feedings or only nutrition by vein (0)

Box 2

3. Symptoms: I have had the following problems that have kept me from eating enough during the past two weeks (check all that apply):
☐ no problems eating (0)
☐ no appetite, just did not feel like eating (3)
☐ nausea (1)
☐ constipation (1)
☐ mouth sores (2)
☐ things taste funny or have no taste (1)
☐ problems swallowing (2)
☐ pain; where? (3) _____
☐ other** (1) _____
** Examples: depression, money, or dental problems

Box 3

4. Activities and Function: Over the past month, I would generally rate my activity as:
☐ normal with no limitations (0)
☐ not my normal self, but able to be up and about with fairly normal activities (1)
☐ not feeling up to most things, but in bed or chair less than half the day (2)
☐ able to do little activity and spend most of the day in bed or chair (3)
☐ pretty much bedridden, rarely out of bed (3)

Box 4

Additive Score of the Boxes 1-4 ☐ A

Appendix S – The EORTC QLQ-C30 (version 3)

ENGLISH

EORTC QLQ-C30 (version 3)

We are interested in some things about you and your health. Please answer all of the questions yourself by circling the number that best applies to you. There are no "right" or "wrong" answers. The information that you provide will remain strictly confidential.

Please fill in your initials:
Your birthdate (Day, Month, Year):
Today's date (Day, Month, Year): 31

	Not at All	A Little	Quite a Bit	Very Much
1. Do you have any trouble doing strenuous activities, like carrying a heavy shopping bag or a suitcase?	1	2	3	4
2. Do you have any trouble taking a long walk?	1	2	3	4
3. Do you have any trouble taking a short walk outside of the house?	1	2	3	4
4. Do you need to stay in bed or a chair during the day?	1	2	3	4
5. Do you need help with eating, dressing, washing yourself or using the toilet?	1	2	3	4

During the past week:	Not at All	A Little	Quite a Bit	Very Much
6. Were you limited in doing either your work or other daily activities?	1	2	3	4
7. Were you limited in pursuing your hobbies or other leisure time activities?	1	2	3	4
8. Were you short of breath?	1	2	3	4
9. Have you had pain?	1	2	3	4
10. Did you need to rest?	1	2	3	4
11. Have you had trouble sleeping?	1	2	3	4
12. Have you felt weak?	1	2	3	4
13. Have you lacked appetite?	1	2	3	4
14. Have you felt nauseated?	1	2	3	4
15. Have you vomited?	1	2	3	4
16. Have you been constipated?	1	2	3	4

Please go on to the next page

During the past week:	Not at All	A Little	Quite a Bit	Very Much
17. Have you had diarrhea?	1	2	3	4
18. Were you tired?	1	2	3	4
19. Did pain interfere with your daily activities?	1	2	3	4
20. Have you had difficulty in concentrating on things, like reading a newspaper or watching television?	1	2	3	4
21. Did you feel tense?	1	2	3	4
22. Did you worry?	1	2	3	4
23. Did you feel irritable?	1	2	3	4
24. Did you feel depressed?	1	2	3	4
25. Have you had difficulty remembering things?	1	2	3	4
26. Has your physical condition or medical treatment interfered with your family life?	1	2	3	4
27. Has your physical condition or medical treatment interfered with your social activities?	1	2	3	4
28. Has your physical condition or medical treatment caused you financial difficulties?	1	2	3	4

For the following questions please circle the number between 1 and 7 that best applies to you

29. How would you rate your overall health during the past week?

1	2	3	4	5	6	7
Very poor						Excellent

30. How would you rate your overall quality of life during the past week?

1	2	3	4	5	6	7
Very poor						Excellent

Appendix T – The EORTC QLQ-CR29 (version 2.1)

ENGLISH

EORTC QLQ – CR29

Patients sometimes report that they have the following symptoms or problems. Please indicate the extent to which you have experienced these symptoms or problems during the past week. Please answer by circling the number that best applies to you.

During the past week:	Not at All	A Little	Quite a Bit	Very Much
31. Did you urinate frequently during the day?	1	2	3	4
32. Did you urinate frequently during the night?	1	2	3	4
33. Have you had any unintentional release (leakage) of urine?	1	2	3	4
34. Did you have pain when you urinated?	1	2	3	4
35. Did you have abdominal pain?	1	2	3	4
36. Did you have pain in your buttocks/anal area/rectum?	1	2	3	4
37. Did you have a bloated feeling in your abdomen?	1	2	3	4
38. Have you had blood in your stools?	1	2	3	4
39. Have you had mucus in your stools?	1	2	3	4

During the past week:	Not at All	A Little	Quite a Bit	Very Much
40. Did you have a dry mouth?	1	2	3	4
41. Have you lost hair as a result of your treatment?	1	2	3	4
42. Have you had problems with your sense of taste?	1	2	3	4
43. Were you worried about your health in the future?	1	2	3	4
44. Have you worried about your weight?	1	2	3	4
45. Have you felt physically less attractive as a result of your disease or treatment?	1	2	3	4
46. Have you been feeling less feminine/masculine as a result of your disease or treatment?	1	2	3	4
47. Have you been dissatisfied with your body?	1	2	3	4
48. Do you have a stoma bag (colostomy/ileostomy)? (please circle the correct answer)	Yes		No	

Please go on to the next page

During the past week:	Not at All	A Little	Quite a Bit	Very Much
Answer these questions ONLY IF YOU HAVE A STOMA BAG, if not please continue below:				
49. Have you had unintentional release of gas/flatulence from your stoma bag?	1	2	3	4
50. Have you had leakage of stools from your stoma bag?	1	2	3	4
51. Have you had sore skin around your stoma?	1	2	3	4
52. Did frequent bag changes occur during the day?	1	2	3	4
53. Did frequent bag changes occur during the night?	1	2	3	4
54. Did you feel embarrassed because of your stoma?	1	2	3	4
55. Did you have problems caring for your stoma?	1	2	3	4

Answer these questions ONLY IF YOU DO NOT HAVE A STOMA BAG:				
49. Have you had unintentional release of gas/flatulence from your back passage?	1	2	3	4
50. Have you had leakage of stools from your back passage?	1	2	3	4
51. Have you had sore skin around your anal area?	1	2	3	4
52. Did frequent bowel movements occur during the day?	1	2	3	4
53. Did frequent bowel movements occur during the night?	1	2	3	4
54. Did you feel embarrassed because of your bowel movement?	1	2	3	4

During the past 4 weeks:	Not at All	A Little	Quite a Bit	Very Much
For men only:				
56. To what extent were you interested in sex?	1	2	3	4
57. Did you have difficulty getting or maintaining an erection?	1	2	3	4

For women only:				
58. To what extent were you interested in sex?	1	2	3	4
59. Did you have pain or discomfort during intercourse?	1	2	3	4

Appendix U – Permission to use EORTC QLQ-CR30 and EORTC QLQ-CR29

PERMISSION TO USE

Dear Sir/Madam,

Please find below the links where you can download the documents you requested.

Best regards,

Your data:

Title: Mrs
Firstname: ZALINA
Lastname: ABU ZAID
Hospital/Institution: Flinders University
Address: Department of Nutrition & Dietetics
County/State: Bedford Park
Postal Code: 5041
Country: Australia
Phone: +61882047068
Fax: +61882046406
Email: abuz0001@flinders.edu.au
Protocol: Effect of intensive nutrition counselling on outcome: A prospective randomized controlled study on nutritional status and quality of life in patients with colorectal cancer undergoing chemotherapy

Documents requested:

QLQ-C30 Core Questionnaire in English
Colorectal Module (CR29) in English
QLQ-C30 Core Questionnaire in Malay
QLQ-C30 Scoring Manual
Addendum scoring instructions validated modules Full reference values Latest issue of the EORTC Quality of Life Group Newsletter

URLs:

http://www.eortc.be/home/qol/downloads/f/C30/QLQ-C30%20English.pdf
http://www.eortc.be/home/qol/downloads/f/CR29/CR29%20English.pdf
http://www.eortc.be/home/qol/downloads/f/C30/QLQ-C30%20Malay%20(Bahasa%20Melayu-Malaysia).pdf
http://www.eortc.be/home/qol/downloads/f/SCManualQLQ-C30.pdf
http://www.eortc.be/home/qol/downloads/f/Addendum_scoring_instructions.pdf
http://www.eortc.be/home/qol/downloads/f/RV/RV_complete.pdf
http://www.eortc.be/home/qol/downloads/f/QOL_newsletter.pdf

If you are having technical difficulties please contact us by email: qlqc30@eortc.be

Appendix V – Questionnaire (Intervention Study)

Flinders UNIVERSITY

Nutrition and Dietetics
School of Medicine

UPM UNIVERSITI PUTRA MALAYSIA

Nutrition and Dietetics
Faculty of Medicine & Health Sciences

QUESTIONNAIRE

EFFECTS OF NUTRITION COUNSELLING AND LIFESTYLE INTERVENTION ON NUTRITIONAL STATUS AND QUALITY OF LIFE IN PATIENTS WITH COLORECTAL CANCER UNDERGOING CHEMOTHERAPY

Patients Number: ☐☐☐☐

Your personal information given in this questionnaire is for research purpose only and will be kept strictly confidential and will not be disclosed to any third parties. Thus, your honesty and cooperation are needed for completing this questionnaire. Indeed, I would be very grateful of you could oblige by completing this attached questionnaire. Thank you.

Patients Initial: ☐☐☐
Visit Date: ☐☐☐☐☐☐

PART A: SOCIO-DEMOGRAPHIC BACKGROUND

Please tick on the relevant boxes and fill in the blanks whenever needed.

1. Name :	
2. NRIC :	MyKad : ☐☐☐☐☐☐☐☐☐☐☐☐ Old IC : ☐☐☐☐☐☐☐☐
3. Address :	..... Postcode : ☐☐☐☐☐ Town/City : ☐ State : ☐
4. Contact no :	H/P : ☐☐☐☐☐☐☐☐☐☐ Home phone : ☐☐☐☐☐☐☐☐☐☐ Email Address : ☐
5. Date of birth : (dd/mm/yyyy)	☐☐ ☐☐ ☐☐☐☐
6. Age :	☐☐ Years old
7. Gender :	☐ Male ☐ Female

8. Ethnic group :	☐ Malay ☐ Chinese ☐ Indian ☐ Others: .....
9. Education level :	☐ Primary school ☐ Certificate/STPM ☐ Secondary school ☐ Others:.....
10. Occupation :	☐ Public Sector ☐ Unemployed ☐ Private Sector ☐ Retired/pensioner ☐ Self-employed
11. Income /month :	☐ RM 0 – 500 ☐ RM 501 – 1000 ☐ RM 1001 – 2000 ☐ RM 2001 - 3000 ☐ RM 3001 and above
12. Marital status :	☐ Single ☐ Married ☐ Widow

PART B: MEDICAL HISTORY

Please tick on the relevant boxes and fill in the blanks whenever needed.

1. Type of disease :	☐ Diabetes Type 2 ☐ Renal Failure ☐ Cardiovascular Disease ☐ Polysystic Ovary syndrome ☐ Hypertension ☐ Other ..... ☐ Psoriasis
2. Duration :	☐ < 1 month ☐ <6 months ☐ < 1 year ☐ < 5 years ☐ > 5 years
3. Treatment obtained :	
4. Medication received/any drugs administration :	
5.Stage of Colorectal Cancer:	
6. Diagnosis Date:	
7. Treatment Stage:	
8. Family history of having any diseases:	

PART C: ANTHROPOMETRIC ASSESSMENT

Date of measurement:			
Measurement	**First Reading**	**Second Reading**	**Average**
Weight (kg)			
Height (cm)			
Waist Circumference (cm)			
Hip Circumference (cm)			
Body Fat (%)			
Body Mass Index (BMI) =	kg/m²		
Waist Hip Ratio (WHR) =			

PART D: SMOKING HABIT

Now, I am going to ask you some questions about your smoking habit.

1. In the **past**, did you smoke?

   ☐ Yes ☐ No ***if no, go to question 3***

2. On average, in the **past** how many cigarettes did you smoke each day?

   .....

   .....

3. Do you **currently** smoke cigarettes?

   ☐ Yes ☐ No ***if yes, go to question 5 (if no for question 1 and 3, go to the next section)***

4. When did you quit smoking?

   ☐ < 1 year after being diagnosed ☐ 3-4 years after being diagnosed

   ☐ 1-2 years after being diagnosed ☐ >4 years after being diagnosed

5. On average, currently how many cigarettes do you smoke each day?

   .....

   .....

6. Have you tried to quit smoking?

   ☐ Yes ☐ No ***if no, go to the next section***

7. How long have you successfully stopped smoking?

   .....

   .....

PART E: ALCOHOL CONSUMPTION

The next questions ask about your consumption of alcohol.

1. Do you currently consume alcoholic drinks such as beer, wine or liquor?

   ☐ Yes ☐ No ***if no, go to question 4***

2. How frequently have you had at least one alcoholic drink?

   ☐ Daily
   ☐ 5-6 days per week
   ☐ 1-4 days per week
   ☐ 1-3 days per month
   ☐ Less than once month

3. How many standard alcoholic drinks do you currently have during one drinking occasion?

   .....

   .....

4. Did you consume alcoholic drinks in the past?

   ☐ Yes ☐ No ***if yes, go to question 5***

5. When did you stop consuming alcohol?

   ☐ < 1 year ago
   ☐ 1-2 years ago
   ☐ 3-4 years ago
   ☐ >4 years ago

6. Why did you stop?

   .....

   .....

   .....

PART F: GODIN LEISURE-TIME EXERCISE QUESTIONNAIRE

1. During a typical **7-day period** (a week), how many times on the average do you do the following kinds of exercise for **more than 15 minutes** during your free time (write on each line the appropriate number).

		Times Per Week
a)	**STRENUOUS EXERCISE** **(HEART BEATS RAPIDLY)** (e.g., running, jogging, hockey, hockey, football, soccer, squash, basketball, cross country skiing, judo, roller skating, vigorous swimming, vigorous long distance bicycling)	_____
b)	**MODERATE EXERCISE** **(NOT EXHAUSTING)** (e.g., fast walking, baseball, tennis, easy bicycling, volleyball, badminton, easy swimming, alpine skiing, popular and folk dancing)	_____
c)	**MILD EXERCISE** **(MINIMAL EFFORT)** (e.g., yoga, archery, fishing from river bank, bowling, horseshoes, golf, snow-mobiling, easy walking)	_____

2. During a typical **7-day period** (a week), in your leisure time, how often do you engage in any regular activity **long enough to work up a sweat** (heart beats rapidly)?

OFTEN	SOMETIMES	NEVER/RARELY
1. ☐	2. ☐	3. ☐

PART G: DIET HISTORY

a) (Date:.....)

Please circle the recall day: Monday / Tuesday / Wednesday / Thursday / Friday / Saturday / Sunday			
Meals	**Foods/Beverages**	**Serving Size**	**Amount of Foods/Beverages**
Breakfast			
Morning snack			
Lunch			
Afternoon snack			
Dinner			
Supper			

PART H: 24-HOUR DIETARY RECALL

b) Weekday (Date:.....)

Please circle the recall day: Monday / Tuesday / Wednesday / Thursday / Friday			
Meals	**Foods/Beverages**	**Serving Size**	**Amount of Foods/Beverages**
Breakfast			
Morning snack			
Lunch			
Afternoon snack			
Dinner			
Supper			

c) Weekend (Date:.....)

Please circle the recall day: Saturday / Sunday			
Meals	**Foods/Beverages**	**Serving Size**	**Amount of Foods/Beverages**
Breakfast			
Morning snack			
Lunch			
Afternoon snack			
Dinner			
Supper			

PART I: STAGES OF CHANGE AND SELF-EFFICACY FOR EXERCISE AND DIET

Please tick on the relevant boxes that indicate your exercise:

1. I currently do not exercise, and I do not intend to start exercising in the next 6 months ☐
2. I currently do not exercise, but I am thinking about starting exercising in the next 6 months ☐
3. I currently exercise some, but not regularly* ☐
4. I currently exercise regularly ☐
5. I have exercised regularly in the past, but I am not doing so currently ☐

*Regular exercise = 3 times per week for 2 min or more at each time

Please tick on the relevant boxes that indicate your confidence that you would remain physically active under several specific situations:

I am confident I can participate in regular exercise when:

1. I am tired

   1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐

   1="not at all confident" 5="very confident"

2. I am in a bad mood

   1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐

   1="not at all confident" 5="very confident"

3. I feel I don't have the time

   1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐

   1="not at all confident" 5="very confident"

4. I am on vacation

   1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐

   1="not at all confident" 5="very confident"

5. It is raining or very hot

   1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐

   1="not at all confident" 5="very confident"

Questionnaire adopted from Marcus et al. 1992. Self-efficacy and the stages of exercise behavior change.

Please tick on the relevant boxes that indicate your confidence that you would remain consuming healthy diet under several specific situations:

How confident are you that you could:

1. Eat more fruit

   1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐

   1="not at all confident" 5="very confident"

2. Eat more vegetables

   1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐

   1="not at all confident" 5="very confident"

3. Reduce your intake of dietary fat

   1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐

   1="not at all confident" 5="very confident"

4. Eat more whole grains cereal, rice, noodles, breads

   1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐

   1="not at all confident" 5="very confident"

5. Limit your consumption of red meat

   1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐

   1="not at all confident" 5="very confident"

6. Limit your consumption of alcohol

   1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐

   1="not at all confident" 5="very confident"

7. Stop smoking

   1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐

   1="not at all confident" 5="very confident"

Questionnaire adopted from Burke et al 2003 & Sallis 1993.

PART J: BELIEFS ON THE EFFECT OF EXERCISE AND DIET AND BEHAVIOURAL CHANGES ON OVERALL HEALTH

Please tick on the relevant boxes that indicate your beliefs on the effect of exercise and diet:

1. Do you think regular exercise can change the course of colorectal cancer?

   1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐

   1="not at all" 5="very much"

2. Do you think diet can change the course of colorectal cancer?

   1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐

   1="not at all" 5="very much"

Please tick on the relevant boxes and answer the following questions that indicate your reasons for increasing exercise and dietary change:

1. Have you changed your level of exercise?

   Yes ☐ No ☐

2. If Yes, have they increased or decreased?

   Increased ☐ Decreased ☐

3. If Yes, why?

   .....

   .....

4. If Not, why?

   .....

   .....

4. Have you modified your diet?

   Yes ☐ No ☐

5. If Yes, why?

   .....

   .....

6. If Not, why?

   .....

   .....

Appendix W – Ethics approval from the Human Research Ethics Committee, Southern Adelaide Health Service / Flinders University (Intervention Study)

465.10 Research application approved by Ethics

Kasperski, Petrina (Health) [Petrina.Kasperski@health.sa.gov.au]

Sent: Wednesday, 2 March 2011 10:49 AM
To: Lynne Cobiac
Cc: Zalina Abu Zaid

Dear Lynne

This is a formal correspondence from the Southern Adelaide Health Service / Flinders University Human Research Ethics Committee. This committee was renamed to reflect the regional nature of the committee and the fact that the committee is jointly hosted by the Flinders University. This committee used to be known as the Flinders Clinical Research Ethics Committee. Whilst this official title of the committee has changed the committee is still properly constituted under AHEC requirements with the registration number EC00188. This committee operates in accordance with the "National Statement on Ethical Conduct in Human Research (2007)." This department only uses email correspondence for all documents unless prior arrangements have been made with the manager. No hard copy correspondence will be issued.

Application Number: 465.10

Title: Effects of nutrition counselling and lifestyle intervention on nutritional status and quality of life in patients with colorectal cancer undergoing chemotherapy.

Chief investigator: Lynne Cobiac

The Issue: The Southern Adelaide Health Service / Flinders University Human Research Ethics Committee (SAFUHREC) have reviewed and approved the above application. Your project may now commence. The approval extends to the following documents/changes:

- Mike Stevens endorsement dated 23 November 2010

Your response to committee concerns received via email on 19 February 2011 containing the following:

- Response to committee concerns document dated 12 January 2011
- Research Application Form dated 12 January 2011
- Proposed study protocol dated 12 January 2011
- Patient information sheet and consent form dated 12 January 2011
- Appendix A: A letter endorsement from the head of department(s)
- Appendix B: The confirmation and support letter by the head of Department of Surgery, Hospital Kuala Lumpur, Malaysia
- Appendix C: The confirmation and support letter by the head of Department of Surgery, Hospital Selayang, Malaysia
- Appendix D: The CV of Mr Gerald Henry
- Appendix E: The CV of Associate Professor Mohd Faisal Jabar
- Appendix F: The support and acknowledgement letter by the head of Department of Nutrition and Dietetics, Faculty of Medicine and Health Sciences, University Putra Malaysia
- Appendix G: Patient Information Sheet and Consent Form in Malay language
- Appendix H: Educational Material in English
- Appendix I: Educational material in Malay language

Approval Period: 01 March 2011 to 01 March2014

Please retain a copy of this approval for your records.

TERMS AND CONDITIONS OF ETHICAL APPROVAL

Final ethical approval is granted subject to the researcher agreeing to meet the following terms and conditions:

1. Compliance with the *National Statement on Ethical Conduct in Human Research* (2007) & the *Australian Code for the Responsible Conduct of Research* (2007)

2. To immediately report to FCREC anything that may change the ethical or scientific integrity of the project.

3. To regularly review the FCREC website and comply with all submission requirements as they change from time to time.

4. Submit an annual report on each anniversary of the date of final approval and in the correct template from the FCREC website

5. Confidentiality of research participants MUST be maintained at all times.

6. A copy of the signed consent form must be given to the participant unless the project is an audit

7. Any reports or publications derived from the research should be submitted to the Committee at the completion of the project.

8. Report Significant Adverse events (SAE's) as per SAE requirements available at our website.

9. The researchers agree to use electronic format for all correspondence with this department.

10. All requests for access to medical records at any SAHS site must be accompanied by this approval email

Kind regards
Petrina

Petrina Kasperski
Acting Executive Officer
Human Research Ethics
Southern Adelaide Health Service
SA Health
Room 2A221 - Inside Human Resources
Flinders Medical Centre, Bedford Park SA 5042

Tel: 08 8204 6453
Fax: 08 8204 4586
Email: research.ethics@health.sa.gov.au

Website: http://www.flinders.sa.gov.au/research/pages/ethics/6590/

Appendix X – Ethics approval from the Medical Research Ethics Committee, Ministry of Health Malaysia (Intervention Study)

PEJABAT TIMBALAN KETUA PENGARAH KESIHATAN
OFFICE OF THE DEPUTY DIRECTOR-GENERAL OF HEALTH
(PENYELIDIKAN & SOKONGAN TEKNIKAL)
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JAWATANKUASA ETIKA & PENYELIDIKAN PERUBATAN
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Tarikh : 21 Julai 2011

Puan Zalina Abu Zaid
Fakulti Perubatan & Sains Kesihatan
Universiti Putra Malaysia

Puan,

NMRR-11-285-8064
Effect Of Nutrition Counseling And Lifestyle Intervention On Nutritional Status And Quality Of Life In Patients With Colorectal Cancer Undergoing Chemotherapy

Lokasi Projek : Hospital Kuala Lumpur/ Hospital Selayang

Dengan hormatnya perkara di atas adalah dirujuk.

2. Jawatankuasa Etika & Penyelidikan Perubatan (JEPP), Kementerian Kesihatan Malaysia (KKM) mengambil maklum bahawa projek tersebut adalah untuk memenuhi keperluan akademik Program PhD di Nutrition and Dietetics, Flinders Clinical Molecular Medicine, School of Medicine, Flinders University, Australia.

3. Sehubungan dengan ini, dimaklumkan bahawa pihak JEPP KKM tiada halangan, dari segi etika, ke atas pelaksanaan projek tersebut. JEPP mengambil maklum bahawa kajian ini mempunyai intervensi klinikal yang rendah ke atas subjek dan hanya menggunakan borang soal-selidik untuk mengumpul data kajian. Segala rekod dan data pegawai adalah SULIT dan hanya digunakan untuk tujuan kajian dan semua isu serta prosedur mengenai *data confidentiality* mesti dipatuhi. Kebenaran daripada Pengarah Hospital di mana kajian akan dijalankan mesti diperolehi terlebih dahulu sebelum kajian dijalankan. Puan perlu akur dan mematuhi keputusan tersebut.

4. Laporan tamat kajian dan sebarang penerbitan dari kajian ini hendaklah dikemukakan kepada Jawatankuasa Etika & Penyelidikan Perubatan selepas tamatnya projek ini.

Sekian terima kasih.

BERKHIDMAT UNTUK NEGARA

Saya yang menurut perintah,

(DATO' DR CHANG KIAN MENG)
Pengerusi
Jawatankuasa Etika & Penyelidikan Perubatan
Kementerian Kesihatan Malaysia