# Characterising whole-of-diet patterns of Australian toddlers to inform the development of a short dietary risk assessment tool

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# THESIS SUMMARY

Toddlerhood is an important period of life when nutritional experiences shape children's growth, health and development. Exposure to foods during this period influences the development of food preferences and thus current and future eating patterns. Yet toddlers begin to exert their independence in food choices and demonstrate fussy eating behaviours, placing them at risk of poor nutrition. Current dietary intakes of toddlers fall short of dietary recommendations, suggesting many are at 'dietary risk', a term used to describe 'inappropriate dietary patterns' that may impair health. As poor dietary behaviours may persist over time and influence short- and long-term health, early risk identification is important so that intervention can be initiated. Traditional dietary assessment methods are associated with limitations, such as being costly, time-intensive and burdensome on researchers and responders. Short questionnaires are an attractive alternative to assess dietary intake. The literature review presented in **chapter one** highlights that there are no short (<50 item) valid and reliable dietary assessment tools to measure diet of Australian toddlers. Thus, the primary aim of this thesis was to develop and validate a short dietary assessment tool for measuring dietary risk in Australian toddlers aged 12 - 36 months.

Dietary patterns of Australian toddlers were characterised by applying principal components analysis to food intake data collected for two Australian studies. This analysis guided selection of tool items and is described in **chapter two**. Patterns were similar at two ages, 14 and 24 months, representing 'core' (items recommended to be consumed every day, such as fruit, vegetables, lean meat, dairy, high-fibre bread and water) and 'non-core' (high-fat, -sugar and/or -salt items not included in the 'core' food groups such as spreads, snacks, chocolate, processed meat and sweetened beverages) intake. Based on extracted patterns and the Australian Dietary Guidelines a 19-item Toddler Dietary Questionnaire (TDQ) that assesses the previous week's food-group intake was developed, and is described in **chapter three.** Intake is evaluated using a scoring system to determine dietary risk (0 - 100;

higher score = higher risk) and stratified into four risk categories (low, moderate, high, very high).

Evaluation of the TDQ psychometric properties, detailed in **chapter three,** showed that risk scores were highly correlated and not significantly different between administrations or compared with a valid and reliable FFQ. Further, all participants were classified into the same or adjacent risk category (low – very high). However, analyses were conducted on data collected from a relatively advantaged sample of Australian toddlers. Thus, the TDQ has reliability and comparative validity as a short toddler dietary risk assessment tool for Australian toddlers from relatively advantaged backgrounds. Further testing was undertaken to determine the convergent validity of the dietary risk construct, and is presented in **chapter four**. Risk scores were associated with nutrient intakes in expected directions; lower and higher risk scores reflect better and poorer nutrient intakes, respectively. Risk scores were positively associated with socio-demographic factors but not BMI z-scores. These findings demonstrate that dietary risk scores measure intake that may impair health but currently do not specifically assess obesity risk. The key findings, strengths and limitations, the implications for practice, and areas for further research are summarised in **chapter five**. In conclusion, the newly developed TDQ is a valid and reliable screening tool for assessing dietary risk of relatively advantaged populations of toddlers, and may therefore be useful in early childhood nutrition promotion.

# 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.’

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Many thanks to the NOURISH and SAIDI study teams at Flinders University and the Queensland University of Technology for their contributions to data used in this thesis. I gratefully acknowledge; Anthea Magarey and Lynne Daniels for coordinating the studies; Dr Rebecca Perry, Chelsea Mauch, Kylie Markow, Rachel Elovaris, Jo Meedeniya, and Rebecca Byrne who assisted in recruitment, data collection and entry; and PhD researchers Gloria Koh and Foorough Kavian who assisted in recruitment and data collection. Without the contribution of each and every member of the team, my PhD journey would not have been a success.

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# ABBREVIATIONS

| | |
|---|---|
| ALSPAC | Avon Longitudinal Study of Parents and Children |
| ANOVA | Analysis of Variance |
| BMI | Body Mass Index |
| CVD | Cardiovascular disease |
| DOB | Date of birth |
| DQI | Diet quality index |
| EDR | Estimated dietary record |
| EDNP | Energy-dense nutrient-poor |
| FFQ | Food Frequency Questionnaire |
| FITS | Feeding Infants and Toddlers Study |
| FSANZ | Food Standards Australia New Zealand |
| HEI | Healthy Eating Index |
| ICC | Intraclass correlation coefficient |
| IQ | Intelligence Quotient |
| IQR | Interquartile range |
| kJ | Kilojoule |
| KMO | Kaiser-Meyer-Olkin |
| MD | Mixed dishes |
| MJ | Megajoule |
| LOA | Limits of agreement |
| NHMRC | National Health and Medical Research Council |
| MD | Mixed dishes |
| PCA | Principal components analysis |
| Q | Quartile |
| RCT | Randomised controlled trial |
| SAIDI` | South Australian Infant Dietary Intake |
| SEIFA | Socio-Economic Indices for Areas |
| SES | Socio-economic status |
| SD | Standard deviation |
| SPSS | Statistical Package for the Social Sciences |
| SWS | Southampton Women's Survey |
| TAFE | Technical and Further Education |
| TDQ | Toddler Dietary Questionnaire |
| UK | United Kingdom |
| USA | United States of America |
| WDR | Weighed dietary record |
| WHO | World Health Organisation |
| %E | Percent energy |

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# OVERVIEW OF THESIS STRUCTURE

This thesis is structured as five chapters, with four comprising material already published or accepted for publication, summarised in Table 0-1 (see Appendix 1 - Papers, conference presentations and awards/prizes arising from this thesis).

**Chapter one** provides the thesis context, outlining the aims and significance of the research. Included in this chapter is a systematic review of the literature on short dietary assessment tools for children aged less than five years, published in the *Journal of Obesity*.

**Chapter two** characterises dietary patterns of Australian toddlers aged 14 and 24 months by applying principal components analysis (PCA) to dietary data from two Australian studies. This work has been published in the *European Journal of Clinical Nutrition*.

The next two chapters detail the development and testing of a short dietary risk assessment tool for Australian toddlers, the Toddler Dietary Questionnaire (TDQ). Two published papers were derived from these chapters: (1) the development of the TDQ and testing of its test-retest reliability and relative validity, published in the *British Journal of Nutrition* (**chapter three**) and, (2) testing of the convergent validity of the TDQ, *accepted for publication in Nutrition & Dietetics* (**chapter four**).

**Chapter five** brings together the thesis findings. The relevance of the findings to clinical practice and research are discussed in the context of the thesis strengths and limitations, leading to a thesis conclusion.

**Table 0-1 Summary of publications contributing to this thesis; their full citation and publication status at the time of submission**

| Chapter | Full citation | Status |
|---|---|---|
| 1 | **Bell L,** Golley R, Magarey A (2013) Short tools to assess young children's dietary intake: a systematic review focusing on application to dietary index research, *Journal of Obesity*, Article ID 709626, 17 pages, Epub 26 Sept 2013. | Published[1] [1] |
| 2 | **Bell L**, Golley R, Daniels L, Magarey A (2013) Dietary patterns of Australian children aged 14 and 24 months and associations with socio-demographic factors and adiposity, *European Journal of Clinical Nutrition*, 67(6): 638-45 | Published[2] [2] |
| 3 | **Bell L,** Golley R, Magarey A (2014) A short food-group based dietary questionnaire is reliable and valid for assessing toddlers' dietary risk, *British Journal of Nutrition*, 112(4): 627-37 | Published[2] [3] |
| 4 | **Bell L**, Golley R, Magarey A (2014) Dietary risk scores of Australian toddlers are associated with nutrient intakes and socio-demographic factors, but not adiposity, *accepted 8th March 2015 Nutrition & Dietetics* | Accepted[2] [4] |

[1]The review was conceived and designed by AM, RG and LB. LB was responsible for the review's conduct and synthesis with input from AM and RG. LB drafted the initial manuscript and AM and RG provided critical review and feedback. All authors read and approved the final manuscript.

[2]The study was conceived and designed by AM, RG and LB. LB was responsible for the study's conduct and performed all statistical analysis with input from AM and RG. LB drafted the initial manuscript and AM and RG provided critical review and feedback. All authors read and approved the final manuscript