

Copyright is owned by the Author of the thesis. Permission is given for a copy to be downloaded by an individual for the purpose of research and private study only. The thesis may not be reproduced elsewhere without the permission of the Author.

Using the Behavioural Paediatric Feeding Assessment Scale to Identify Fussy Eaters, and Their Adherence to Dietary Guidelines

A thesis presented in partial fulfilment of the requirements for the degree of

Master in Science
in
Human Nutrition

at Massey University, Albany,
New Zealand

Sara Sayaka Hashimoto

2015

Copyright is owned by the author of the thesis. Permission is given for a copy to be downloaded by an individual for the purposes of research and private study only. The thesis may not be reproduced elsewhere without the permission of the author.

Abstract

Background: Childhood feeding issues range from problems with few immediate health risks to significant problems requiring medical intervention. Fussy eating is implicated in low critical nutrient intake and poor eating habits that could risk later chronic disease. A simple tool to assess fussy eating is not available and it is unknown whether fussy eaters risk subsequent poor adherence to dietary guidelines. The Behavioural Paediatric Feeding Assessment Scale (BPFAS) is a parent-response tool designed to measure feeding issues in children. DICE was developed to measure adherence to NZ Ministry of Health (MoH) food and nutrition guidelines.

Aims: Primary aim: To determine whether the BPFAS can be used to identify young children who are fussy eaters and at risk of not adhering to MoH food and nutrition guidelines. Secondary aim: To identify risk factors for poor adherence to MoH food and nutrition guidelines, and higher incidence of problem mealtime behaviours. Objectives were to a) determine whether a higher score on the BPFAS facilitates the identification of young children as fussy eaters, b) to determine whether a higher score on the BPFAS and/or parental perception of their child as a fussy eater relates to poor adherence to MoH food and nutrition guidelines and c) to identify risk factors for poor adherence to MoH food and nutrition guidelines as measured by DICE, and higher incidence of problem mealtime behaviours as measured by the BPFAS.

Methods: 1959 parents of New Zealand 2 to 4 year old children were recruited through online- and print-media to complete an online questionnaire about their child's eating. 570 were excluded based on age, place of residence and lack of consent. Data was collected on: incidence of problem mealtime behaviours using the Total Frequency Score (TFS) from BPFAS; adherence to Ministry of Health (MoH) food and nutrition guidelines using the Dietary Index for a Child's Eating (DICE); parental perceptions of fussiness; and medical history and dietary restrictions related to feeding problems. Pearson's chi-square tests were used to examine associations between BPFAS and parental perceptions of fussiness and the association of DICE with BPFAS and parental perceptions of fussiness respectively. Children were stratified into those with and without risk factors for feeding issues and independent t-tests and Mann-Whitney U tests were conducted to ascertain if

any significant differences between groups existed with regard to DICE and BPFAS scores.

Results: 22.7% of children scored 81 or more on the TFS (range: 36-141) and were stratified into the clinical feeding problem group. TFS for normative and problem groups were 62.6 ± 9.98 and 92.4 ± 10.5 respectively. The problem group had poorer DICE (range: 49-114) scores (81.9 ± 12.3) than normative group (91.8 ± 9.23). There were overall moderately strong inverse correlations ($r = -0.45$, $p < 0.001$) between DICE and TFS, and between DICE and parentally-perceived fussiness score ($r = -0.42$, $p < 0.001$). A strong positive correlation between TFS and parentally-perceived fussiness score ($r = 0.72$, $p < 0.001$) was also found. These relationships remained significant when analysis was repeated only on the normative group. TFS was worse in children who had: problems breastfeeding (72.1 ± 16.5 vs 67.8 ± 15.5) and starting solids (77.6 ± 19.2 vs 68.3 ± 15.3); autism (85 ± 25.0 vs 69.2 ± 15.9); medical problems affecting feeding (80.9 ± 18.2 vs 69.2 ± 16.0) and not affecting feeding (75.5 ± 17.0 vs 69.1 ± 15.9); eating difficulties (84.9 ± 19.4 vs 69.1 ± 15.8); parental perception of underweight (77.8 ± 17.9 vs 68.0 ± 15.2 and 67.0 ± 16.2 for average and overweight); and parental concern about weight (82.1 ± 18.1 vs 67.8 ± 15.0), than those who did not. DICE was worse in children who had: problems starting solids (84.9 ± 11.5 vs 90.1 ± 10.7); developmental delay (82.8 ± 12.9 vs 89.7 ± 10.9); eating difficulties (80.9 ± 14.5 vs 89.8 ± 10.8); parental perception of underweight (86.0 ± 11.9 vs 90.12 ± 10.7 and 90.7 ± 10.0 for average and overweight); and parental concern about weight (84.7 ± 12.9 vs 90.2 ± 10.5), than those who did not.

Conclusion: These results indicate that children with higher TFS have higher incidences of problem mealtime behaviours and adhere less to MoH food and nutrition guidelines than normative eaters. Children in the higher end of the normative range for TFS are also classed as fussy eaters by their parents, suggesting the BPFAS can be used to identify fussy eaters.

Problems with breastfeeding and starting solids, autism, medical problems, eating difficulties, parental perception of underweight, and parental concern about weight appear to be red flags for problem mealtime behaviours. Indicators for poor adherence to guidelines may be: breastfeeding problems, developmental delay, eating difficulties, parental perception of underweight and parental concern about weight.

Acknowledgements

I would like to acknowledge the contribution of a number of people for their involvement in and support during this research. Without the expertise and insight of both my academic supervisors Dr. Cath Conlon and Dr. Pamela von Hurst, this thesis could not have been completed. Your thorough and detailed feedback helped turned what I feared could just be enthusiasm into good science. Thank you.

Thanks to Niki Bezzant and Sonia Yoshioka-Braid for their help with recruitment, and Kathryn Beck for her advice on developing the Dietary Index for a Child's Eating. I would also like to acknowledge the help of Aaron Schiff who provided statistical guidance.

I am so grateful to my mother and stepfather Margaret and John Bukowski for their financial and emotional support over the course of this whole change of direction in my life - you have two scientists in the family now! Thank you also to my father and stepmother Makoto and Seiko Hashimoto for their moral and practical support. I always feel like you are there for me. Arigatou.

Finally, thank you to Ben Temple for being my sounding board and editor, for your Excel help and your constant and unstinting emotional, moral and financial support. Your understanding, support and love are everything to me, and without them this challenge would have been only a struggle, not the journey it has been.

Table of Contents

Abstract	ii
Acknowledgements	v
Abbreviations	x
1. Introduction	1
1.1 Background	1
1.2 Purpose of the Study	5
1.3 Aims and Objectives.....	6
1.4 Thesis Structure	7
1.5 Researchers' Contributions	7
2. Literature Review	8
2.1 Focus and Scope	8
2.2 Why are Feeding Issues a Concern?	9
2.3 Fussy Eating: Definition and Prevalence.....	14
2.4 The Development of Fussy Eating	16
2.5 Nutrient Intakes, Weight and Growth	21
2.6 Predictors and Correlates of Fussy Eating Behaviours at Mealtime	24
2.7 Measures of Food Fussiness, Mealtime Behaviours, Adherence to MoH Food and Nutrition Guidelines and Parental Perceptions of Fussy Eating	27
2.8 MOH Food and Nutrition Guidelines	31
2.9 Measuring Nutritional Adequacy	34
2.10 Summary	43
3. Methods	45
3.1 Study Design	45
3.2 Ethical Approval	45
3.3 Study Population	45
3.4 Informed Consent.....	47
3.5 Data Collection and Questionnaire.....	47
3.6 Measures to Assess Fussy Eating, Parental Perceptions of Fussy Eating and Feeding Behaviours	49
3.7 Assessment of Adherence to MoH Food and Nutrition Guidelines: Dietary Index for a Child's Eating (DICE) (Section Three of Questionnaire)	53
3.8 Assessing Risk Factors for Feeding Problems, Medical History Related to Feeding Behaviours, Dietary Restrictions and Parental Perception of Weight	58
3.9 Collection of Demographic Data.....	58
3.10 Dissemination of Results and Feedback to Participants	59
3.11 Statistical Analysis.....	59

4. Results	63
4.1 Participants.....	63
4.2 Behavioural Paediatric Feeding Assessment Scale (BPFAS).....	65
4.3 Dietary Index for a Child's Eating (DICE) Score.....	67
4.4 Children's Eating Behaviour Questionnaire Fussiness Sub Scale (CEBQ-FSS)	69
4.5 Parental Perception of Fussiness Likert Type Item Score (LTIS)	70
4.6 Effect of Risk Factors, Medical History and Dietary Restrictions on BPFAS, DICE, CEBQ-FSS and Parental Perception of Fussiness LTIS	71
4.7 Associations Between BPFAS, DICE, CEBQ-FSS and Parental Perception of Fussiness LTIS.....	75
4.8 Effect of Parental Perception of Weight on BPFAS, DICE, CEBQ-FSS and Parental Perception of Fussiness LTIS	77
4.9 Effect of Parental Concern About Weight on BPFAS, DICE, CEBQ-FSS and Parental Perception of Fussiness LTIS	78
4.10 Factors Contributing to DICE Scores	79
5. Discussion	81
5.1 Characteristics of Study Population	82
5.2 Behavioural Paediatric Feeding Assessment Scale (BPFAS).....	84
5.3 Dietary Index for a Child's Eating (DICE) Score.....	86
5.4 Children's Eating Behaviour Questionnaire Fussiness Sub Scale (CEBQ-FSS)	88
5.5 Parental Perception of Fussiness Likert Type Item Score (LTIS)	89
5.6 Effect of Risk Factors, Medical History and Dietary Restrictions on Mealtime Behaviours, Adherence to MoH Food and Nutrition Guidelines and Parental Fussiness Perceptions ...	89
5.7 Parental Perceptions and Concern About their Child's Weight	93
6. Conclusion.....	95
6.1 Summary of the Study.....	95
6.2 Conclusions.....	96
6.3 Limitations	97
6.4 Strengths.....	99
6.5 Recommendations for Future Studies.....	101
7. Reference List.....	102
8. Appendices	114

List of Tables

Table 1.1 Researchers' Contributions to the Study.....	7
Table 2.1 Tools Used to Assess Fussy Eating in Children.....	29
Table 2.2 Components of the Dietary Guideline Index According to the Dietary Guidelines for Australian Adults	39
Table 2.3 Methods of Assessing Nutritional Intake	42
Table 3.1 Behavioural Paediatric Feeding Assessment Scale Scores for Normative and Clinical Groups.....	52
Table 3.2 Components of the Dietary Index for a Child's Eating (DICE).....	55
Table 4.1 Demographic Characteristics of Participants	65
Table 4.2 Behavioural Paediatric Feeding Assessment Scale Scores for All Participants and Normative/Clinical Feeding Problem Groups	67
Table 4.3 Dietary Index for a Child's Eating Scores for All Participants and Normative/Clinical Feeding Problem Groups	68
Table 4.4 Children's Eating Behaviour Questionnaire Fussiness Sub Scale Scores for All Participants and Normative/Clinical Feeding Problem Groups	70
Table 4.5 Parental Perception of Fussiness LTIS for All Participants and Groups	70
Table 4.6 Comparison of Behavioural Paediatric Feeding Assessment Scale Scores Between Yes/No Groups for Risk Factors for Feeding Issues and Medical History.....	72
Table 4.7 Comparison of Dietary Index for a Child's Eating Scores Between Groups With and Without Risk Factors for a Feeding Issue or Dietary Restriction	73
Table 4.8 Comparison of Parental Perception of Fussiness LTIS Between Groups With and Without Risk Factors for Feeding Issues and Medical History	75
Table 4.9 Associations Between Behavioural Paediatric Feeding Assessment Scale, Dietary Index for a Child's Eating, Children's Eating Behaviour Questionnaire Fussiness Sub Scale Score and Parental Perception of Fussiness LTIS.....	76
Table 4.10 Relationship Between Total Frequency Score, Total Problem Score, CEBQ Fussiness Sub Scale and Parental Perception of Fussiness LTIS in Normative and Clinical Feeding Problem Groups	76
Table 4.11 Effect of Parental Perception of Weight on Behavioural Paediatric Feeding Assessment Scale, Dietary Index for a Child's Eating, Children's Eating Behaviour Questionnaire Fussiness Sub Scale Score and Parental Perception of Fussiness	78
Table 4.12 Effect of Parental Concern About Weight on Behavioural Paediatric Feeding Assessment Scale, Dietary Index for a Child's Eating, Children's Eating Behaviour Questionnaire Fussiness Sub Scale Score and Parental Perception of Fussiness LTIS....	79
Table 4.13 Summary of Multiple Regression for Factors Contributing to Dietary Index for a Child's Eating Score (n = 1389).....	80
Table 5.1 Comparison of Frequency Scores from the Current Study and the Literature	86

List of Figures

Figure 2.1 New Zealand policy context for the Food and Nutrition Guidelines for Healthy Children and Young People (Aged 2-18 Years): A Background Paper	33
Figure 4.1 Flow Diagram Outlining Recruitment and Final Number of Participants for Data Analysis	64
Figure 4.2 Relationship Between Dietary Index for a Child's Eating (DICE) and Behavioural Paediatric Feeding Assessment (BPFAS) Total Frequency Score	69

Abbreviations

AGHE	Australian Guidelines for Healthy Eating
BPFAS	Behavioural Paediatric Feeding Assessment Scale
CEBQ-FSS	Children's Eating Behaviour Questionnaire Fussiness Sub Scale
CFS	Child Frequency Score
CPS	Child Problem Score
DGI	Dietary Guideline Index
DGAA	Dietary Guidelines for Australian Adults
DICE	Dietary Index for a Child's Eating
DSM	Diagnostic and Statistical Manual of Mental Disorders
ECE	Early Childhood Education
FHQ	Food Habits and Attitudes Questionnaire
FFQ	Food Frequency Questionnaire
HEAT	Health Equity Assessment Tool
LTIS	Likert Type Item Score
MoH	New Zealand Ministry of Health
NNS	Australian National Nutrition Survey
NRV	Nutrient Reference Values
NZ	New Zealand
OECD	Organisation for Economic Co-operation and Development
PBM	Peak Bone Mass
PFS	Parent Frequency Score
PPS	Parent Problem Score
PPFussiness	Parental Perception of Fussiness
RDI	Recommended Daily Intake
TFS	Total Frequency Score
TPS	Total Problem Score
UNICEF	United Nations Childrens' Fund
US	United States
WHO	World Health Organisation
YES	Young Childrens' Eating Study

1. Introduction

1.1 Background

Most childhood feeding problems involve food refusal to a greater or lesser degree and include but are not limited to issues such as neophobia, infantile anorexia and picky/fussy eating (Galloway, Fiorito et al. 2005). As Bryant-Waugh et al. (2010) discuss, feeding issues in childhood affect not only the child but the whole family. Family relationships and interactions around mealtimes also contribute to the development of feeding problems. Feeding problems, even those that have their roots in an underlying physical issue, are the result of a complex interplay of physical, behavioural and social factors. Not only the nature but the severity of feeding problems vary greatly in range (Babbitt, Hoch et al. 1994).

Many parents encounter feeding issues of varying degrees at some stage of their children's development (Carruth, Ziegler et al. 2004) although they may not consider them to be a feeding problem, that is, something that requires solving. Because eating is an inextricable part of human life, parental concerns about their child's eating behaviour may be for social or health reasons, or both. Eating behaviour in this study is defined as patterns of behaviour at and around mealtimes (Crist & Napier-Phillips 2001). These include what foods are accepted and refused, refusal patterns such as whining and delaying, and behaviour related to difficulty handling certain foods such as gagging (Crist & Napier-Phillips 2001). Feeding behaviour will refer to both the child's eating behaviour and parental strategies around mealtimes.

Visits to the family doctor to address concerns about feeding problems in children are commonplace (Jacobi, Agras et al. 2003). Some eating behaviours that parents may find problematic are in fact part of normal development (Cooke, Haworth et al. 2007) and are no cause for concern. Nevertheless, some eating behaviours can develop into serious feeding problems if mishandled (Carruth, Ziegler et al. 2004). Childhood feeding problems may develop into long-term undesirable eating habits which promote poor dietary diversity and are associated with a variety of health problems in later life (Barker 2012). Risk factors for feeding problems in infancy include problems with breastfeeding and preterm birth

(Schmid, Schreier et al. 2011) and later risk factors include medical conditions such as autism spectrum disorder (ASD) (Provost, Crowe et al. 2010).

Childhood feeding issues range from milder problems with comparatively fewer immediate health risks such as fussy eating, the focus of this study, to significant problems that require medical intervention (Berlin, Davies et al. 2009) such as dysphagia. Fussy eating has been defined inconsistently and the assessment of fussy eating is in its infancy (Dovey, Staples et al. 2008). Unfortunately, identifying fussy eating in children is hampered by a) the lack of simple diagnostic tools and a standardised definition, and b) the subjective perceptions of parents. For example, one parent might not describe their child as a fussy eater while another parent may say they think they are. Parents can also be inconsistent in their description of their child as a fussy eater over a short time period (Boquin, Smith-Simpson et al. 2014).

A robust tool specifically designed to assess fussy eating is not available. However, the Behavioural Paediatric Feeding Assessment Scale (BPFAS) which is designed to assess whether a child's feeding problem has clinical significance, has been validated for use in a number of countries. Using the BPFAS, children are classed as either having a feeding issue of clinical significance or as a normative eater. While all children in studies that have used the BPFAS displayed similar problem mealtime behaviours (which included characteristically fussy eating behaviours), children in the clinical feeding problem group displayed these behaviours more frequently than children in the normative group. It is likely that children who are not in the clinical range (Dovey, Jordan et al. 2013), but at the upper end of the normative range of this scale could be classed as fussy eaters and will also be classed as fussy eaters by their parents. None of the studies to date that have used the BPFAS have determined whether a score within the upper range of the normative feeding scale is indicative of a fussy eater or whether this is associated with parental perception of their child being a fussy eater.

Fussy eating is also known in the literature as picky eating and less commonly as faddy and selective eating. Although searches for picky eating return a greater number of results than for fussy eating, the two phrases are used interchangeably in many studies (Dovey, Staples et al. 2008; Tharner, Jansen et al. 2014). Although we allude to the same concept as other studies in this field, this study will refer for the sake of consistency to fussy, rather

than picky eating, in line with the New Zealand Ministry of Health (MoH) parlance used in online publications for parents.

Many studies define fussiness using parental perception by asking parents whether their child is fussy as part of a questionnaire (Carruth, Skinner et al. 1998; Jacobi, Schmitz et al. 2008; Li, Wang et al. 2014; Reau, Senturia et al. 1996) although at least one study combined this with behavioural observation (Boquin, Smith-Simpson et al. 2014). Children whose parents described them as fussy and non-fussy eaters were observed using standardised foods in their own homes. There were significant differences in mealtime behaviours and reactions to common food products between the two groups (Boquin, Smith-Simpson et al. 2014). According to parental reports, eating small amounts, neophobic behaviour, refusal of specific food groups and preference for specific methods of food preparation are characteristic of fussy eaters (Jae Eun, Juhee et al. 2011). Another approach assesses the proportion of recommended daily intake (RDI) that actual intake achieves. For example, fussy eating defined as an average consumption of <65% for four of six food groups (Leal, Salto et al. 2012).

There have been several attempts to define fussy eating. A latent profile analysis of data collected using the Children's Eating Behaviour Questionnaire (CEBQ) was used to identify fussy eating behaviours in 4 year olds. The fussy eating behaviour profile showed high food fussiness, slowness in eating and satiety responsiveness combined with low enjoyment of food and food responsiveness (Tharner, Jansen et al. 2014). Fussy eating usually involves the consumption of an insufficient amount or inadequate variety of food through rejection of certain foods, including familiar foods (Dovey, Staples et al. 2008).

The MoH food and nutrition guidelines were developed in order to promote optimal growth and physical and cognitive development in children over both the short and long term. If parents provide food and nutrition which meets these guidelines, their children will meet recommendations for nutrient intakes for their age group. Fussy eating is thus a concern if it means children are not meeting these guidelines.

Fussy eating has been associated with lower intakes of energy, protein, fat and vegetables (Dubois, Farmer et al. 2007), micronutrients including calcium (Carruth, Ziegler et al. 2004)

and omega 3 fatty acids (Tharner, Jansen et al. 2014). Poor nutritional status affects cognitive and physical development in children in the short and long term (Barker 2012).

Although fussy eating has been associated with underweight (Ekstein, Laniado et al. 2010) there are now concerns that the eating patterns associated with fussy eating may lead to overweight and obesity (Finistrella, Manco et al. 2012; Haszard, Skidmore et al. 2015). It is possible for fussy eating to be overlooked or misdiagnosed because a child is showing normal growth. Children with very restricted diets may even be overweight, but at the same time deficient in a number of critical nutrients. On the other hand, while it is normal for children to begin to exhibit signs of food neophobia around the age they begin walking (Birch 1999), expectations of what a child *should* eat may also cause parents to label children fussy eaters without cause (Leung, Marchand et al. 2012). Fussy eating behaviours cause stress for parents and children at mealtimes, and disagreement on how to handle fussy eating behaviours between parents (Jacobi, Agras et al. 2003).

While the development of fussy eating has a genetic component (Cooke, Haworth et al. 2007; Carnell, Haworth et al. 2008), the development of fussy eating behaviours in children is also related to parental feeding practices and environment (Cooke, Haworth et al. 2007; Tan & Holub 2012; Morrison, Power et al. 2013). Eating behaviour has been found to remain continuous and stable over childhood (Ashcroft, Semmler et al. 2008) and therefore the establishment of good eating behaviours in early childhood is important.

Food is widely available and affordable for many people in New Zealand although food insecurity is an issue among some New Zealanders and is known to impact on dietary diversity (D'Souza & Jolliffe 2014; Lee & Nam, 2014). Nevertheless, financially secure parents for whom food insecurity is not an issue express concern over eating behaviours that affect the diversity, or lack thereof, in their child's diet. While the current prevalence of fussy eating in New Zealand is unknown, the New Zealand Children's Food and Drinks Survey shows that 13% of parents always find it difficult to get their children to eat healthfully, while 26% sometimes find it difficult (National Bureau of Research 2008) and an older population study found 24% of parents of 2 year olds in New Zealand described their child as having eating or feeding problems with 18% of parents reporting the same at 4 years old (Beautrais, Fergusson et al. 1982).

If high numbers of children are perceived by their parents to be fussy eaters then it is important to examine whether this is merely a function of unrealistic expectations about the number of foods children should accept so that parents can be reassured, or whether widespread fussy eating means young children in New Zealand are not meeting the nutritional recommendations in the MoH food and nutrition guidelines.

1.2 Purpose of the Study

There is a paucity of research on fussy eating in young children which is specific to New Zealand. A simple diagnostic tool to assess fussy eating is not available. It is not known whether fussy eaters are actually at risk of poor adherence to MoH food and nutrition guidelines in New Zealand or whether parental perceptions of fussiness in their child relate to a feeding problem. It is also not clear whether the risk factors for higher incidence of problem mealtime behaviours and poor adherence to food and nutrition guidelines in New Zealand are the same as in other countries.

To shed light on these issues, this cross-sectional study aims to determine whether the BPFAS can be used to identify young children who are classed as fussy eaters and how fussy eating relates to adherence to MoH food and nutrition guidelines. The Dietary Index for a Child's Eating (DICE) is a diet quality indicator that was developed for this study in order to assess adherence to MoH food and nutrition guidelines. A low score on the DICE could be an indicator of dietary insufficiency.

This study has also been designed to investigate how well the BPFAS correlates with parental perceptions of feeding issues in their children. This thesis presents parental report of feeding behaviour, adherence to MoH food and nutrition guidelines, and parental perceptions of their child's fussiness, along with medical and other risk factors which may have contributed to the development of their eating behaviours.

By age two, children are usually at a stage of development where they can eat independently and can accept and reject foods that are offered to them based on their own preferences. Fussy eating seems to be especially common in late pre-school aged children (Caton, Blundell et al. 2014). Furthermore, numbers of serving sizes in the New Zealand MoH food and nutrition guidelines change for some foods between pre-school

aged children and children of school age. For these reasons the study participants were limited to parents of children between the ages of 2 and 4 years.

Findings from this research will be useful for healthcare professionals dealing with parents who are concerned about their child's eating behaviour. If parental perceptions of their child's fussiness are a reliable indicator of feeding issues, then children of concerned parents are likely to be good candidates for further screening using the BPFAS. If children who are deemed to be fussy eaters by their parents score higher in the normative range of the BPFAS than children who are not described as such, the tool may be useful for the identification of fussy eaters. If scoring highly on the BPFAS tool also correlates with poor scores on the DICE tool then this has the potential to identify those fussy eating children who have poor adherence to current MoH food and nutrition guidelines and are thus at risk of nutritional insufficiency. As the BPFAS measures mealtime behaviours, it will highlight areas of concern for which behavioural interventions can be designed - such as those that address fussy eating or increase dietary diversity.

1.3 Aims and Objectives

1.3.1 Primary Aim

To determine whether the BPFAS can be used to identify young children who are fussy eaters and at risk of not adhering to MoH food and nutrition guidelines.

1.3.2 Secondary Aim

To identify risk factors for poor adherence to MoH food and nutrition guidelines, and higher incidence of problem mealtime behaviours.

1.3.3 Objectives

1. To determine whether a higher score on the BPFAS facilitates the identification of young children as fussy eaters.
2. To determine whether a higher score on the BPFAS and/or parental perception of their child as a fussy eater relates to poor adherence to MoH food and nutrition guidelines.

3. To identify risk factors for poor adherence to MoH food and nutrition guidelines as measured by the DICE, and higher incidence of problem mealtime behaviours as measured by the BPFAS.

1.4 Thesis Structure

This study is structured into six chapters. The introductory chapter places the study in context and explains the rationale for conducting the research. Chapter 2 reviews the literature on the aetiology and impact of fussy eating, and the literature on the instruments used in the study. In Chapter 3, the methods used to determine whether the BPFAS can be used to identify young children who are risk of poor adherence to MoH food and nutrition guidelines and hence at risk of nutritional insufficiency are outlined and justified. The results of the study are presented in Chapter 4 with findings discussed in Chapter 5. Finally, Chapter 6 summarises the study and reflects on the strengths and limitations of this research, with recommendations for future research.

1.5 Researchers' Contributions

Table 1.1 Researchers' Contributions to the Study

Author	Contributions to Thesis
Saya Hashimoto	Led the research, applied for ethics, designed research including questionnaire and Dietary Index for a Child's Eating tool, recruited participants, conducted research, analysed data and performed statistical analysis, interpreted results, authored thesis
Dr. Cath Conlon	Academic supervisor, applied for ethics, designed research including assistance with questionnaire development, recruited participants, revised and approved thesis
Dr. Pamela von Hurst	Academic supervisor, applied for ethics, assisted with designing research, recruited participants, assisted with statistical analysis, revised and approved thesis
Dr. Kathryn Beck	Assistance with design of Dietary Index for a Child's Eating tool

2. Literature Review

2.1 Focus and Scope

A systematic method was used to identify, select and critically appraise relevant research and to collect and analyse data from the studies that are included in this literature review. Concepts were identified from the research question and then subject headings created for each concept. Key words were identified under each subject heading. Web of Science, Scopus and Google Scholar were used to search between August 2014 and February 2015 using the following key words alone and in combination: avoidant/restrictive food intake disorder (ARFID), calcium, children, deficiency, development, diet quality index, diet* diversity, diet* guidelines, diet* quality, dietary assessment, eating behaviour, faddy eating, feeding issues, feeding practice, feeding problems, food aversion, food avoidance, fussy eating, iron, Likert scales, measure, neophobia, nutrition, nutrition* status, nutritional sufficiency, picky eating, selective eating, tool, young children.

English language meta-reviews, case studies and clinical trials on children were included while meetings and conference presentations were filtered out. Only studies conducted between 1980 and 2015 were included. Key authors were also used as search terms and reference lists from key papers were used to further identify any studies or relevant evidence that had been missed in the electronic literature search.

2.1.1 Focus

The aim of this review is to provide the background for, introduce the tools used in and to clarify the concepts necessary for understanding the scientific rationale behind the current study. This review will focus on the published literature related to why fussy eating is of concern for parents and health professionals and how fussy eating is defined and assessed. Tools used to assess feeding issues in this study will be discussed, including the Behavioural Paediatric Feeding Assessment Scale (BPFAS). One of the main concerns with feeding issues in young children is the effect on diet quality and whether this is adequate to promote optimal health and growth. Therefore measures of diet quality and how adherence to nutrition guidelines are assessed will also be reviewed.

2.1.2 Scope

Earlier conceptions of feeding difficulties were framed as an organic/non-organic dichotomy where organic feeding problems had a biological cause such as oral motor delay (Burklow, Phelps et al. 1998). However, even in such cases, psychological and social factors cannot be separated from the aetiology of the condition in 85% of cases (Burklow, Phelps et al. 1998) and bio-psychosocial models such as the one presented by Berlin et al. (2009) are now widely used to conceptualise and treat feeding issues by drawing on an interdisciplinary approach (Berlin, Davies et al. 2009; Kroll, 2011; Owen, Ziebell et al., 2012). In this type of model, the interplay between biological and behavioural aspects of feeding issues is reflected. Severe feeding difficulties such as those found in children with neurological impairment and cerebral palsy (Sullivan, Lambert et al. 2000) are outside the scope of this review which will concentrate specifically on what is known in the literature as fussy, selective, faddy or picky eating. While this less severe type of feeding issue is also found in older children, the focus here will be on fussy eating in early childhood and on nutritional guidelines and diet quality as they relate to this age group, although longitudinal studies on children up to pre-adolescence will be discussed.

2.2 Why are Feeding Issues a Concern?

Appropriate physical and cognitive development and health over the lifecycle requires adequate nutrition. Eating is not only necessary to sustain life, our eating behaviour is inextricably linked with our physical and cognitive health and development, mental state (Jacka, Kremer et al. 2011; Loprinzi & Mahoney, 2014) and social lives (Golija 2014; Wiggins 2013) from birth to death. Children grow continuously and go through periods of very rapid growth. Adequate intakes of energy, macronutrients and micronutrients are necessary for optimal growth, brain development and health in later life (Barker 2012).

2.2.1 Physical and Cognitive Effects

Studies comparing children with and without iron deficiency report poorer cognitive, behavioural and psychological outcomes in later childhood (Gottfried, Gerring et al. 2013) mental and psychomotor skills (Madan, Rusia et al. 2011) IQ and executive function (Doom, Gunnar et al. 2014) social-emotional function and persisting neuro-physiological differences (Lozoff, Beard et al. 2006; Lozoff, Castillo et al. 2014). The potential mechanisms of iron deficiency on brain development include effects on neuro-metabolism, myelination, and neurotransmitter function (Lozoff, Beard et al. 2006).

Sufficient intakes of dietary calcium along with sufficient protein, vitamins K and D, magnesium, zinc and phosphorus are crucial for the achievement of optimal peak bone mass (PBM) in children and adolescents. Variations in calcium intake during growth may account for between 5 -10% of difference in achievement of PBM (Ilich, Badenhop et al. 1996). Calcium intake during growth directly affects an individual's PBM and therefore relates to risk for developing osteoporosis and fracture risk in later life (Zhu & Prince 2012).

Protein is necessary not only for muscle development and maintenance but a multitude of immunological and hormonal processes, while essential fatty acids are involved in brain growth and cellular signalling. One example of this mechanism was seen in a randomised controlled trial which showed that omega-3 supplementation reduces behavioural problems in children (Raine, Portnoy et al. 2014). Vitamin B deficiency which is sometimes found in infants who consume a vegan diet can cause pernicious anaemia and death.

If energy intake is adequate or excessive, it is possible for children with poor diets to be of a normal weight or overweight, but at the same time deficient in a number of critical nutrients (Shmayaa, Eilat-Adar et al. 2015) and therefore reliance solely on growth as an indicator of dietary adequacy can be misleading.

Population studies have found that while mothers of fussy and non-fussy eaters offer their children foods of similar energy density in similar amounts, young children who fail to thrive or have poor growth reject offered food more often and self-feed less often than children with normal growth. These behavioural differences accounted for about a third of the difference in energy intake between the groups (Drewett, Kasese-Hara et al. 2003). However, children who are described as fussy eaters by their parents generally show normal growth in population-wide studies (Wright, Parkinson et al. 2007).

2.2.2 Psychological and Behavioural Issues

Fussy eating that begins in early childhood can continue into later childhood and is associated with undesirable outcomes during both stages. In a study which followed children from birth to 5.5 years of age (n = 135), 3.5 to 5.5 year old fussy eaters were more likely to show negative affect such as anxiety, distress and depression than non-fussy eaters (Jacobi, Agras et al. 2003). Fussy eating in a cohort (n = 426) of 8 -12 year olds

was associated with higher levels of anxiety and depression, symptoms of withdrawal, somatic complaints and delinquent behaviours (Jacobi, Schmitz et al. 2008).

There is limited robust evidence on the effect of fussy eating in early childhood on anorexia nervosa in adolescence. In a study of 659 children interviewed three times between ages one and 21 (Marchi & Cohen 1990) and a cross-sectional case-control study using data collected from retrospective interviews of patients' mothers (Rastam 1992) childhood feeding problems were found to be more common in anorexics than non-anorexics. More current studies have found no significant differences in retrospective maternal report of childhood feeding and eating practices between anorexics and non-anorexics however (Dellava, Trace et al. 2012; Micali, Holliday et al. 2007). Fussy eating may in fact be protective against anorexia because fussy eaters are not concerned with being thin, a precursor to disordered eating (Jacobi, Schmitz et al. 2008).

As research on fussy eating is in its infancy, there are only a small number of studies which look at the long term effects of associations with fussy eating in early childhood but eating patterns have significant stability over time (Ashcroft, Semmler et al. 2008; Marchi & Cohen 1990). In two studies by Jacobi (2002 and 2008) fussy eating had a similar prevalence in pre-school aged children and pre-adolescents.

It is not clear whether poor behavioural and psychological outcomes are precursors, concomitants or consequences of fussy eating. Nevertheless, early intervention for children who show fussy eating behaviours is important not only to ensure appropriate growth and development in early childhood, but also because it may help avoid behavioural problems continuing into later childhood and adulthood.

2.2.3 Developing Healthy Eating Behaviours in Early Life

It is important to establish good eating habits as soon as complementary foods are introduced. Early childhood is a seminal time in the development of food preferences and eating habits (Savage, Fisher et al. 2007a) and children's food preferences are established by around age five (Birch 1999). Dietary diversity is associated with improved health outcomes (Royo-Bordonada, Gorgojo et al. 2003) and New Zealand Ministry of Health (MoH) food and nutrition guidelines emphasise the importance of eating a wide range of foods from all the food groups (MoH 2012).

Poor diet in childhood often predicts poor diet in adulthood (Craigie, Lake et al. 2011). Poor diet increases the risk for preventable nutrition-related diseases (Barker 2012) that reduce quality of life for individuals and place a great burden on the health system (Lal, Moodie et al. 2012). Fussy eating is one of the major psychological barriers to improving dietary diversity (Galloway, Lee et al. 2003). Avoiding the restrictive nature of fussy eaters' diets by encouraging dietary variety in early childhood could be instrumental in improving health outcomes over the lifecycle.

2.2.4 Parental Expectations of Childrens' Appetite and Eating Behaviours

Parents may mistake normal developmental stages for fussy eating and become unnecessarily concerned, or practise feeding styles that promote fussy eating behaviours. It is normal for children to go through a phase of neophobia and fussiness about food (Cashdan 1998) but certain parental feeding styles may cause problematic eating behaviours to become entrenched (Moroshko & Brennan, 2013; Rigal, Chabanet et al. 2012).

Unrealistic parental expectations of what constitutes appropriate appetite and intake may result in unnecessary concern. Using threats to force a child to eat can aggravate the child's food refusal (Leung, Marchand et al. 2012) contrary to parents' intentions to increase intake. Many parents are unaware that it can take many exposures to new foods before children will accept them (Hausner, Olsen et al. 2012; Wardle, Cooke et al. 2003) and may regard their children as being fussy eaters for refusing foods that they have simply not learned to eat yet. Between 12 -18 months of age, it is normal for children to reject some foods they previously accepted or become more reluctant to try new foods than before (i.e: neophobic) (Cooke, Haworth et al. 2007). In 20 - 50% of children these behaviours develop into fussy eating (Carruth, Ziegler et al. 2004; Chatoor 2002; Mascola, Bryson, et al. 2007). The majority of children with parentally reported feeding problems suffer no adverse consequences in terms of growth but for some parents, the main concern relates to getting their child to eat "right" rather than the amounts they are consuming (Wright, Parkinson et al. 2007).

Nevertheless, parental reports of fussy eating are associated with a consistent pattern of inhibited and selective eating beginning in infancy (Jacobi, Agras et al. 2003). It is

therefore important to take parental opinions into account when assessing children for food fussiness, while at the same time managing parental expectations about what and how their child should eat.

2.2.5 Low Dietary Diversity and Subsequent Health Issues

Fussy eating behaviours do not promote the intake of a wide variety of foods which is of concern because dietary diversity is associated with appropriate growth, development and longer term health. Fussy eaters eat a limited variety of foods (Mascola, Bryson et al. 2010; Wright, Parkinson et al. 2007) and less fibre than non-fussy eaters (Galloway, Fiorito et al. 2005a). Fussy eating has been associated with deficiencies in intake of essential nutrients including vitamins A, B6 and C, folic acid, calcium and zinc (Xia, Zhou et al. 2010) and vitamins E and C (Galloway, Fiorito et al. 2005bb) all of which are important for appropriate growth and development. These nutrients are found in foods such as red and green vegetables, dairy foods, meat and wholegrains and are reflective of the foods that many fussy eaters reject.

Dietary diversity is associated with nutritional adequacy, height for age scores in children and is a potential indicator for diet quality (Arimond & Ruel 2004). The consumption of a wide variety of foods from the four major food groups promotes health and reduces the incidence of chronic nutrition-related disease (MoH 2003). Due to the limited variety of foods fussy eaters accept, they may be at greater risk of poor growth and development in childhood as well as avoidable diseases in later life, such as cardiovascular disease or cancer.

Paradoxically, excessive weight gain in childhood co-exists with nutrient deficiencies (Carruth, Skinner et al. 1998; Dovey, Staples et al., 2008). Although the term “fussy eater” tends to evoke images of underweight, fussy eating behaviours have been associated with overweight (Finistrella, Manco et al. 2012; Haszard, Skidmore et al. 2015). Fussy eaters eat fewer fruit and vegetables and more starchy carbohydrate than non-fussy eaters (Jacobi, Agras et al. 2003; Williams, Gibbons et al. 2005). The availability of processed and fast foods that have an high hedonic value and high energy density can displace nutrient dense foods such as fruit and vegetables in the diet (Dennison, Rockwell et al. 1998; Fisher & Birch 1995). This, combined with the innate preference of infants for sweet and salty foods (Rosenstein & Oster 1988) may skew fussy eaters’ intakes toward more

energy dense foods. Prospective studies that examine the effect of fussy eating in childhood on eating habits, weight and disease risk in adult life are lacking. This is an area requiring further research.

2.3 Fussy Eating: Definition and Prevalence

An operational definition of fussy eating does not exist in the scientific literature, which makes it difficult to consistently quantify the degree of fussy eating. One of the most commonly used definitions of fussy eaters appears to be “children who consume an inadequate variety of foods through rejection of both familiar and unfamiliar foods” (Birch, Johnson et al. 1991; Galloway, Fiorito et al. 2005a; Smith, Roux et al. 2005). Neophobia, that is, avoidance of novel foods, is closely related to and a feature of fussy eating but is not a synonym (Potts & Wardle 1998) and the two are behaviourally distinct with different predictive factors (Galloway, Lee et al., 2003; Potts & Wardle 1998). Many studies rely on parental perceptions of their child’s eating behaviour by defining fussy eaters as “children whose parents identified them as fussy eaters” (Carruth, Ziegler et al. 2004; Jacobi, Schmitz et al. 2008; Reau, Senturia et al. 1996).

In order to capture a greater number of patients who present with avoidant or restrictive eating, the fifth Diagnostic and Statistical Manual of Mental Disorders (DSM-5) subsumed and expanded the classification “Feeding Disorder of Infancy or Early Childhood” from the DSM-4 and renamed the classification “Avoidant/Restrictive Food Intake Disorder” (ARFID) (Nicely 2014). ARFID is described as a problem with eating or feeding (e.g: disinterest in food, a repulsion toward certain foods based on their sensory qualities or fears about the aversive effects of eating) which leads to a recurrent inability to intake adequate energy/nutrition combined with one or more of the following: major nutritional deficiency, substantial weight loss or lack of expected weight gain, reliance on naso-gastric, gastric tube feeding or oral nutrition supplements and impaired psycho-social function. ARFID is not present when eating problems are due to body image disturbance, there is a scarcity of food or due to a culturally endorsed tradition (e.g: religious fasting) or due to a concomitant psychiatric disorder whereupon the eating problem would resolve if the underlying disorder were treated (Nicely 2014). Some fussy eaters may fall under this classification; in a case-control study of 8 - 18 year olds (n = 712), 28.7 % of patients with ARFID included those with fussy eating since early childhood (Fisher, Rosen et al. 2014). Despite this broadening of the classification, ARFID has been criticised for not being

inclusive enough. In a paediatric treatment-seeking sample of 2231 children where ARFID features were common, it was found that only 1.5% of cases met full criteria (Eddy, Thomas et al. 2014).

2.3.1 Prevalence of Parent Reported Fussy Eating

Because many studies rely on parental perception of whether their child is a fussy eater or parental reports of their child's behaviour, prevalence estimates vary. While the answer to the question "is your child a picky eater?" can vary even over a short period of time (Boquin, Smith-Simpson et al. 2014), parental perceptions of fussy eating do correlate with fussy eating behaviours observed in the laboratory or under controlled conditions (Boquin, Smith-Simpson et al. 2014; Jacobi, Agras et al. 2003). Thus, it is likely that parental perception of children's food fussiness has a strong relationship with actual fussy eating behaviours and intake. In this study, data on parental perception of fussiness is collected in order to assess its relationship with more objective measures of food fussiness and problem mealtime behaviours as well as adherence to MoH food and nutrition guidelines.

In developed countries, approximately 25 - 35% of toddlers and pre-school aged children's parents describe them as fussy eaters (Leung & Robson 1994; Reau, Senturia et al., 1996), although it has been suggested that the majority of them have an appetite that is appropriate for their age and growth rate (Leung & Robson 1994). Between the ages of 2 and 5 years old, weight gain slows compared to the first year of life and appetite often decreases (Leung & Robson 1994). Normal range for children's weight and height falls between the third and 97th percentile, but many parents mistakenly believe that the average weight (50th percentile) is normal and therefore much parental concern regarding weight may be unnecessary.

In a prospective study (n = 120), between 13% and 22% of children were reported by their parents to be fussy eaters at any given age between 2 and 11 years old (Mascola, Bryson et al. 2010). While incidence declined over time, point prevalence increased, suggesting that fussy eating is often a chronic problem with 40% having a duration of more than 2 years (Mascola, Bryson et al. 2010). This is of concern because children who are parentally perceived to be fussy also have lower dietary variety and diversity scores (Carruth, Skinner et al. 1998) and poor dietary habits can continue into adulthood (Craigie,

Lake et al. 2011). This puts children who are parentally perceived to be fussy at risk for poor health outcomes in later life.

Longitudinally, (n = 455) parents of 30 month olds found that while 20% perceived their child to have feeding problems, only 13% sought help, usually from their health visitor (Wright, Parkinson et al. 2007). Shame regarding coping strategies at mealtime may prevent parents from seeking help. In the case of a second child, parents may have observed that their first child went through a stage of fussiness that resolved itself. Fussy eating behaviour appears to increase after the age of one. In a cohort study (n = 913) fussy eating behaviour increased significantly from age 1.5 to 4.5 years (Hafstad, Abebe et al. 2013) and in a study 4 to 36 month olds (n = 1663), fussy eating increased from 7.4% in 4 to 6 month olds who rejected mostly dairy foods, to 36% in 25 to 36 month olds who tended to reject vegetables (Li, Wang et al. 2014). Carruth (2004) found parentally reported fussy eating increased from 19% at 4 to 6 months old to 50% at 19 to 24 months old. These changes are likely to reflect the increase in neophobic behaviours that are a normal part of development at about 12 to 18 months of age (Birch 1999), a phase that may be exacerbated and prolonged by problematic parental strategies at mealtime.

2.3.1.1 Accuracy of Parental Perceptions of Fussiness

The accuracy of parental perception about their child's fussiness may change with age. Children in Li's 2014 study were divided into fussy/non-fussy eaters based on parental perception and dietary intake was compared between the two groups. Before the age of 12 months, parental perceptions of whether their child was a fussy eater tended to be inaccurate, whereas after 12 months, parents were more accurate in their estimation. This is probably because children after the age of one are expected to eat family foods, as recommended in MoH (2012), while children eat foods specific to their developmental needs before this age. It may be more difficult for parents to gauge appropriate intakes based on these types of foods.

2.4 The Development of Fussy Eating

There may be inherent factors that predispose some children toward fussy eating. For example, children with emotional temperaments are more food avoidant than other children (Hafstad, Abebe et al. 2013; Haycraft, Farrow et al. 2011; Powell, Farrow et al. 2011). There is also limited evidence that common genes underlie behavioural phenotypes

for fruit preference, vegetable preference and food fussiness (Fildes, Llewellyn et al. 2014). Neophobia may be predicted by dispositional factors while fussy eating is predicted by environmental or experiential factors (Galloway, Lee et al. 2003). However, the majority of evidence points to factors such as parental feeding styles, negative experiences with food, management of food neophobia, timing of introduction of complementary foods and medical issues in the development of fussy eating behaviours.

2.4.1 Feeding Practices

Striking the right balance between permissiveness and control is important for avoiding the development of fussy eating behaviours. Strategies involving punishment and reward (for example: “If you eat, you can play”) are associated with food avoidance (Ainuki & Akamatsu, 2013; Powell, Farrow et al. 2011) but overly permissive parental feeding styles were also positively associated with fussy eating in a Japanese study (n = 834) of mothers of 3 to 6 year olds (Ainuki & Akamatsu 2013). 104 mothers from a variety of occupational backgrounds in the United Kingdom were asked about the eating behaviours of their 3 to 6 year old children. The study, which used a questionnaire that included four of the sub scales from the Children’s Eating Behaviour Questionnaire (CEBQ) and the Comprehensive Feeding Practices Questionnaire, was distributed to a number of schools and nurseries. The following behaviours were associated with food avoidance: parents using food for behaviour regulation, a high level of maternal feeding control and low encouragement of balanced eating. After controlling for child emotionality, pressure to eat contributed to avoidant eating behaviours in a multiple regression (Powell, Farrow et al. 2011). Mothers who reported higher food fussiness used more pressure to get their child to eat, restricted foods for health reasons and displayed less maternal monitoring of food intake and encouragement to consume a balanced and varied diet (Powell, Farrow et al. 2011).

2.4.2 Gastro-Intestinal Upsets and Pain

Association of mealtimes or certain foods with negative experiences such as illness or pain are a factor in the development of fussy eating behaviours (Timimi, Douglas et al. 1997) and these behaviours may be reinforced by continued negative experiences. For example, lower vegetable and fruit intakes typical of fussy eaters may lead to constipation. Because fussy eaters also tend to reject mixed foods (Carruth, Ziegler et al. 2004), it is difficult to “hide” vegetables in their meal and relieve this, potentially resulting in a cycle of food

avoidance and gastro-intestinal pain (Tharner, Jansen et al. 2015). Hiding food is problematic in itself as it is a short-term solution rather than a strategy that encourages children to enjoy a wide range of foods.

2.4.3 Food Neophobia

Once children are mobile, the potential for them to consume poisonous substances or plants increases. Food neophobia, the rejection of novel foods, is thought to be an evolutionary adaptation to this (Cashdan 1998). Food neophobia is based on visual cues and odours and ends when new foods are accepted into the mouth (Dovey, Staples et al. 2008). Fussy eating involves neophobia but extends beyond this to the rejection of familiar foods (Cooke, Haworth et al. 2007). While neophobia is a typical developmental stage, parental handling of neophobia may lead to the development of fussy eating behaviours. It can take up to 15 positive exposures before a food becomes familiar and will be accepted (Hausner, Olsen et al. 2012) but the average number of times parents offered a new food before deciding the child disliked it was only 3 to 5 times in one study (Carruth, Ziegler et al. 2004). Parental exasperation and pressure on a child to eat increases neophobia (Fisher, Mitchell et al. 2002; Galloway, Fiorito et al. 2005b; Wardle, Carnell et al. 2005). Subsequent presentations of the food can be associated with previous negative experiences and the child can continue to reject the food in the future (Pliner & Loewen 1997). These findings highlight the necessity for mealtimes to be a positive experience where the emphasis is on learning to eat and exposure to novel foods happens alongside familiar foods. MoH food and nutrition guidelines encourage this with recommendations which promote family meals and the involvement of children in growing and cooking foods (MoH 2012).

2.4.4 Family Influence

The food that is made available and thus becomes familiar to a child as their eating skills and habits develop strongly affects their preferences and behaviours. As parents are generally the primary provider of food to their child, they have a significant effect on the development of these preferences, and also provide cues on what is considered normal. Thus, children's eating habits are closely associated with that of their parents (Savage, Fisher et al. 2007b). For example, a parent's fruit and vegetable consumption is a strong predictor of their child's fruit and vegetable consumption (Wardle, Carnell et al. 2005). Having siblings also protects against the development of fussy eating (Hafstad, Abebe et

al., 2013; Jacobi, Agras et al. 2003). This may be because older siblings serve as role models for eating. It is also possible that having siblings could reduce parental pressure to eat at mealtime due to the need for parents to divide their attention.

2.4.5 Breastfeeding

The development of food preferences starts during pregnancy when the foetus is exposed to flavours in the amniotic fluid (Mennella, Jagnow et al. 2001), and continues after birth with the infant's exposure to new flavours in breastmilk and in later infancy with complementary feeding (Mennella & Trabulsi 2012).

Breastfeeding and the appropriate timing of introduction to complementary foods appear to be protective against fussy eating although evidence is limited. A small study of 36 infants showed that breastfed infants had greater increases and higher intakes of either pureed green beans or peas after re-exposure to a novel food than formula fed infants (Sullivan & Birch, 1994). Exclusive breastfeeding up to the age of 6 months (n = 129) lowered the risk of developing a preference for specific food preparation methods by 78%, food rejection by 81% and food neophobia by 75% while children who were introduced to complementary foods before 6 months old had a 2.5 times higher odds of developing food neophobia and acceptance of a limited variety of foods (Shim, Kim et al. 2011). Being breastfed for less than 6 months was predictive of fussy eating in a cross-sectional study of 7 year old girls and their parents (n = 192) (Galloway, Lee et al. 2003). Although participants in the above studies do not appear to be representative, these findings indicate that exposure to different flavours in early life may promote later food acceptance.

2.4.6 Autism Spectrum Disorders (ASD) and Tactile Defensiveness

Children with autism spectrum disorders display fussy eating behaviours more often than their typically developing peers (Nadon, Feldman et al. 2011; Williams, Gibbons et al. 2005). In a study that compared healthy (n = 69), special needs (n = 45) and ASD (n = 64) children between 2 - 12 years of age, children with ASD displayed similar behaviours to other fussy eaters but also idiosyncratic behaviours not found in other fussy eaters such as insistence on always drinking from a particular cup. Special needs children displayed more oral motor issues such as gagging and spitting food compared to ASD and healthy children and displayed more obsessive compulsive behaviours and anxiety than the other two groups (Williams, Gibbons et al. 2005).

Tactile defensiveness involves hypersensitivity to a variety of ordinary touch sensations such as hugs, textured clothing and certain foods. Because children with tactile defensiveness display behaviours including neophobia, refusal of certain foods due to smell or temperature, avoidance of vegetables, limited selection of foods and gagging, it has been suggested that many fussy eaters may suffer from tactile defensiveness (Smith, Roux et al. 2005). The findings from these studies suggest that while fussy eaters of all types appear to display similar mealtime behaviours, it is important to take into account the aetiology of fussy eating behaviours. Treatment for underlying conditions could resolve fussy eating behaviours in some cases.

2.4.7 Preterm Infants

Extremely preterm (gestation <28 weeks) and very preterm (gestation 28-32 weeks) birth are risk factors for feeding problems in later childhood (Cerro, Zeunert et al. 2002; Samara, Johnson et al. 2010). In a representative sample of 6 year olds, eating difficulties (such as oral motor problems, behavioural problems and hypersensitivity) were more common among 223 extremely preterm children than the 148 in the matched comparison group who were born at term (Samara, Johnson et al. 2010). 58% of all children born very preterm between July 1994 and 1996 in a hospital in South Australia (n = 95), reported food refusal in their children between 1.5 and 3.5 years of age. 20% of these children were parentally identified as being fussy eaters, and 51% and 69% of parents used food rewards or coaxing respectively, to encourage food intake (Cerro, Zeunert et al. 2002). While some of these problems are likely to have been the result of neurological difficulties resulting from preterm birth, others could be due to parental mealtime pressure resulting from concern about underweight or children's negative associations with feeding and eating. Strategies to help parents of preterm children with their child's problem mealtime behaviours could prevent or reduce long-term problem mealtime behaviours. The oral deprivation that can develop in preterm infants is also a risk factor for the development of feeding issues (Gisel, Birnbaum et al. 1998). This occurs as tube-feeding cannot stimulate the suck/swallow reflexes that develop during breastfeeding and bottle-feeding. Parents of toddlers in the Cerro study (2002) who were tube-fed (n = 5) reported poorer feeding indicators although these results must be interpreted with caution due to very low numbers in this group.

2.5 Nutrient Intakes, Weight and Growth

Fussy eating has the potential to affect nutrient intake because of how it limits dietary variety but there are only a small number of studies that have compared nutrient intakes between fussy and non-fussy eaters during childhood.

2.5.1 Nutrient Intakes

Dubois (2007) found that fussy eaters consumed more energy from carbohydrate than protein compared to non-fussy eaters in a large representative sample (n = 2103). Fussy eaters from families of both high (n = 74) and low (n = 44) socio-economic status 24 - 36 months old ate a limited variety of food and avoided some food groups which resulted in lower dietary variety and diversity scores (Carruth, Skinner et al. 1998) while children between 3.5 and 5.5 years old ate fewer foods than non-fussy eaters in a study of 135 children recruited from three hospitals in the San Francisco Bay area (Jacobi, Agras et al. 2003). Although there was no significant difference in nutrient intake between fussy and non-fussy eaters based on data from a 2 day food record and a 24 hour recall with mothers (Carruth, Skinner et al. 1998), fussy eaters are likely to be at higher risk of developing poor long-term eating habits than their peers.

Vegetables are an important source of a variety of vitamins, minerals, trace elements and phytochemicals as well as fibre. This high nutrient density means that vegetable intake levels are associated with health outcomes. Large scale population studies of diet patterns that include high vegetable intakes show a reduced risk of avoidable chronic diseases such as cardiovascular disease and cancer, and decreased mortality (Harmon, Boushey et al. 2015). 27% of 13 - 24 month olds and 47% of 25 - 36 month old parentally perceived fussy eaters avoided vegetables in a cross-sectional study of 663 infants (Li, Wang et al. 2014). In a cohort study (n = 4914), 14 month old fussy eaters had a lower intake of vegetables but higher intakes of savoury snacks and sweets than non-fussy eaters (Tharner, Jansen et al. 2014). Jacobi (2003) and Dubois (2007) also reported that fussy eaters ate fewer vegetables than their peers. These findings indicate that fussy eaters may be at risk of lower micronutrient and fibre intake and higher salt, fat and sugar intake than normal eaters and hence at higher risk of diet-related chronic disease in later life.

2.5.1.1 Energy

Although there is a perception that fussy eating results in low energy intake, it appears that this may be true only in healthy fussy eaters. Nutrition data collected in a 24 hour recall by trained nutritionists in a representative sample of 4.5 year olds (n = 2103) showed that fussy eaters consumed about 75 kilocalories less energy per day than children who had never been reported as fussy eaters (Dubois, Farmer et al. 2007). The energy intake of non-fussy eaters and overeaters was the same, however, which suggests that fussy eaters were being compared with overeaters in this study. This limits the pertinence of these results. In another large group (n = 1101) of 3 to 6 year olds, 18.4% of whom were fussy eaters, fussy eaters also had lower energy intakes than non-fussy eaters (Leal, Salto et al. 2012). However, in a small group (n = 30) of children with autism spectrum disorders (ASD) who displayed fussy eating behaviours, food refusal was associated with increased energy consumption (Lane, Geraghty et al. 2014). While healthy fussy eaters appear to have lower energy intakes in younger years, their poor eating habits may mean that energy intakes increase in later life as nutrient dense foods such as meat, fish and vegetables are displaced by palatable carbohydrate foods. The relationship between fussy eating and growth and weight is discussed below (section 2.5.2). Further research into the association between fussy eating and energy intake leading to overweight in older childhood and adulthood is necessary.

2.5.1.2 Protein and Fats

Many fussy eaters avoid protein sources such as meat and fish. This may be due to issues with texture, flavour or smell. For example, steak can be difficult to chew and children may find the flavour or smell of fish unfamiliar and off-putting. The quality of protein children are exposed to is also important. Sausages and fried white fish, which tend to be more palatable to children because they are soft and easy to eat, are often high in fat. Fried white fish is also lower in omega-3 fatty acids than fatty fish such as salmon. In the Dubois study (2007), fussy eaters consumed less protein than children never reporting fussy eating behaviours and were more likely than non-fussy eaters to consume one serve or less of meat per day. In a meta-review of children with ASD who displayed feeding problems, nutrient analyses indicated significantly lower protein intake than controls (Sharp, Berry et al. 2013). Nutritionists have ascertained that fussy eaters consumed fewer overall fats than non-fussy eaters (Dubois, Farmer et al. 2007) and in the Tharner study (2014), fussy eaters consumed less omega-3 fatty acid containing fish than other children

when measured by a food frequency questionnaire that had been validated against 24 hour diet recalls. Repeatedly exposing fussy children to a range of quality protein foods alongside accepted foods is likely to improve acceptance and help develop good eating habits.

2.5.1.3 Calcium, Iron and B12 and Other Micronutrients

Dairy foods are an important source of calcium for children but could be rejected for a number of reasons including taste, feelings of fullness after consumption and unpleasant experiences due to intolerance. 25% of 4 - 6 month old fussy eaters and 24% of 7 - 12 month old fussy eaters avoided dairy foods (Li, Wang et al. 2014). ASD children with feeding problems consume significantly less calcium than their peers (Sharp, Berry et al. 2013) which is of concern as calcium is essential in bone development and a number of other metabolic processes.

Parental perceptions of pickiness in a large study of 3022 infants defined pickiness by asking “do you consider your child to be very picky, somewhat picky or not picky?” without defining pickiness for parents (Carruth, Ziegler et al. 2004). Fussy 9 to 11 month olds in this cross-sectional study consumed lower amounts of a variety of micronutrients including vitamins C and E, folate, B12, thiamin, riboflavin, B6, magnesium, zinc and calcium than non-fussy eaters. However, mean intakes for both groups were above the recommended daily intakes (RDIs) (Carruth, Ziegler et al. 2004). Lower intakes of vegetables, dairy foods and meat and wholegrains which are foods commonly reported by parents as being rejected by fussy eaters could contribute to these results. Although RDIs were met in the Carruth (2004) study, it is of concern that the rejection of whole food groups could mean that a habit of diverse food intake is not being developed.

2.5.2 Weight, BMI and Growth

Many parents assume that a child who is a fussy eater is at risk of underweight or less than optimal growth but the evidence is conflicting. Growth is a key indicator of health which is routinely measured during childhood and there is evidence that fussy eating can lead to underweight in a minority of children. In a cohort study of over 4000 children, only 7% more fussy eaters (19.3%) were underweight at 4 years of age than non-fussy eaters (12.3%) (Tharner, Jansen et al. 2014). In a small study comparing 34 fussy eaters who were referred to a paediatric feeding clinic with 136 healthy controls, weight for height

measurements showed that 20.6% of fussy eaters were underweight as compared to 6.6% in the control group (Ekstein, Laniado et al. 2010), a difference of 14%. Of feeding clinic patients (n = 236) who included autistic, special needs and non-special needs children, 26.4% were underweight, as measured by BMI (Hendy, Williams et al. 2010). That the numbers of underweight in fussy eaters is similar across different types of studies may indicate a trend across the population. Further research in this area is needed.

In other studies, growth and BMI do not seem to be affected by fussy eating. In a longitudinal study of 120 children from 2 to 11 years of age, no significant effects on growth were observed in fussy eaters (Mascola, Bryson et al. 2010). BMI in 8 to 12 year old fussy eaters did not differ significantly from non-fussy eaters (Jacobi, Schmitz et al. 2008).

Finistrella (2012) and Haszard (2015) both found an association between fussiness and overweight cross-sectionally in 2 - 6 year olds (n = 127) and 4 - 8 year olds (n = 203) respectively. An association between fussy eating and overweight seems counterintuitive. However, it is plausible that a restricted diet consisting mostly of high fat, carbohydrate-rich snacks, and low in vegetables and protein, means that fussy eating could lead to overweight. Data on parental perceptions of weight have been collected in this study to assess how parental perceptions of weight and concern about weight are related to incidence of problem mealtime behaviours, parental perceptions of fussiness, adherence to MoH food and nutrition guidelines and food fussiness.

2.6 Predictors and Correlates of Fussy Eating Behaviours at Mealtime

Similar mealtime behaviours in children and mealtime strategies in parents are found across studies of fussy eaters. The fussy eating behaviour profile is characterised by high food fussiness, slowness in eating and satiety responsiveness combined with low food enjoyment and food responsiveness (Tharner, Jansen et al. 2014) and eating a limited variety of foods (Carruth, Skinner et al. 1998; Dubois, Farmer et al. 2007; Wright, Parkinson et al., 2007). Fussy eaters display strong likes and dislikes regarding food, demanding specific preparation and presentation (Carruth, Skinner et al. 1998; Jacobi, Agras et al. 2003; Jacobi, Schmitz et al. 2008). Wright et al. (2007) found that slimy and unfamiliar foods were the least accepted by fussy eaters. The prevalence of fussy eating

does not seem to be related to the sex of the child (Carruth, Ziegler et al. 2004; Tharner, Jansen et al. 2014).

Parents of fussy eaters have concerns about whether their child's eating patterns affects his/her health (Chatoor, Hirsch et al. 1998). Their problematic strategies in the management of their fussy eating child are likely to exacerbate feeding problems. The BPFAS measures incidence of problem feeding behaviours. Parents whose children scored highly on the Total Frequency Score (TFS) of the BPFAS were more likely to coax, threaten, force-feed and make their child a separate meal (Crist & Napier-Phillips 2001). Parents of fussy eaters reported more frequent struggles with their child over food and disagreements with other adults about how to feed their child (Crist & Napier-Phillips 2001; Jacobi, Schmitz et al. 2008). It is unclear whether parental strategies cause or are a result of problem mealtime behaviours.

The timing of drink intake is likely to affect food intake, for example, offering drinks before a mealtime may cause children to feel full. The number of milky drinks consumed by 30 month olds correlated negatively with appetite (Wright, Parkinson et al. 2007). This is likely to be because milky drinks are nutrient rich and filling. However, the number of non-milky drinks consumed correlated positively with appetite (Wright, Parkinson et al. 2007). This may be related to a child's inherent appetite; it is plausible that children who have larger appetites also have a larger appetite for fluids, and vice versa.

2.6.1 Mealtime Behaviour and Length

In their study comparing medically treated and non-medically treated children who had been admitted to a feeding clinic with a normative group, Crist & Napier Phillips (2001) found all children displayed behaviours such as: getting up from the table during a meal, eating "junk" snack foods but not meals, refusing to eat meals but requesting food immediately after, whining, crying, tantrums and delaying meals by talking, avoiding coming to the table, food neophobia and refusal of vegetables. However, the frequency of these behaviours in both groups of children from the feeding clinic was significantly higher than in the normative group.

Drawn out mealtimes or eating slowly is a characteristic of fussy eating (Reau, Senturia et al. 1996). Crist (2001) found 14.3% of parents of younger (<27months) and 12.1% of older

children (27 months to 7 years) reported mealtimes longer than 30 minutes. There was also a significant correlation between mealtime length and both problem eating behaviours in children and problematic feeding strategies by parents. Although Jacobi (2003) did not find fussy eaters took longer to eat, they did find fussy eaters were less likely to eat quickly. Fussy eaters may use stalling tactics to avoid eating or simply eat more slowly due to lack of interest. It is also likely that high incidence of problem behaviours are exacerbated because of struggles between children and parents at mealtimes.

2.6.2 Parental Characteristics of Fussy Eaters

A number of studies have looked at whether parental characteristics such as ethnicity and acculturation, income and age affect feeding behaviours. In a study of Black, White, English-speaking Hispanic and Spanish-speaking Hispanic parents of 1 to 5 year olds in the United States (n = 721), there were significant differences according to ethnic background and level of acculturation in parental feeding practices and concerns related to their child's weight. For example, Spanish-speaking Hispanic parents were more likely to have concerns about their child being underweight than the English-speaking Hispanic parents. Spanish-speaking Hispanic and Black parents used food to soothe more often than English-speaking Hispanic parents (Evans, Seth et al. 2011). As New Zealand is an ethnically diverse country, it is important to keep in mind that levels of acculturation and ethnicity may influence feeding styles when collecting data and designing interventions. Food is an important expression of culture in many ethnic communities in New Zealand, however evidence about how this is associated with the development and prevalence of fussy eating is lacking.

The relationship between household income and fussy eating is not clear. Fussy eaters were more often from families with low household incomes than non-fussy eaters in a cohort study (n = 4914) of 4 year olds in The Netherlands (Tharner, Jansen et al. 2014). Cross-sectionally, Evans (2011) found the opposite in the United States: high income respondents were more likely to report having fussy eaters in the family. Other studies have found no association (Crist & Napier-Phillips 2001). Expectations of what children should eat clearly have an influence on parental reports. Observational studies of fussy eating behavior could shed light in this area.

Mothers of fussy eaters in a prospective study were slightly younger than mothers who did not have children with fussy eating behaviours (Jacobi, Agras et al. 2003). There do not appear to be any other studies that have found a link between maternal age and food fussiness. Further research into parental characteristics is important to clarify the aetiology of fussy eating.

2.6.2.1 Parental Eating Style and Behaviours

Parental eating styles and behaviours may affect children's eating behaviour but evidence is limited. Mothers of 8 to 12 year old fussy eaters had a higher desire to be thin than mothers of non-fussy eaters (Jacobi, Schmitz et al. 2008). Jacobi (2003) found no association between disturbed eating in mothers and fussiness, but associations between maternal neophobia and child neophobia (Galloway, Lee et al. 2003) and maternal negative outlook in early life (Hafstad, Abebe et al. 2013) have been found to have implications for the development of a child's eating patterns. It is unclear whether these associations are due to the effect broader maternal mental health issues may have on children (such as fussy eating as an attention-seeking behaviour), or because children imitate maternal behaviours.

2.7 Measures of Food Fussiness, Mealtime Behaviours, Adherence to MoH Food and Nutrition Guidelines and Parental Perceptions of Fussy Eating

The Fussiness Sub Scale from the Children's Eating Behaviour Questionnaire (CEBQ-FSS) is used in this study as a more objective measure of children's food fussiness than parental perceptions. The CEBQ-FSS uses Likert type items and scores which provide a way to assess behaviour and beliefs that is easy for respondents to understand (Carifio & Perla 2007). A Likert type item is a single statement in which the respondent is asked to evaluate a statement according to subjective or objective criteria. A Likert type scale or score is the sum of responses on several Likert type items.

2.7.1 Assessing Fussy Eating Behaviour: Children's Eating Behaviour Questionnaire Fussiness Sub Scale (CEBQ-FSS)

Studies have used the entire CEBQ (Mallan, Liu et al. 2013; Tharner, Jansen et al. 2014) as well as only the fussiness sub scale (Hendy, Williams et al. 2010) as a measure of child eating behaviour and it has been shown to have good psychometric properties such as good internal consistency (Cronbach's alphas ranging from 0.72 to 0.91, with a Cronbach's

alpha of 0.91 for the fussiness sub scale), adequate two-week test-retest reliability with correlation coefficients ranging from 0.52 to 0.87 (Wardle, Guthrie et al. 2001) and construct validity (Carnell & Wardle 2007).

Principal component analysis (PCA) is a technique used to emphasise variation and bring out strong patterns in a dataset (Field 2009). PCA of the CEBQ showed that each scale in the questionnaire had a single factor that explained 50–84% of the variance. Factor analysis explains the structure of data by explaining the correlations between variables. Data is summarised into a few dimensions by condensing a large number of variables into a smaller set of factors. Factor loadings represent how much a factor explains a variable in factor analysis (Field 2009). An overall factor analysis of the CEBQ verified these hypothesised scales (Sleddens, Kremers et al. 2008).

There are a number of parental report questionnaires that have been developed to measure fussy eating behaviours in children, however the CEBQ-FSS measures the fussy eating behaviours commonly found in the literature (child's lack of food enjoyment, food neophobia, strong preferences with regard to presentation and preparation, and poor variety of intake) while reducing subject burden by using a limited number of questions. Table 2.1 compares a number of tools that have been used in parent report of fussy eating behaviours and demonstrates the relative numbers of questions used.

Table 2.1 Tools Used to Assess Fussy Eating in Children

Name of tool	Wardle (2001): Children's Eating Behaviour Questionnaire (CEBQ)	Lewinsohn (2005): Oregon Research Institute Child Eating Behaviour Inventory	Carruth (1998): Interview Questions for Mothers	Jacobi (2003): Stanford Feeding Questionnaire
Questions to assess fussiness	<ul style="list-style-type: none"> · My child enjoys tasting new foods · My child enjoys a wide variety of foods · My child is interested in tasting food s/he hasn't tasted before · My child refuses new foods at first · My child decides that s/he doesn't like food without even without tasting it · My child is difficult to please with meals 	<ul style="list-style-type: none"> · Does your child eat a limited variety of foods? · Will s/he eat favourite foods only if prepared a very specific way? · Does your child accept new foods readily? · Do you think your child is a picky eater? · Does your child refuse fish? · Does your child refuse soups? · Does your child refuse vegetables? · Does your child refuse squash? · Does your child refuse meats? · Does your child refuse eggs? · Does your child refuse cheese? · Does your child refuse milk? · Does your child refuse yogurt? · Does your child refuse potatoes, rice, pasta? · Does your child refuse breads? · Does your child refuse cereals? · Does your child refuse chips? 	<ul style="list-style-type: none"> · To what extent would you consider your child to be a feeding problem? · Overall, to what extent does your child like a wide variety of foods from those that you think he/she should eat? · Rank your child's eating behavior as a whole (extremely poor to extremely good eater) · In general, at the end of the meal, how often has your child eaten the amount you think he/she should eat? · How often do you attempt to persuade your child to eat a food? · How often do you prepare a special food for your child because she/he does not like what the rest of the family is eating? · How often does your child try new and unfamiliar foods at home? · How willing is your child to try new and unfamiliar food when offered? 	<ul style="list-style-type: none"> · Is your child a picky eater? · Eats limited variety of foods · Eats food prepared in specific ways · Child accepts new foods readily · Child has strong likes/dislikes about food · Child is a slow/ fast eater

2.7.2 Assessing Feeding Issues: Behavioural Paediatric Feeding Assessment Scale (BPFAS)

The Behavioural Paediatric Feeding Assessment Scale (BPFAS) is a parent report tool. It is used in this study as the key measure of the incidence of problem mealtime behaviours and to class children into groups who have normative eating habits and clinical feeding problems.

2.7.2.1 Validity

The Behavioural Paediatric Feeding Assessment Scale (Crist & Napier-Phillips 2001) is a validated inventory used to examine parent and child behaviour at and around mealtimes, in children between the ages of 9 months and 8 years of age. The BPFAS has adequate internal consistency with a Cronbach alpha value of 0.76 for the 35 item scale and test-retest reliability over a 2 year period (Crist & Napier-Phillips 2001). Parental responses on the BPFAS are a reliable report of actual mealtime behaviours in children and thus, it may be used as a proxy for observed mealtime behaviour (Piazza-Waggoner, Driscoll et al. 2008).

2.7.2.2 Development and Use

The BPFAS was originally developed to evaluate problem eating behaviours commonly observed in young children with cystic fibrosis and was later used by the authors to investigate whether children with feeding issues engage in fundamentally different eating behaviours to other children, or similar behaviours, but at an increased frequency. In the latter study, the eating behaviours of a normative sample (n = 96) of healthy Canadian children were compared to the eating behaviours of children who attended a Feeding and Nutrition clinic. The latter group included children whose feeding issues were not considered severe enough to warrant medical treatment (n = 95, clinical/non-medical) and a group whose medical issues were treated at the Health Centre attached to the clinic (n = 154, clinical/medical).

The BPFAS has been used to evaluate feeding issues in children with cystic fibrosis (Powers, Patton et al. 2002), type one diabetes mellitus (Patton, Dolan et al. 2006) and autism (Martins, Young et al. 2008). It has also been used to assess outcomes of behavioural interventions in children with feeding problems. The BPFAS has been validated for use in children in the U.K (Dovey, Jordan et al. 2013), Canada (Crist &

Napier-Phillips 2001) and Australia (Marshall, Raatz et al. 2014). Compared to other measures of childhood feeding behaviour published in the literature to date (Archer, Rosenbaum et al. 1991; Berlin, Davies et al. 2011; Lukens & Linscheid, 2008), the BPFAS has undergone more rigorous psychometric testing (Marshall, Raatz et al. 2014). Because the BPFAS can be administered and scored quickly, it has practical uses in a clinical setting as well as in monitoring the presence of feeding issues in children who are at particular risk of nutritional insufficiency.

2.7.2.3 Factor Analysis of BPFAS

In a factor analysis (section 2.7.2) of the BPFAS, a five factor structure emerged in each of the three groups (normative, clinical/medical and clinical/non-medical) in the sample: “picky eating,” “toddler refusal (general),” “older children refusal (general),” “toddler refusal (textured foods),” and “stallers”. The picky eating factor of the BPFAS evaluates a child’s willingness to try new foods and eat a variety of foods at mealtimes. At the severe end of the scale, food restriction is so strict that sufficient amounts of key nutrients are unlikely to be consumed while the lower end represents mealtime behaviours that are common in most toddlers. Food refusal behaviours more common in younger children such as whining and crying loaded on the toddler refusal (general) factor while questions such as “my child tries to negotiate what he/she will and will not eat” and delaying tactics unique to older children such as talking appear in the older children refusal (general) factor. The toddler refusal (textured foods) factor measures refusal of food types which are usually offered when the transition from soft to chewier foods is made. It includes items such as “my child eats only ground, strained or soft food” and “my child lets food sit in his/her mouth and does not swallow it.” Unlike the meal-disrupting behaviours children display in the general food refusal questions, these items reflect difficulty in handling or selective refusal of, textured foods. While the staller factor was less well-defined than the other factors, items such as allowing food to sit in the mouth, preference for drinking over eating and avoiding coming to the table loaded on this factor.

2.8 MOH Food and Nutrition Guidelines

Food and nutrition guidelines are set by national health departments to provide evidence based nutrition information and advice in country-specific contexts. Guidelines are usually set according to stage of the lifecycle and gender. The MoH food and nutrition guidelines were developed in order to provide a template for healthful eating for individuals, families

and whānau which promote health and prevent obesity and diet-related disease. They were formulated by the MoH after extensive consultation with the wider New Zealand (NZ) community, and are specific to the NZ population.

There are different sets of guidelines for infants and toddlers (0 to 2 years old), children and young people (2 to 18 years old), pregnant and breastfeeding women, adults and older people. In the current study, eligible participants were parents of New Zealand children between the ages of 2 and 4 years old (24 to 47 months), thus “MoH food and nutrition guidelines” will refer specifically to the New Zealand Ministry of Health Food and Nutrition Guidelines for Healthy Children and Young People (aged 2 to 18 years) (MoH 2012).

2.8.1 Policy Context and Purpose of the MoH Food and Nutrition Guidelines

The New Zealand Ministry of Health Food and Nutrition Guidelines for Children and Young People (aged 2 to 18 years) are produced in the context of international strategies and conventions relating to health, nutrition and physical activity including:

- United Nations Convention on the Rights of the Child (UNICEF 1990)
- Diet, Nutrition and Prevention of Chronic Diseases (WHO 2003a)
- Global Strategy on Diet, Physical Activity and Health (WHO 2004)
- Interventions on Diet and Physical Activity: What Works (WHO 2009b)
- Food, Nutrition, Physical Activity and the Prevention of Cancer: A Global Perspective (World Cancer Research Fund and American Institute for Cancer Research, 2007)
- Global Strategy for the Prevention and Control of Non-communicable Diseases and 2008-2013 Action Plan (WHO 2008)
- Improving Lifestyles, Tackling Obesity: The Health and Economic Impact of Prevention Strategies (OECD/WHO, 2009)

National health policy direction is set by a number of strategies that address issues pertinent to the New Zealand context. He Korowai Oranga is a high-level strategy to guide nutrition and health policy so that it is implemented in a meaningful and sustainable way in order to improve Māori health and reduce inequalities for Māori through a vision of whānau ora (MoH 2002) while the Ala Mo'ui: Pathways to Pacific Health and Wellbeing sets the

strategic direction to improve health outcomes and reduce inequalities for Pacific peoples (MoH, 2014).

The Health Equity Assessment Tool (HEAT) (Signal, Martin et al. 2008) is a planning and evaluation resource used to consider the impact of social and economic inequalities on people’s health and people’s access to services and is used to assess policies arising from The New Zealand Health Strategy which sets the direction and priorities for the New Zealand Health system. As part of health policy, the MoH food and nutrition guidelines are guided by these strategies as well as embedded in a broader national policy context of policies relevant to the health of children and young people (MoH 2012) as summarised in Figure 2.1.

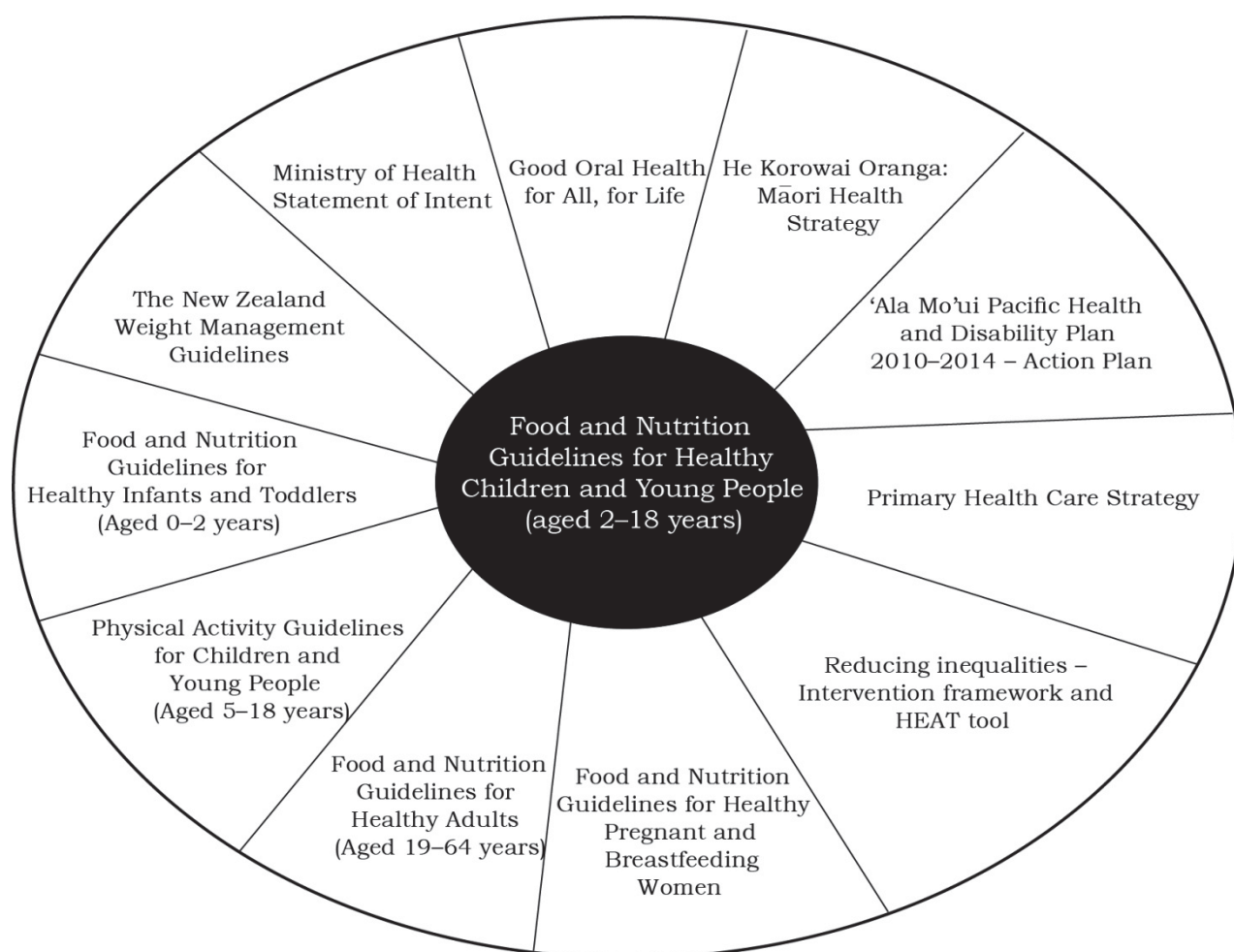


Figure 2.1 New Zealand policy context for the Food and Nutrition Guidelines for Healthy Children and Young People (Aged 2-18 Years): A Background Paper

Reprinted from Ministry of Health Website. Retrieved from <http://www.health.govt.nz/system/files/documents/publications/food-and-nutrition-guidelines-for-healthy-children-and-young-people-aged-2-18-years.pdf>. Copyright [2012] by the Ministry of Health

2.8.1.1 Purpose of the Guidelines

The purpose of the MoH food and nutrition guidelines are to ensure optimal growth and prevent nutritional deficiencies in children. They aim to promote health while preventing avoidable diet-related disease and obesity in later life (MoH 2012). MoH food and nutrition guidelines provide advice on the recommended number of servings for each of the four main food groups, fluid intake, physical activity and ideal meal patterns. In the background paper, nutrition and health issues for Māori, Pacific and Asian populations are discussed in order to enhance the cultural competence of practitioners working with these groups. Information on special dietary considerations such as vegetarianism and veganism, food allergies, disordered and fussy eating, dietary supplements and food safety and additives is also given (MoH 2012).

2.8.2 Do Fussy Eaters Meet Nutritional Guidelines?

Fussy eaters score lower on food variety and diversity scores than other children (Carruth, Skinner et al. 1998). A low variety diet increases the risk of nutritional insufficiency (Galloway, Lee et al. 2003) and fussy eaters, like all restrictive eaters, are at greater risk of developing a nutrient imbalance because of this (de Lauzon-Guillain, Oliveira et al. 2012). However, Carruth (2004) found that both fussy and non-fussy eaters met or exceeded U.S age-related nutritional recommendations. While this and a number of other studies have compared nutritional intakes of fussy eaters with non-fussy eaters and found that fussy eaters consume fewer nutrients than their peers, whether or not fussy eaters meet nutritional guidelines is unclear.

2.9 Measuring Nutritional Adequacy

Nutritional adequacy is measured in a variety of ways including nutritional intake assessments, nutritional status assessments and diet quality indices. Cost, respondent burden and response rate are among the factors necessary to consider when choosing the appropriate method of measurement for a study. For example, while they are considered the gold standard in nutritional intake assessment, weighed food diaries have a high attrition rate due to high respondent burden (Holmes, Dick et al. 2008). Nutritional biomarkers are costly but they are objective and accurate measures of nutrition status and therefore suitable to validate other measurements against (Holmes, Dick et al. 2008). Diet quality is used to examine epidemiological associations between dietary intake and health

outcomes (Wirt & Collins 2009) such as mental health in adolescents (Jacka, Kremer et al. 2011) and risk of chronic disease (Kant 1996). Diet quality indices such as those measuring adherence to food and nutrition guidelines give an overview of how people eat by including not only adherence to recommendations but also behavioural measures. Because food and nutrition guidelines are developed to promote optimal health and growth, poor adherence could result in nutritional inadequacy.

2.9.1 Diet Quality Measures

Diet quality is a relatively new concept that assesses the quality and variety of the whole diet and is measured by scoring how closely diet patterns adhere to dietary guidelines. Some tools also measure how much variety within or across core food groups exists, with higher scores awarded for increased variety. Diet quality indicators allow the relationship between health outcomes and whole foods, as opposed to just nutrients, to be examined (Kant 1996; Wirt & Collins, 2009). Diet quality indices are used as screening tools for health assessment, markers for risk assessment and as a tool for health education (Alkerwi 2014). Diet quality is relevant to children because better diet quality means better food choices in childhood and in future life.

While many indices measure adherence to national nutrition guidelines, some indicators, particularly those formulated to investigate cardiovascular disease risk, examine conformance to Mediterranean diet patterns (Fung, Hu et al. 2006; Knoop, Groot et al. 2006). The majority of indicators are based on a combination of food groups and nutrients (Hann, Rock et al. 2001; Weinstein, Vogt et al. 2004), although some are based only on foods and food groups (Osler, Heitmann et al. 2001). Food based dietary indices have several advantages over those based on food and nutrient intakes such as indirectly assessing intakes of nutrient and non-nutrient components of food as well as retaining the complexity of food intake (McNaughton, Ball et al. 2008). Diet quality indices can investigate whether a diet pattern is detrimental to health, by taking into account risk factors for chronic diet-related disease such as sodium and saturated fat intake and generate scores that reflect diet patterns which are healthy, unhealthy or a combination of both (Waijers, Feskens et al. 2007).

Cut-off boundaries, dichotomous values and continuous variables are used to determine adherence to guidelines. For example, median cut-off points in Mediterranean Diet Scores

allow participants to be scored negatively or positively on a scale (Fung, Hu et al. 2006; Knoops, Groot et al. 2006). If a dietary guideline has been met, some indices award 1 point while if it has not, no points are given and some tools use lower, intermediate and upper cut-off points (Waijers, Feskens et al. 2007). However, there appears to be no consensus on which of these three methods are more appropriate for evaluating conformance to dietary guidelines and examination of association with disease risk (Wirt & Collins 2009).

Measures of factors such as eating as a family, being involved with cooking and level physical activity assess behaviours that contribute to the development of good eating and lifestyle habits rather than merely review nutrient intake or dietary patterns. The MoH food and nutrition guidelines for 2 - 18 year olds place much greater emphasis on these behavioural recommendations than MoH food and nutrition guidelines for adults due to the importance of establishing these habits in early life.

2.9.1.1 Validity and Reliability

Within measures used to assess diet quality it is important to consider validity and reliability. Validity refers to how well a test measures what it is designed to measure and reliability is the degree to which an assessment tool produces stable and consistent results (Field 2009). Due to the wide range of diet quality indices, it is not possible to generalise about the overall validity and reliability of all indices; the attributes reflected in the construction of various dietary quality scores obviously depend on research objectives and this affects the number of components included, their respective cut-off values and the scoring criteria (Alkerwi 2014). However, in a review of more than twenty such tools Wirt (2009) concluded that diet quality tools are appropriate for adapting for use in clinical practice and self-evaluation of dietary intake. Furthermore, given the complexity of the human diet, quality indicators are more likely to capture inter-related aspects of intake than other measurements of nutritional adequacy (Kant 1996). For these reasons, a diet quality index was deemed to be the best assessment of nutritional adequacy in this study.

2.9.2 The Dietary Guideline Index

Although New Zealand and Australia have different populations with different health needs, the two countries are similar in ways that affect the development of food and nutrition guidelines. For example, both countries have ethnically diverse populations due to

their colonial histories. Nutrient Reference Values (NRVs) refer to the levels of recommended intakes of essential nutrients, such as vitamins and minerals. The development of the NRVs for Australia and New Zealand is a joint project between the MoH and the Australian Commonwealth Department of Health and Ageing (MoH and NHMRC 2005) and so although materials such as the MoH food and nutrition guidelines for various age groups are different to corresponding Australian guidelines, they develop out of the same set of recommendations. The Dietary Guideline Index (DGI) was developed to assess compliance to the Dietary Guidelines for Australian Adults (DGAA) using food groups from the Australian Guide to Healthy Eating (AGHE) that give sex and age-related recommendations for intakes from five core food groups (vegetables, fruits, cereals, meat and alternatives and dairy products) and “extra foods” such as sugar-sweetened beverages and meat pies which contain high levels of sugar and/or saturated fats and provide poor nutrient density. The DGI has been validated for use in adults (McNaughton, Ball et al. 2008) and children and adolescents (Golley, McNaughton et al. 2015). The DGI was developed for the Australian context and provides a comprehensive measurement of dietary, behavioural and diet quality recommendations. A dietary guideline index of similar quality was not found for New Zealand and thus the DGI was chosen as a model for the development of the DICE. The DICE is the key measure of adherence to MoH food and nutrition guidelines in this study.

2.9.2.1 Validation and Measures

Validation of the DGI was based on analysis of data from 8220 participants >19y from rural and urban areas in the Australian National Nutrition Survey (NNS) in 1995. The NNS included a 24 hour recall, a food frequency questionnaire (FFQ) and a food habits and attitudes questionnaire (FHQ) as well as anthropometric measures, blood pressure and information on a range of health behaviours such as smoking and physical activity (McNaughton, Ball et al. 2008).

2.9.2.2 Development of DGI Components

For each of the 15 dietary guidelines including one for dietary variety, indicators and cut-offs were identified based on AGHE food groupings to give a total of 15 items. For example, for the dietary guideline “eat plenty of fruits,” the indicator was servings of fruits per day. The criterion for the maximum score for fruit intake was ≥ 2 servings as per the recommendations and the criterion for the minimum score was 0 servings. Each of the 15

items was scored from zero to ten, where higher scores indicated closer adherence to guidelines. Intermediate consumption was scored proportionately; in the case of fruit intake for example, 1 serving of fruit per day scored 5 points. Over-reporting of fruit and vegetable intakes associated with FFQ measures was avoided by basing consumption for these items on the FHQ which may be a more reliable measure (Coyne, Ibiebele et al. 2005).

The dietary variety component was measured based only on foods from the core food groups and excluded “extra foods” which are not essential to nutrient requirements and have a high sugar, fat and salt content. Diet quality was integrated into the DGI by including items such as whole-grain cereals, lean meats and low-fat dairy products (McNaughton, Ball et al. 2008). Cereal consumption overall was assessed using items on the FFQ but because breads were the only cereals that distinguished wholegrain and wholemeal varieties, wholegrain cereal intakes were based only on bread intakes and not rice, pasta and breakfast cereal intakes. While one behavioural measure relating to physical activity is included on the DGI, the DICE which was developed for children includes several behavioural measures. Components of the DGI are summarised in Table 2.2.

Table 2.2 Components of the Dietary Guideline Index According to the Dietary Guidelines for Australian Adults

Dietary guideline	Indicator and description	Criteria for maximum score (10) ⁽¹⁾	Criteria for minimum score (0)
Enjoy a wide variety of nutritious foods	Dietary variety: proportion of foods for each core food group that are consumed at least once per week	100%	0%
Eat plenty of vegetables, legumes, and fruits	Fruit: servings of fruit per day	≥2	0
	Vegetables: servings of vegetables and legumes per day	≥5	0
Eat plenty of cereals (including breads, rice, pasta, and noodles), preferably whole-grain	Cereals: frequency of consumption of breads and cereals per day	19–60 y: M≥6, F≥4; >60 y: M≥4, F≥4	0
	Whole-grain cereals ⁽²⁾ : proportion of whole-meal/whole-grain bread consumed relative to total bread	100%	0%
Include lean meat, fish, poultry, and/or alternatives	Meat and meat alternatives: frequency of consumption of lean meats and alternatives per day	≥1	0
	Lean protein sources: proportion of lean meats and alternative relative to total meats and alternatives	100%	0%
Include milks, yoghurts, cheeses, and/or alternatives Reduced-fat varieties should be chosen, where possible	Dairy foods: frequency of consumption of dairy products per day	≥2	0
	Low-fat/reduced-fat dairy: type of milk usually consumed	Low fat milk	Whole milk
Drink plenty of water	Fluids: frequency of consumption of beverages	≥8	0
	Fluids: proportion of water consumed relative to total beverages ⁽²⁾ :	50%	0%

Dietary guideline	Indicator and description	Criteria for maximum score (10) ⁽¹⁾	Criteria for minimum score (0)
Limit saturated fat and moderate total fat intake	Saturated fat intake: type of milk usually consumed	Low fat milk	Whole milk
Choose foods low in salt	Saturated fat intake: trimming of fat from meat	Usually	Never or rarely
	Salt use: salt used in cooking	Never or rarely	Usually
	Salt use: salt used at the table	Never or rarely	Usually
Limit your alcohol intake if you choose to drink	Alcohol: frequency of consumption of all alcoholic beverages per day	M \geq 2, F \geq 1	M \geq 4, F \geq 2
Consume only moderate amounts of sugars and foods containing added sugars	Added sugars ⁽³⁾ : frequency of consumption of soft drink, cordial, fruit juice drink, jam, chocolate, confectionery per day	19–60 y: M<1.5, F<1.25; >60 y: M<1.25, F<1	19–60 y: M>1.5, F>1.25; >60 y: M>1.25, F>1
Prevent weight gain: be physically active and eat according to your energy needs	Extra foods ⁽³⁾ : frequency of consumption of extra foods per day	19–60 y: M<3, F<2.5; >60 y: M<2.5, F<2	19–60 y: M>3, F>2.5; >60 y: M>2.5, F>2

(1) Servings unless otherwise indicated. Participants with intakes between the maximum and minimum amount were assigned scores proportionately.

(2) No quantitative Australian guidelines currently exist. Maximum score cut-offs are based on the Dietary Guidelines for Americans and United States Beverage Guidance Panel.

(3) Guidelines for added sugars and extra foods are presented as an upper limit. Because there is no quantitative guideline for added sugars, one-half the extras foods guideline is used which is consistent with existing dietary indices.

M=male; F=female.

Note: reprinted from "An Index of Diet and Eating Patterns is a Valid Measure of Diet Quality in an Australian Population," by Sarah A. McNaughton, Kylie Ball, David Crawford and Gita D. Mishra. 2007, *Journal of Nutrition*, 138, p. 86-93.

2.9.3 Nutritional Intake Assessments

Nutritional intake measures are used to assess whether an individual's food intake matches their energy needs or nutrient requirements. Intake assessments include 24 hour food recalls, weighed and estimated food diaries and FFQs (Table 2.3). This type of dietary assessment may identify nutrient deficiencies but does not give an overall picture of how people eat. Some nutritional intake assessments, such as 24 hour recalls and FFQs are low cost and have a low respondent burden and can therefore be suitable for large scale studies. Nevertheless, these measures are not designed to examine relationships between diet and long-term health outcomes unlike diet quality scores such as the DICE which can be developed to incorporate measures that give a comprehensive view of eating behaviour that includes physical activity, dietary diversity and adherence to guidelines.

Traditional types of assessment lack recommendations aimed at creating lifelong good eating habits such as eating meals with family and whānau and involvement with cooking food, which are usually included in diet quality indices for children. Furthermore, neither 24 hour recalls nor FFQs provide a diet quality score that can be compared with a measurement of feeding issues such as BPFAS and thus, these methods were not selected for the current study. Advantages and disadvantages of other dietary assessment methods are summarised in Table 2.3.

Table 2.3 Methods of Assessing Nutritional Intake

Method	Methodology	Advantages	Disadvantages
24 hour food recall	A dietary recall is a retrospective method of dietary assessment where an individual is interviewed about their food and beverage consumption during a defined period of time, typically the previous day or the preceding 24 hours.	<ul style="list-style-type: none"> · Light subject burden · High response rate · A skilled interviewer can go a long way toward eliciting full intake from subject · Can give accurate qualitative data on what types of foods subject is eating when top foods by weight are considered 	<ul style="list-style-type: none"> · Single 24 hour recall not representative of habitual intake but may be useful for group means · Method dependent on respondent's ability to recall intake accurately · Possibility of recall bias where the individual may selectively recall food items, as with all self-report methods · Can be expensive if done multiple times
Food diary	A weighed food diary records details of food and drink eaten at the time of consumption. Instructions and record sheets or booklets are provided, together with a set of weighing scales for the food and drink. Portions of food are weighed onto a plate and described in detail in the record booklet. Brand names, a complete description of the method of preparation, cooking and recipes for composite dishes should be recorded. Plate waste is often weighed and recorded separately.	<ul style="list-style-type: none"> · Considered the gold standard for dietary assessment · No reliance on memory · Accurate record of actual intake of macro- and micro-nutrients for the period when done correctly · Accurate quantitative and qualitative data on foods by weight 	<ul style="list-style-type: none"> · Heavy subject burden · Temptation to eat foods which are easier to record is high · Temptation to record at the end of the day rather than as foods are eaten is high · Shows only data for the period recorded
Food frequency questionnaire	FFQs assess habitual diet by asking about the frequency with which food items or specific food groups are consumed over a reference period. Questionnaires can be self-administered or interviewer administered.	<ul style="list-style-type: none"> · Light subject burden · Gives good qualitative data on what types of foods subject consumes over a longer period · Seasonal changes are considered · Low cost · May be self-administered 	<ul style="list-style-type: none"> · Completely excludes data collection about foods which are not included in the questions · Unsuitable for people of various ethnic backgrounds as many foods not included.

Medical Research Council. (2014). Diet and physical activity measurement toolkit. Retrieved 17/09/2014, from <http://dapa-toolkit.mrc.ac.uk/dietary-assessment/methods/index.html>

2.10 Summary

Feeding issues often develop in early childhood and if not recognised and addressed, can cause serious nutritional insufficiencies. Fussy eating is the consumption of an insufficient amount or inadequate variety of food through rejection of certain foods. Around the age of 12 to 18 months most children reject foods that they had previously eaten or become reluctant to try new foods. Most get over this, but a small percentage develop feeding issues such as fussy eating. Nutritional inadequacy affects children's cognitive and physical development and poor adherence to dietary guidelines is a risk factor for diet-related disease. There are a number of risk factors for feeding problems such as problems with breastfeeding, gastro-intestinal issues in infancy, preterm birth and poor parental feeding strategies at mealtime.

It is possible for fussy eating to be overlooked or misdiagnosed because the child is showing normal growth - in fact some children with restricted diets can be overweight - but at the same time fussy eaters may be at risk of deficiency in nutrients critical for growth and development, and later chronic disease. Health professionals struggle with the subjective opinions of parents and lack of clear diagnostic tools. Meanwhile, if recognised and addressed at an early age, the development of fussy eating behaviours into poor eating habits could be avoided.

MoH food and nutrition guidelines are developed to ensure optimal growth, prevent nutritional deficiencies and aim to promote health while preventing avoidable diet-related disease and obesity. While there are a number of ways to assess nutritional sufficiency, diet quality indices are a cost-effective way of measuring adherence to nutritional guidelines in large samples. They assess not only dietary intake but behaviour and diet quality.

The BPFAS is a validated tool and will be used to measure incidence of problem mealtime behaviours in children and differentiate children with a clinical feeding problem from normative eaters in this study. The DICE was developed for this study based on the Australian DGI to measure adherence to MoH food and nutrition guidelines for children.

The primary aim of this research is to determine whether the BPFAS can be used to identify young children who are fussy eaters and at risk of not adhering to MoH food and nutrition guidelines. We also aim to identify risk factors for poor adherence to MoH food and nutrition guidelines, and higher incidence of problem mealtime behaviours.

3. Methods

3.1 Study Design

“Using the Behavioural Paediatric Feeding Assessment Scale to Identify Fussy Eaters, and Their Adherence to Dietary Guidelines” is a cross-sectional study using an online questionnaire. The primary aim of this study is to determine whether the Behavioural Paediatric Feeding Assessment Scale (BPFAS) can be used to identify young children who are fussy eaters and at risk of not adhering to the current New Zealand Ministry of Health (MoH) Food and Nutrition Guidelines for Healthy Children and Young People (aged 2 to 18 years) (MoH 2012). The secondary aim of this study is to identify risk factors for poor adherence to MoH food and nutrition guidelines, and higher incidence of problem mealtime behaviours.

3.2 Ethical Approval

Ethical approval for this study was gained from the Massey University Human Ethics Committee, Northern (Reference 13/056).

3.3 Study Population

3.3.1 Setting

The current study was conducted nationwide in New Zealand. New Zealand has an ethnically diverse population of approximately 4.5 million people living in both urban and rural areas, although approximately a third live in the country's largest city, Auckland. In the 2013 census, 292,044 or 6.5% of the population were aged ≤ 4 years old (Statistics NZ 2013).

3.3.2 Eligibility Criteria

Parents of pre-school aged children were eligible for this study if they had a child ≥ 24 months and ≤ 47 months at the time of completing the questionnaire. Parents with children who normally live outside of New Zealand were excluded from the study.

3.3.3 Sample Size

There was no precedent on which to base a power calculation for the sample size in this exploratory study. In order to collect observational data on the eating behaviours of a wide

cross-section of young children throughout New Zealand, a goal of 1000 participants was set and exceeded.

3.3.4 Recruitment of Participants

Recruitment for the study was conducted nationwide by email and through online, social and print media between February and September 2014. During recruitment and data collection, the working title for the study was Young Children's Eating Study (YES) to avoid the misconception that only parents of children with fussy eating or feeding problems should respond.

Massey University is New Zealand's largest residential university and has campuses in Auckland, Palmerston North and Wellington. At the beginning of the recruitment period, an email invitation with a hyperlink to the online questionnaire which was hosted on the website SurveyMonkey, was circulated to all Massey University staff. The invitation was also sent by email through the professional networks of the researcher's supervisors and the researcher. These networks included Parents Centre and the Plunket Society and span both the North and South Island. Recipients were invited to distribute the hyperlink to the questionnaire through their own networks and social media. Participants throughout the country who were involved in previous nutrition research studies at Massey University in Albany were also sent the same email invitation.

Early childhood education (ECE) centres and Kohanga and Puna Reo throughout the country were contacted in person or by email. They were invited to display advertisement posters (Appendix A) on their community noticeboards, which asked parents of 2 to 4 year olds to access the online questionnaire.

A news release (Appendix B) was sent by Massey University Albany's Communications Advisor to national online and print media. It included an outline of the study, the hyperlink to the questionnaire and the contact details of the researcher.

A brief explanation of the study and a hyperlink was also posted to the Facebook page of The Healthy Food Guide, a magazine with a nutrition focus that is sold in supermarkets, bookstores and airports all over New Zealand. A snowballing effect then occurred where the blurb and hyperlink was shared through the social networks of all the above contacts.

3.4 Informed Consent

Parents who accessed the hyperlink through the emails or posters were directed to an information page on the SurveyMonkey website. The information page contained details about the purpose of the study and how long it would take to complete the questionnaire. Consent was obtained by requiring a positive answer to both the second and final questions “I agree to take part in this research study” and “I understand that by submitting this questionnaire, I am agreeing to participate in this study,” respectively. If participants responded negatively to these questions, they were redirected to a thank-you page, which provided details about accessing information in case of concern about their child’s eating habits.

3.5 Data Collection and Questionnaire

3.5.1 Platform and Layout

All data was collected from parents of 2 to 4 year olds using a questionnaire (Appendix C) on the online platform SurveyMonkey. The use of this platform allowed data collection from respondents with internet access throughout the country and standardised the way in which the questionnaire was delivered. Online data collection was deemed the most cost-effective strategy for reaching the widest range and largest number of parents nationally. The study was designed to capture a large sample and thus a range of feeding behaviours in order to most effectively answer the aim of this study.

The questionnaire, which was made up of seven sections with headings and explanations where necessary to provide continuity and clarity for respondents (Fanning 2005), is outlined below. Due to the number and complexity of the measures used in this study, each section summary in the outline names the tool used and gives a brief explanation of what the section was designed to measure for the reader’s reference. A more thorough explanation of each of the main measures is given in the following section (section 3.6)

Section One (CEBQ-FSS)

Section one measured parentally reported fussy eating behaviours using the Fussiness Sub Scale (FSS) from the validated tool Children's Eating Behaviour Questionnaire (CEBQ) (Wardle, Guthrie et al. 2001). It is referred to through the text as CEBQ-FSS.

Section Two: Finding Out About Mealtimes and Your Feelings (BPFAS)

The Behavioural Paediatric Feeding Assessment Scale (BPFAS) is a validated parental report questionnaire designed to assess feeding behaviours and feeding problems in children (Crist & Napier-Phillips 2001).

Section Three: What Your Child Eats (DICE)

The researcher-designed Dietary Index for a Child's Eating (DICE) assessed adherence to New Zealand Ministry of Health Food and Nutrition Guidelines for Healthy Children and Young People (aged 2 to 18 years). The DICE has undergone validation but has not yet been published.

Section Four: When Your Child Was a Baby

This section was designed to ascertain the presence of known risk factors for feeding issues in the respondent's child's infancy.

Section Five (Parental Perception of Fussiness LTIS)

Section five assessed parental perception of their child's fussy eating using the Parental Perception of Fussiness Likert Type Item Score (LTIS) as well as perceptions of fussy eating in general.

Section Six

A medical history questionnaire was designed to ascertain the presence of known risk factors and concomitants of fussy eating, diet restrictions and parental perceptions of their child's weight.

Section Seven: About You and Your Child

This section was designed to collect demographic data on both parent and child to enable accurate reporting of sample characteristics.

3.5.2 Instructions and Elimination of Ineligible Respondents

Instructions (e.g: “please tick one circle only” and “please tick all that apply”) were given at the beginning of each segment to improve participant understanding (Fanning 2005). Question logic was used to eliminate ineligible respondents; if a respondent replied negatively to the first question “Do you live in New Zealand and is your child aged between 2 and 4 years old?,” they could not continue with the questionnaire.

3.5.3 Question Order and Rationale

Questions seeking potentially sensitive information such as income or medical history, or information that is maybe difficult to remember was placed after questions which are easier to answer (Dillman 2000). Section one and two collected information about habitual behaviours that are generally easier to recall. As recollection of child’s food intake was necessary for a parent to complete questions in the DICE, these questions were placed in section three. Written and visual examples of serving sizes for commonly eaten foods were given in the DICE segment to help parents answer diet quality questions accurately. Demographic questions included sensitive data on household income, thus this section and the medical history questions were placed at the end.

3.5.4 Privacy

Data collection was anonymously conducted because the promise of greater privacy may increase the number of participants from some sub-populations (Murdoch, Simon et al. 2014). Data from respondents who did not give final consent to be included in the study was not retained.

3.6 Measures to Assess Fussy Eating, Parental Perceptions of Fussy Eating and Feeding Behaviours

3.6.1 Assessing Fussy Eating: CEBQ-FSS (Section One of Questionnaire)

Parentally reported fussy eating behaviours were measured in the current study using the CEBQ-FSS. The six questions from the sub scale were designed to ascertain the presence and intensity of fussy eating behaviours in children. The questions measure the child’s parentally reported interest in tasting new foods, enjoyment of a wide range of foods, whether their child is interested in tasting foods s/he hasn’t tasted before, whether their child refuses new foods at first and difficulty to please with meals.

3.6.1.1 Scoring the CEBQ-FSS

Questions on the CEBQ-FSS are phrased both positively and negatively so when the questionnaire is scored, positive ratings are transformed. Higher scores therefore indicate greater fussiness. Each behaviour is rated on a 5 point Likert type item that ranges from 1 point for “never” to 5 points for “always.” To produce a final score, the Likert type items are summed and this total is divided by the number of questions to give a highest possible score of five. The mean±SD score for the FSS for children up to 3 years of age in the validation study was 2.9±0.8 (Wardle, Guthrie et al. 2001). A study that gives a cut-off score to differentiate between fussy and non-fussy eaters using this sub scale has not been done. We therefore followed the lead of Wardle (2001) in using the mean to stratify into below and above mean fussy eating groups during analysis.

3.6.2 Assessing Parental Perceptions of Fussy Eating: Parental Perception of Fussiness LTIS (Section Five of Questionnaire)

Section five was designed to assess parental perceptions of what fussy eating behaviour entails. This was done by asking participants to choose as many items as they wished from a drop-down menu of fussy eating behaviours derived from the literature including: refuses many foods, refuses fruit, refuses vegetables, refuses meat/fish/poultry and other protein-rich foods, refuses foods of a particular texture, refuses new foods, eats the same few foods only and eats a limited amount of food. Analysis of this data was not performed for this study.

Participants were also asked to rate their own child’s fussiness on a Likert type item from one which was not at all fussy to ten, extremely fussy. This was the main measure of parental perception of fussiness and referred to throughout the text as Parental Perception of Fussiness LTIS.

3.6.3 Assessing Feeding Issues: The Behavioural Paediatric Feeding Assessment Scale (BPFAS) (Section Two of Questionnaire)

The BPFAS was designed to measure feeding problems in children based on incidence of problem feeding behaviours. Permission to use the BPFAS was received from Dr. Crist in September 2014 (Appendix D). Crist & Napier (2001) compared a normative group with two other groups: children who attended their feeding clinic and required medical intervention (clinical/medical) and those who did not require it (clinical/non-medical). They

found that all children displayed problem feeding behaviours but that the clinical groups displayed a higher incidence of them.

The BPFAS served as the primary measure of feeding problems and feeding behaviours in participants' children in the current study and was included in its entirety. It comprises 70 questions and is completed by the parent. The first 25 Likert type items relate to the child's eating behaviour (and are summed to create the Child Frequency Score or CFS) and the following ten Likert type items relate to parental strategies for, and feelings about, mealtimes (and are summed to create the Parent Frequency Score or PFS). The CFS and PFS are summed to create the Total Frequency Score (TFS).

Each of the Likert type items are followed by a yes/no question asking "Is this a problem for you?" The Child Problem Score (CPS) is produced from the yes/no questions relating to the first 25 Likert type-items and the Parent Problem Score (PPS) from the last ten. The CPS and PPS are summed to create the Total Problem Score (TPS).

3.6.3.1 Scoring the BPFAS

All 35 Likert type items range from 1 point for "never" to 5 points for "always." Since questions are phrased both positively and negatively, when the questionnaire is scored, positive ratings are transformed. The resulting TFS is scored out of 175. The TPS is scored by giving 1 point for each "yes" answer and is scored out of a maximum of 35. Higher scores in TPS and TFS therefore indicate problem feeding behaviours and parental problems handling them, respectively.

3.6.3.2 Total Frequency Score and Total Problem Score

The BPFAS Likert type items are designed to assess the presence of feeding problems based on the frequency of certain child feeding behaviours and parental strategies, and how frequently these behaviours and strategies are problematic for the parent. In their validation study, Crist & Napier (2001) found that in the normative sample, the mean \pm SD TFS was 63.9 \pm 14.2, while the means for the TFS were 98.4 \pm 17.1 and 94.5 \pm 16.7 in the clinical/non-medical and clinical/medical groups respectively. TPS for the same groups were 3.0 \pm 4.5, 15.4 \pm 7.8 and 13 \pm 7.8 respectively. Both the mean TFS and TPS for the normative sample were significantly different from the clinical groups at $p < 0.001$. BPFAS mean scores for normative and clinical groups are summarised in Table 3.1.

Table 3.1 Behavioural Paediatric Feeding Assessment Scale Scores for Normative and Clinical Groups

	Normative (n=96)		Clinical/non-medical (n=95)		Clinical/medical (n=154)	
	Mean	SD	Mean	SD	Mean	SD
Child Frequency Score	46.6*	10.3	69.9	12.6	67.8	12.1
Child Problem Score	2.2*	3.2	10.7**	5.6	9.0	5.6
Parent Frequency Score	17.3*	4.8	28.5	5.9	26.9	5.9
Parent Problem Score	0.8*	1.6	4.7	2.8	4.0	2.8
Total Frequency Score	63.9*	14.2	98.4	17.1	94.5	16.7
Total Problem Score	3.0*	4.5	15.4**	7.8	13.0	7.8

*Significant main effect for population group, $p < 0.001$. Mean scores for normative group significantly lower than for clinical groups, $p < 0.001$. **Number of items endorsed as problems higher for clinical/non-medical group than for clinical/medical group, $p < 0.01$.
 Note: Reprinted with permission from "Mealtime Behaviors of Young Children: A Comparison of Normative and Clinical Data" by William Crist and Anne Napier-Phillips. 2001, Developmental and Behavioral Pediatrics, Vol 22, No.5, p. 279-286.

In order to delineate between children with a clinical feeding problem and a normative sample, a statistically determined cut-off score was produced in the Australian validation study of the BPFAS. A score of more than 61 for the CFS and six for the CPS, 20 for the PFS and two for the PPS was returned (Dovey, Jordan et al. 2013).

3.6.3.3 Measures of Child Feeding Behaviours in the BPFAS

Child behaviours at mealtime assessed by the BPFAS include: eating a limited variety of food, low enjoyment of eating, refusal to try new foods, avoidance of certain food groups including protein- and carbohydrate-rich foods and fruit and vegetables, long mealtimes, avoidance of mealtimes, eating snacks but not meals, leaving the table before mealtime is

finished, crying or whining, throwing tantrums, delaying eating by talking, negotiation of what will be eaten, refusing to eat meals but requesting food immediately after a meal, drinking milk, poor appetite and preferring to drink rather than eat.

3.6.3.4 Measures of Organic Feeding Problems in the BPFAS

Oral-motor delays and other medical problems can result in feeding issues. The BPFAS Likert type items are designed to assess behaviours including: problems with chewing food, gagging or choking, vomiting around mealtimes, eating only soft, pureed or strained foods, allowing food to sit in the mouth, spitting out food and requiring nasal-gastric feeds to maintain nutritional status.

3.6.3.5 Measures of Parent Feeding Strategies in the BPFAS

Measures of parent feeding behaviours that the BPFAS Likert type items are designed to assess are coaxing, forcing or threatening their child to make them eat, making fussy eaters a separate meal from the rest of the family, concern over whether their child has a sufficient intake of food or that their eating pattern affects their health, feeling frustrated, anxious, angry or a lack of confidence about their ability to manage their child's mealtime behaviour and disagreeing with their spouse or other family members about their feeding style.

3.7 Assessment of Adherence to MoH Food and Nutrition Guidelines: Dietary Index for a Child's Eating (DICE) (Section Three of Questionnaire)

The DICE, based on McNaughton's (2007) Dietary Guideline Index (DGI) was developed to measure adherence to the MoH Food and Nutrition Guidelines for Healthy Children and Young People (aged 2 to 18 years) which gives recommendations for the consumption of foods from four major food groups: fruit and vegetables, meat and alternatives, breads and cereals and dairy products. All decisions on the development of questions were reviewed by a team of experts in dietary assessment in a roundtable discussion.

3.7.1 Development of Indicators and Cut-offs, and Scoring

Indicators and cut-offs were identified for each of the dietary guidelines, to give a total of 17 items with a total possible score of 120 where higher total scores indicate closer adherence to guidelines. The food group, fluid and sugar-sweetened beverage intake recommendations were all allowed a maximum score of ten, reflecting the relative

importance of these guidelines. For diet quality measures, frequency of meals, family mealtime and physical activity measures, the maximum score was 5 points. For example, for dietary guidelines related to recommended intakes of food groups such as “eat a variety of milk and milk products or alternatives each day” the indicator was servings per day. The criteria for the maximum score for intake was ≥ 2 servings as per the guidelines and the criteria for the minimum score was 0 servings. Intermediate consumption for intake recommendations was scored proportionately; in the case of dairy or alternative intake for example, half a serving of dairy or alternatives per day scored 2.5 points, 1 serving per day scored 5 points and one and a half servings was awarded 7.5 points.

3.7.2 Fruit and Vegetable Intake Indicators

The risk of over-reporting fruit and vegetable intakes associated with FFQ measures (Coyne, Ibiebele et al. 2005) was not taken into account as the data was parentally reported rather than self-administered. Recent recommendations on dietary index methodology suggest that fruit and vegetable intakes should be measured in two separate index components (Waijers, Feskens et al. 2007), thus fruit and vegetables were measured in separate items on the DICE. Both fruit and vegetables were scored in the same way as milk and alternatives. Indicators, descriptions and cut-offs for each guideline are detailed in Table 3.2. The DICE is scored out of a total maximum score of 120.

Table 3.2 Components of the Dietary Index for a Child's Eating (DICE)

Dietary guideline	Indicator and description	Criteria for scores
Eat a variety of vegetables and fruit, including different colours and textures	Servings of fruit per day	≥2=10 1.5=7.5 1=5 0.5=2.5 0=0
	Servings of vegetables per day	≥2=10 1.5=7.5 1=5 0.5=2.5 0=0
Eat a variety of milk and milk products or suitable alternatives, preferably reduced or low-fat options	Servings of milk products per day	≥2=10 1.5=7.5 1=5 0.5=2.5 0=0
	How often reduced and low fat versions are chosen	Every day=5 Most days=4 Some days=3 Rarely=0 Never=0
Eat a variety of lean meat, poultry, fish, shellfish, eggs, legumes, nuts and seeds.	Servings of meat or alternatives per day	≥1=10 0.5=5 0=0
Eat a variety of breads and cereals, increasing wholegrain products as children increase in age	Servings of bread and cereals per day	≥4=10 3=7.5 2=5 1=2.5 0=0
	How often wholegrain versions are eaten	Every, most and some days=5 Rarely and never=0
Eat regularly over the day, that is, have breakfast, lunch and dinner and include in-between snacks for young children or if hungry	Number of meals and snacks that are usually eaten per day	Has B, L and D most or every day=5 Has B, L and D some days=2 Has B, L and D rarely or never=0
		Every day=5 Most days=4 Some days=3 Rarely=0 Never=0
Prepare foods or choose pre-prepared foods, snacks and drinks that are low in fat, especially saturated fat	How often low fat food, snack and drink options are chosen	Every day=5 Most days=4 Some days=3 Rarely=0 Never=0

Dietary guideline	Indicator and description	Criteria for scores
Prepare foods or choose pre-prepared foods, snacks and drinks that are low in sugar, especially added sugar	How often low sugar food, snack and drink options are chosen	Every day=5 Most days=4 Some days=3 Rarely=0 Never=0
Prepare foods or choose pre-prepared foods, snacks and drinks that are low in salt	How often low salt food, snack and drink options are chosen	Every day=5 Most days=4 Some days=3 Rarely=0 Never=0
Drink plenty of water during the day. Include reduced or low-fat milk every day. Limit drinks such as fruit juice, cordial, fruit drink, fizzy drinks (including diet drinks), sports drinks and sports water	Fluid, cups per day Fruit juice and drink, cordial, fizzy drinks, sports drinks and sports water, flavoured milk/milk based drinks, as a proportion of fluids	≥4=10 3=7.5 2=5 <2=0 0%=10 >0%=0
Eat meals with family or whānau as often as possible	How often meals are eaten with family or whānau	Every day=5 Most days=4 Some days=3 Rarely=0 Never=0
Encourage children and young people to be involved in shopping, growing and cooking family meals.	How often child is involved in shopping, growing and cooking family meals	Every day=5 Most days=4 Some days=3 Rarely=0 Never=0

Dietary guideline	Indicator and description	Criteria for scores
Be physically active. <ul style="list-style-type: none"> Take part in regular physical activity, aiming for 60 minutes or more of moderate to vigorous activity each day. Spend less than two hours a day (out of school time) in front of television, computers and gaming consoles. Be active in as many ways as possible, for example, through play, cultural activities, dance, sport and recreation, jobs and going from place to place. Be active with friends and whānau, at home, school, and in your community 	<p>How often the child does moderate to vigorous PA for at least 60 min a day</p> <p>How often the child spends more than 2 hours a day in front of TV, computers or gaming consoles</p>	<p>Every day=5 Most days=4 Some days=3 Rarely=0 Never=0</p> <p>Every day=0 Most days=0 Some days=3 Rarely=4 Never=5</p>

B=breakfast, L=lunch, D=dinner; PA=physical activity. NB: The DICE is scored out of a total maximum score of 120.

3.7.3 Diet Quality and Meal Frequency

Diet quality was integrated into the DICE by including items which reflect whole-grain cereal and reduced or low-fat dairy product intake, and intake of low-fat, -sugar and -salt food, snacks and drinks. Apart from the criteria for wholegrain cereals which was dichotomously valued with all, most and some days awarded 10 points and rarely or never 0 points, other diet quality indicators were scored proportionately, as was meal frequency.

3.7.4 Fluids and Sugar-Sweetened Beverages

Fluid intake indicators are scored proportionately. However, because the MoH food and nutrition guidelines advise limiting sugar-sweetened beverages and do not suggest a quantitative upper limit, intakes for these are scored dichotomously, with 0% intake scoring 10 and >0% scoring 0. Sugar-sweetened beverages are strongly associated with obesity (Bigornia, LaValley et al. 2015) and the score in this measure reflects the importance of avoiding them.

3.7.5 Family Meals, Involvement in Food Preparation

The importance of mealtimes and the value placed upon the consumption of foods within the family setting has a significant impact upon the development of eating habits (Boutelle, Birnbaum et al. 2003) and obesity (Utter, Scragg et al. 2008) while involvement with growing food for consumption increases children's liking for vegetables (Nolan, McFarland

et al. 2012). Eating meals as a family and involving children in growing, shopping and cooking were therefore scored proportionately with the maximum score of five awarded to children who reportedly did these things every day.

3.7.6 Television and Physical Activity

Television watching influences both the quantity and quality of foods being eaten (Coon, Goldberg et al. 2001) thus the item which measured whether a child reportedly looked at a screen for more than 2 hours per day was scored inversely and continuously, with the maximum score of five being allowed for answering never. Physical activity was also scored proportionately out of five.

3.8 Assessing Risk Factors for Feeding Problems, Medical History Related to Feeding Behaviours, Dietary Restrictions and Parental Perception of Weight

Section four was designed to assess the presence of known risk factors for feeding issues in the participant's child which include preterm birth and problems as an infant with: breastfeeding, reflux, food allergies, food intolerances and starting solid foods.

Section six collected data on medical issues and diet restrictions that are associated with problematic feeding behaviours such as autism spectrum disorders (ASD), food allergies and intolerances. Parents were asked whether their child had been diagnosed with developmental delay, autism, attention deficit disorders, medical conditions that do or do not affect feeding and eating difficulties.

Participants were also asked in section six if they restricted their child's food intake due to food allergies, intolerances or sensitivities and if yes, whether these had been diagnosed by a medical practitioner. Data on dietary restrictions for any other reason (e.g: for religious or ethical reasons) and child's supplement intake were also collected. The last two questions in this section asked how parents rated their child's weight compared to other children of the same age and sex and how concerned about it they felt.

3.9 Collection of Demographic Data

Participants completed a series of items adapted from the New Zealand census questions (Statistics NZ 2013) to document their child's age in months, ethnicity, the mother's

highest level of education and household income. In order to allow participants to self-identify with regard to ethnicity (Statistics NZ, 2005), more than one ethnicity could be selected. Ethical approval for this study proscribed use of ethnicity data for purposes other than describing the sample and thus tests to compare differences between ethnic groups with regard to outcome measures were not performed.

Participants were asked their child's age twice in order to verify that they fulfilled age criteria; at the beginning of the questionnaire, a screening question asked parents whether their child was between 24 and 47 months of age. In the latter part of the questionnaire, their child's birthdate was also inputted using drop-down menus. As sex does not appear to be a significant factor in children's fussy eating (Carruth, Ziegler et al. 2004; Tharner, Jansen et al. 2014), this information was not collected.

3.10 Dissemination of Results and Feedback to Participants

At the end of the questionnaire, participants were provided with a hyperlink to the Massey University Paediatric Infant Feeding and Nutrition (PIFaN) website which will host a summary of the results, a link to Ministry of Health information about healthy eating for children and advised to contact Plunket or their doctor in case of concern about their child's eating habits.

3.11 Statistical Analysis

The current analysis is based on data from eligible parents who completed the questions for at least one of the main measures (BPFAS, DICE, CEBQ-FSS, Parental Perception of Fussiness LTIS) in full. All data was imported into SPSS (IBM SPSS Statistics Version 22) from SurveyMonkey and coded for statistical analysis.

Initial data analysis was performed orthogonally to the main statistical analyses in order to: make decisions regarding missing values, check assumptions for fitting models and make any necessary transformations. Exploratory data analysis was performed visually in order to ensure accuracy of data, summarise the main characteristics of the data and to generate a plan for confirmatory data analysis and hypothesis testing.

3.11.1 Initial Data Analysis

Incomplete data from any measure were excluded from analysis pairwise; any section that a participant completed in full was included in analysis while sections with any missing values were not. This meant that while the total number of participants in this study was 1389, only 1240 were eligible for BPFAS analyses, 1159 for DICE analyses, 1364 for CEBQ-FSS analyses and 1239 for Parental Perception of Fussiness LTIS analyses. When data was examined, none of the outliers appeared to be due to input error and because of the exploratory nature of this research, no outliers were excluded.

Scores for the CEBQ-FSS, the BPFAS Total, Child and Parent Frequency and Total, Child and Parent Problem Scores and DICE were calculated. Participants who identified as Chinese and as Indian were collapsed into the Asian group and participants who identified as Cook Island Māori, Tongan, Samoan and Niuean were collapsed into the Pacific group due to low numbers in some of the ethnic groups.

Kolmogorov-Smirnov and Shapiro-Wilks tests are inappropriate in testing for normality in large samples (Field 2009), therefore normality of distribution was ascertained visually using normality plots and histograms. When data was found to be parametric, independent t-tests and one-way ANOVA were performed. In cases where data was non-parametric, log and square root transformations were attempted and tests for normal distribution were repeated. When data was non-parametric, Pearson's chi-square tests, Mann-Whitney U tests and Kruskal Wallis tests were undertaken.

When assumption of homogeneity of variances as assessed by Levene's test for equality of variances were violated in parametric multivariate tests, Tukey's Kramer post hoc tests were selected, otherwise Tukey's post hoc tests were used. In the case of non-parametric multivariate tests, pairwise comparisons were performed using Dunn's procedure (Dunn 1964) with a Bonferroni correction for multiple comparisons.

3.11.2 Exploratory Data Analysis

Descriptive statistics were carried out for demographic data and all outcome measures and the mean and standard deviation or median and 25th and 75th percentiles recorded. Data was examined using scatterplots, box plots and histograms.

3.11.3 Confirmatory Data Analysis and Hypothesis Testing

A p -value of less than 0.05 was considered statistically significant in tests of proportion between groups, in the multiple linear regression, one-way ANOVA and Kruskal Wallis tests. All tests between groups were two-tailed.

Participants were stratified into did and did not complete groups for each of the outcome measures described above and independent t-tests and Pearson's chi-square tests were performed to examine whether any differences existed between them with regard to socio-economic data and age.

Participants were then stratified into high and low CEBQ-FSS groups. Participants were also stratified into normative and clinical feeding problem groups using the TFS cut-offs from Dovey (2013) and independent t-tests and Pearson's chi-square tests were performed to examine whether any differences existed between groups with regard to socio-economic data and age. The same tests were performed in order to test for differences between groups with regard to all outcome measures.

Participants were stratified into yes and no groups based on whether they had risk factors and medical status associated with feeding issues and/or dietary restrictions. Differences in all outcome measures were compared between the groups using Mann-Whitney U and independent t-tests.

Pearson's product moment correlations or in the case of non-parametric data, Spearman's correlations were carried out for all participants between each of the main outcome measures: CEBQ-FSS; TFS; TPS; DICE and Parental Perception of Fussiness LTIS.

These analyses were repeated for TFS normative feeding group.

Participants were classified into three groups based on parental perception of weight. One-way ANOVA and Kruskal-Wallis tests were conducted to determine if outcome measures were different for children between groups. Participants were stratified into two groups based on parental concern about weight. One-way ANOVA and Kruskal-Wallis tests were conducted to determine if outcome measures were different between groups.

To determine the contribution of BPFAS to adherence to MoH food and nutrition guidelines, multiple linear regression analysis was performed with DICE scores as the dependent variable and TFS scores and other factors as independent variables.

4. Results

The first aim of this cross-sectional study was to determine whether the Behavioural Paediatric Feeding Assessment Scale (BPFAS) can be used to identify young children who are fussy eaters and at risk of not adhering to the current New Zealand Ministry of Health (MoH) Food and Nutrition Guidelines. The second aim was identify risk factors for poor adherence to MoH food and nutrition guidelines, and higher incidence of problem mealtime behaviours.

4.1 Participants

Data for this study was collected online between February and September 2014. Information about the study was given on the landing page. If participants were interested in the study, they completed a self-screening based on their child's age in years and place of residence. Of the 1959 participants who answered these questions, 1894 were eligible to continue. 1894 people answered "yes" to the first consent question which preceded the questionnaire. Of the 1591 people who answered the second and final consent question, 1587 agreed to participate in the study and thus data from these participants was downloaded for analysis. Of these, 198 participants were deemed ineligible based on child's age given in months and final statistical analysis was performed on data from 1389 participants.

Figure 4.1 outlines the process from screening parents of young children in New Zealand to the final number of participants used in data analysis in this study. As not all participants who were eligible for final data analysis completed all measures in the questionnaire, numbers for analysis per measure are also presented. All data in the study was reported by parents but concerns their child.

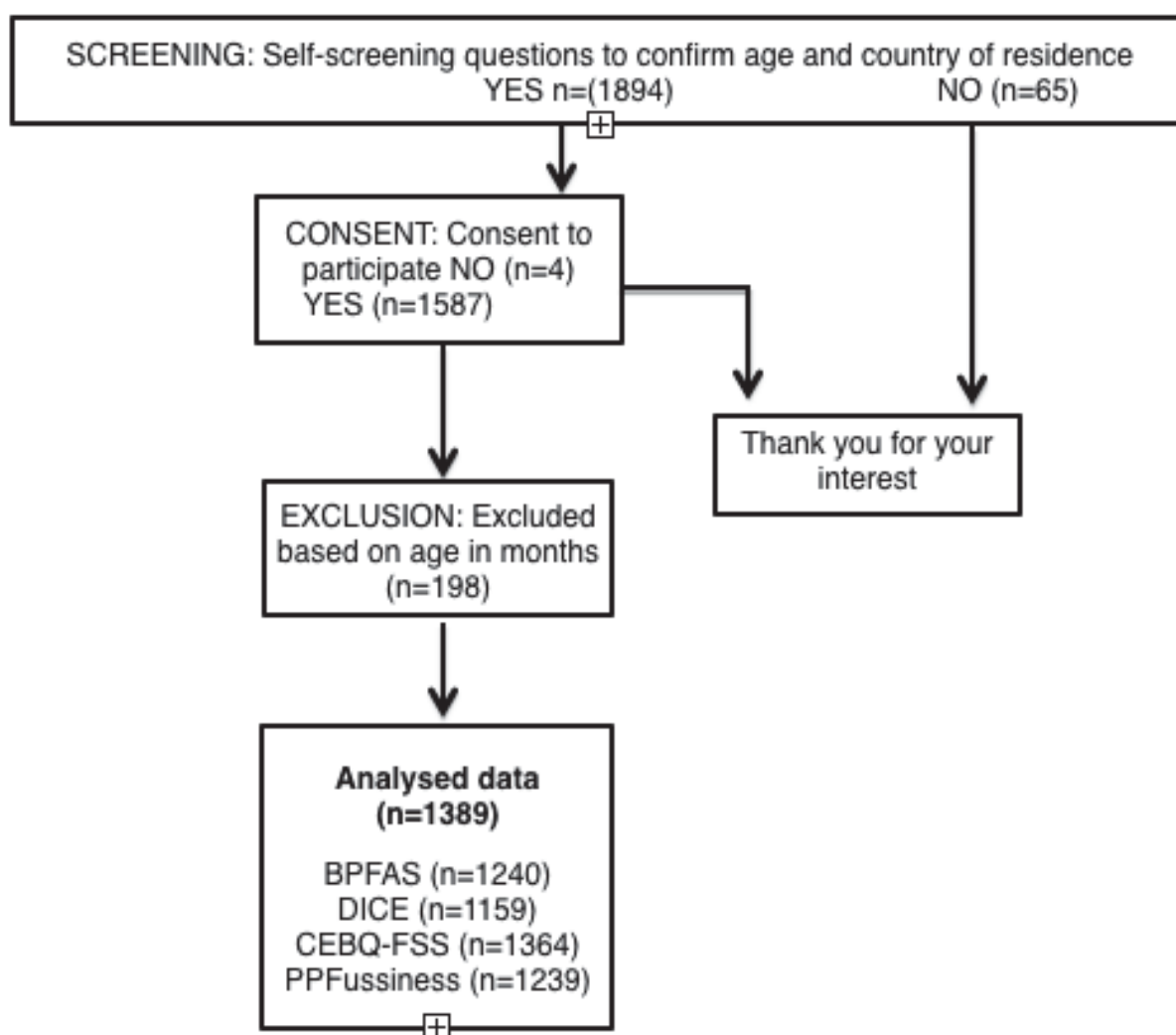


Figure 4.1 Flow Diagram Outlining Recruitment and Final Number of Participants for Data Analysis

ECE=Early childhood education; CEBQ-FSS=Fussiness sub scale from the Children's Eating Behaviour Questionnaire; TFS=Total Frequency Score from Behavioural Paediatric Feeding Assessment Scale (BPFAS); DICE=Dietary Index for a Child's Eating; PPFussiness=Parental Perception of Fussiness NB: If a participant did not complete a particular measure from the questionnaire, they were only excluded from analysis that involved that particular measure rather than excluded from analysis entirely.

4.1.1 Demographic Characteristics of Participants

The age, ethnicity and socio-economic characteristics of participants are detailed in Table 4.1. The majority of the participants were New Zealand Europeans. The majority of mothers (61.2%) were educated to university level and the most common household income bracket was over \$75,001 per year. The mean±SD age was 35.2±6.75 months (just under 3 years old). Participants were stratified into did and did not complete groups

for the four outcome measures in Figure 4.1. No significant differences were found between groups with respect to age and socio-economic characteristics.

Table 4.1 Demographic Characteristics of Participants

Characteristics	N=1389
Age in months mean±SD	35.2±6.75
Child ethnicity † ∞ n(%)	
NZ European	1311 (94.4)
Māori	181 (13.0)
Pacific	65 (4.7)
Asian	54 (3.9)
Other ethnicity	88 (6.3)
Mother's highest level of education † n(%)	
Primary	2 (0.1)
Some High School	264 (19)
College of Education	57 (4.1)
Polytech Diploma	167 (12.0)
University Degree	850 (61.2)
Household income † n(%)	
≤\$25,000 per annum	41 (3.0)
\$25,001-\$50,000 per annum	154 (11.1)
\$50,001-\$75,000 per annum	306 (22.0)
Over \$75,001 per annum	815 (58.7)

† Missing data: Ethnicity=9, Mother's highest level of education=49, Household income=73.

∞ Because many participants were identified as belonging to more than one ethnic group, the total of all ethnic groups exceeds the total number of participants.

4.2 Behavioural Paediatric Feeding Assessment Scale (BPFAS)

The BPFAS was the main measure of feeding issues in this study (section 3.6.3). It is made up of two main scores (Total Frequency Score (TFS) and Total Problem Score (TPS)) and four sub scores (outlined below), where higher scores indicate increased frequency of problematic feeding behaviours and parental problems with these,

respectively. The behavioural measures include the Child Frequency Score (CFS) and Parent Frequency Score (PFS), which are summed to give a TFS out of 175. The Child Problem Score (CPS) and Parent Problem Score (PPS) make up the TPS, which is scored out of 35. Cut-off values have been determined by Dovey (2013) to differentiate children with a clinical feeding problem from those who do not (normative feeding group) (Table 4.2). No significant differences were found with regard to age and the socio-economic indicators of participants between groups. TFS and TPS correlate strongly with each other ($r = 0.77$, $p < 0.001$) but are independent scores.

4.2.1 Classification of Participants with a Clinical Feeding Problem

TFS for all participants in this study ranged from 36 to 141 with a mean \pm SD of 69.4 \pm 16.0. Of those who completed the TFS ($n = 1240$) in this study 281 (22.7%) scored 81 or more and were therefore stratified into the TFS clinical feeding problem group. TFS ranged from 81 to 141 for the clinical feeding problem group, and from 36 to 80 for the normative feeding group. Because not all respondents completed the TFS and thus could not be stratified into a feeding group, mean and median scores in Tables 4.3 – 4.5 could only be calculated for respondents who had completed both measures.

Table 4.2 details mean \pm SD and median [25,75] Child, Parent and Total Frequency and Problem Scores stratified by clinical feeding problem/normative TFS groups, as well as for all participants. Refer to Table 3.1 in the Methods section for possible, normative and clinical feeding problem ranges.

Table 4.2 Behavioural Paediatric Feeding Assessment Scale Scores for All Participants and Normative/Clinical Feeding Problem Groups

Measure	All participants †	Normative feeding group (BPFAS≤80)	Clinical feeding problem group (BPFAS≥81)
Child Frequency Score (mean±SD) n=1276 †	50.6±11.5 (range: 26-105)	46.0±7.6 (range: 26-65)	66.5±7.44 (range: 54-105)
Parent Frequency Score (mean±SD) n=1340 †	18.7±5.4 (range: 10-50)	16.7±3.42 (range: 10-28)	25.9±4.59 (range: 16-50)
Total Frequency Score (mean±SD) n=1240 †	69.4±16.0 (range: 36-141)	62.6±9.98 (range: 36-80)	92.4±10.5 (range: 81-141)
Child Problem Score † (median [25,75]) n=1033	2 [0,6] (range: 0-21)	1 [0,6] (range: 0-12)	10 [6.75,14] (range:0-21)
Parent Problem Score † (median [25,75]) n=1246	0 [0,2] (range: 0-10)	0 [0,1] (range: 0-9)	5 [2,6] (range: 0-10)
Total Problem Score † (median [25,75]) n=967	3 [0,9] (range: 0-29)	1 [0,4] (range: 0-17)	14 [10,20] (range: 0-29)

† Missing data: Child Frequency Score: 113, Parent Frequency Score: 49, Total Frequency Score: 149, Child Problem Score: 356, Parent Problem Score: 143, Total Problem Score: 422. NB: Normative feeding group range for TPS, CPS and PPS exceeds clinical cut-offs (Dovey 2013) because normative/clinical feeding problem group in this study were only stratified according to TFS, not TPS.

4.2.2 Total Problem Score

A Total Problem Score of eight or more indicates a clinically significant feeding problem (Dovey, Jordan et al. 2013). Of the 967 participants who completed the TPS, 272 (28.1%) scored eight or above.

4.3 Dietary Index for a Child's Eating (DICE) Score

The Dietary Index for a Child's Eating was the main measure of adherence to MoH food and nutrition guidelines in this study (section 3.7). It is scored out of 120, where a higher score indicates closer adherence to the guidelines. The mean±SD DICE score for all participants was 89.6±10.9 and their scores ranged between 49 and 114. Children identified with a clinical feeding problem (BPFAS score ≥81) had significantly lower DICE scores than children in the normative feeding group (BPFAS score ≤80) (Table 4.3).

Table 4.3 Dietary Index for a Child's Eating Scores for All Participants and Normative/Clinical Feeding Problem Groups

Measure	All participants †	Normative group n=803	Clinical feeding problem group n=239	p-value between groups
Dietary Index for a Child's Eating[†] (mean±SD)	89.6±10.9 (range: 49-114)	91.8±9.23 (range: 58-114)	81.9±12.3 (range: 49-109)	<0.001

† Missing data: 117. Independent t-test for difference between groups.

4.3.1 Correlation Between Dietary Index for a Child's Eating and Total Frequency Score

Higher Total Frequency Scores on the BPFAS tool indicate increased frequency of problematic feeding behaviours and there was an inverse linear relationship ($r = -0.45$, $p < 0.001$) between Total Frequency Score and the Dietary Index for a Child's Eating. As TFS increased, DICE scores decreased (Figure 4.2). DICE also had a weak inverse correlation with TPS ($r = -0.33$, $p < 0.001$).

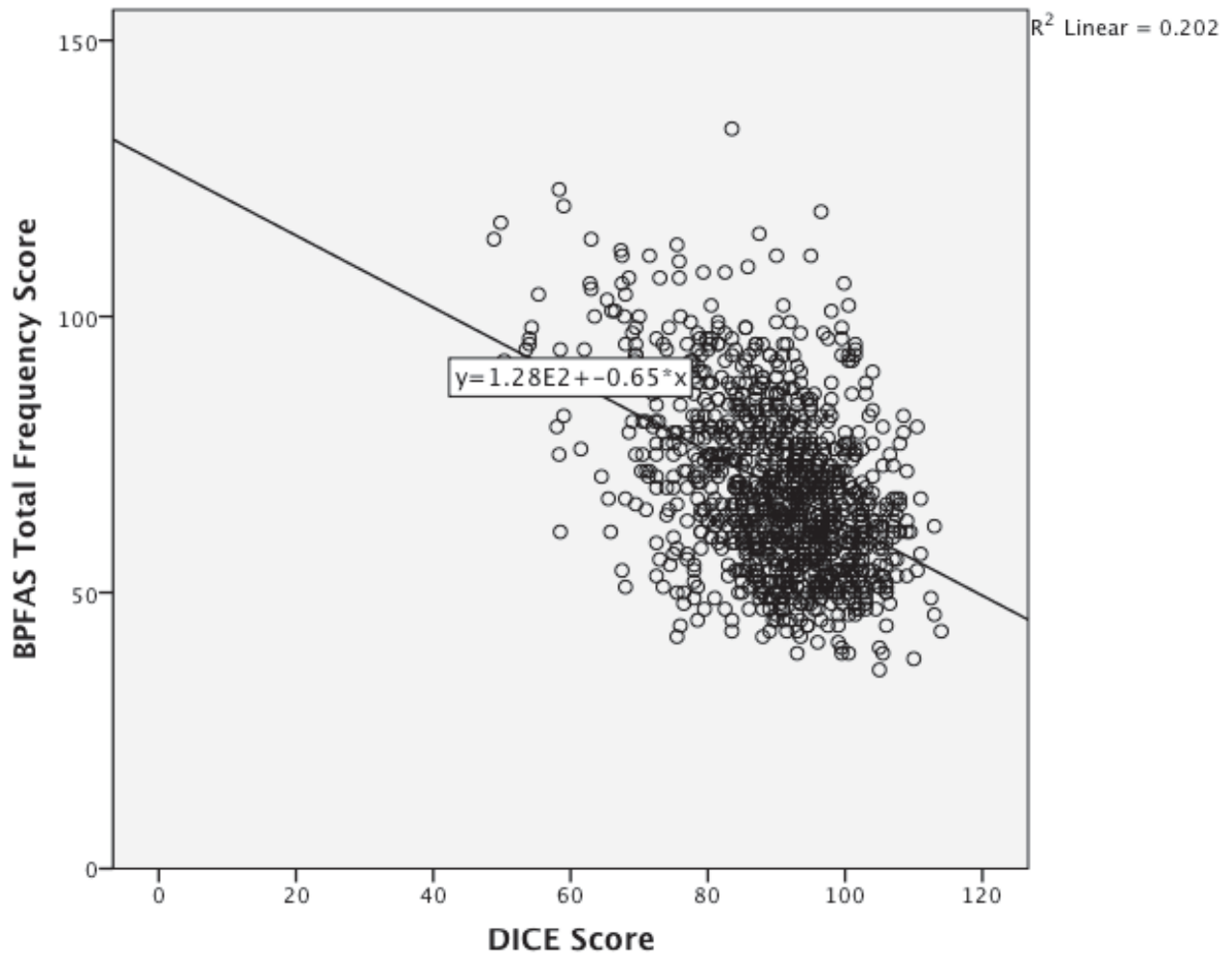


Figure 4.2 Relationship Between Dietary Index for a Child's Eating (DICE) and Behavioural Paediatric Feeding Assessment (BPFAS) Total Frequency Score

4.4 Children's Eating Behaviour Questionnaire Fussiness Sub Scale (CEBQ-FSS)

The fussiness sub scale from the Children's Eating Behaviour Questionnaire (CEBQ-FSS) was the main measure of food fussiness in this study (section 3.6.1). Children's food fussiness was measured on a scale from one to five where one was not at all fussy and five was extremely fussy. The fussiness sub scale scores for all participants ranged from 1.67 to 4.00. No significant difference in CEBQ-FSS score was observed between the normative and clinical feeding problem groups (Table 4.4). When CEBQ-FSS was stratified into below and above mean groups, no significant differences were found with regard to age and the socio-economic characteristics of participants between groups. No

significant correlations were observed between the CEBQ-FSS and any of the other outcome measures.

Table 4.4 Children’s Eating Behaviour Questionnaire Fussiness Sub Scale Scores for All Participants and Normative/Clinical Feeding Problem Groups

Measure	All participants †	Normative group n=945	Clinical feeding problem group n=277	p-value between groups
CEBQ-FSS[†] (mean±SD)	2.87±0.28 (range: 1.67-4.00)	2.88±0.28 (range: 1.83-4.00)	2.86±0.26 (range: 1.67-3.67)	0.24

† Missing data: 142. CEBQ-FSS=Children’s Eating Behaviour Questionnaire Fussiness Sub Scale. Independent t-test for difference between groups.

4.5 Parental Perception of Fussiness Likert Type Item Score (LTIS)

The Parental Perception of Fussiness LTIS was the main measure of parental perception of fussiness in this study (section 3.6.2). Parental perceptions of their child’s fussiness were measured on a scale from one to ten where one was not at all fussy and ten was extremely fussy. Parental Perception of Fussiness LTIS in this study ranged from a minimum of one to a maximum of ten. There was a significant difference in parental perceptions of fussiness between normative eaters and children with clinical feeding problems (Table 4.5). There was a moderately strong inverse correlation between Parental Perception of Fussiness LTIS and the Dietary Index for a Child's Eating ($r = -0.42$, $p < 0.001$). There was also a strong positive correlation between Parental Perception of Fussiness LTIS and TFS ($r = 0.72$, $p < 0.001$) and TPS ($r = 0.69$, $p < 0.001$).

Table 4.5 Parental Perception of Fussiness LTIS for All Participants and Groups

Measure	All participants †	Normative group n=958	Clinical feeding problem group n=281	p-value between groups
PP Fussiness[†] (median [25,75])	3 [2,6] (range: 1- 10)	2 [1,4] (range: 1- 10)	7 [6,8] (range: 1- 10)	<0.001^c

† Missing data: 149. PP Fussiness=Parental Perception of Fussiness. ^c Mann Whitney U test for differences between groups.

4.6 Effect of Risk Factors, Medical History and Dietary Restrictions on BPFAS, DICE, CEBQ-FSS and Parental Perception of Fussiness LTIS

Participants were stratified into yes and no groups based on whether they had risk factors for a feeding issue (section 3.8) and/or a medical status that has been associated with a feeding issue that requires any type of dietary restriction (section 3.8). BPFAS, DICE, CEBQ-FSS and Parental Perception of Fussiness LTIS were compared between groups. Tables 4.6 to 4.8 detail the differences in these scores. Only one participant with attention deficit disorder (ADD) completed this questionnaire and therefore the main measures could not be compared between ADD and non-ADD children.

4.6.1 BPFAS and Risk Factors for and Concomitants of Feeding Issues

Both TFS and TPS were significantly higher in the yes group with regards to problems with breastfeeding, starting solids, reflux in infancy and diagnosed eating difficulty than the no problems group. Children with autism spectrum disorder (ASD) and medical problems affecting and not affecting feeding had significantly higher TFS than non-ASD children and children without any medical problems, respectively (Table 4.6).

Table 4.6 Comparison of Behavioural Paediatric Feeding Assessment Scale Scores Between Yes/No Groups for Risk Factors for Feeding Issues and Medical History

Risk Factors		BPFAS					
		TFS			TPS		
		Yes group mean±SD n	No group mean±SD n	p-value	Yes group Mdn [25,75] n	No group Mdn [25,75] n	p-value
Risk Factors for Feeding Issues in Infancy	Problems with BF	72.1±16.5 n=438	67.8±15.5 n=796	<0.001	4[1,11] n=341	2[0,7] n=620	<0.001
	Reflux	71.9±16.5 n=374	68.1±15.6 n=849	<0.001	3[1,10] n=270	2[0,8] n=682	<0.001
	Allergy	70.8±14.7 n=147	69.0±16.0 n=1066	0.21	3[1,8.5] n=113	2[0,9] n=836	0.36
	Intolerance	70.9±15.1 n=229	68.8±16.2 n=991	0.08	3 [0,8] n=173	2[0,9] n=779	0.91
	Problems starting solids	77.6±19.2 n=127	68.3±15.3 n=1082	<0.001	6.5[2,13] n=100	2[0,8] n=845	<0.001
	Preterm birth	70.7±17.1 n=112	69.2±15.9 n=1122	0.35	4[0,12] n=79	2[0,8] n=884	0.19
	Developmental Delay	72.1±16.8 n=23	69.3±16.0 n=1213	0.41	2[0,6.5] n=17	3[0,9] n=947	0.60
Medical History	ASD	85±25.0 n=4	69.2±15.9 n=1230	0.05	13[1,13] n=3	3[0,8] n=959	0.15
	Medical conditions affecting feeding	80.9±18.2 n=17	69.2±16.0 n=1219	0.03	3.5[1.25,14.7] n=12	3[0,8] n=951	0.22
	Medical conditions not affecting feeding	75.5±17.0 n=56	69.1±15.9 n=1167	0.03	4.5[0,11.75] n=44	3[0,8.25] n=914	0.32
	Eating Difficulties	84.9±19.4 n=20	69.1±15.8 n=1192	<0.001	9[1.5,18] n=17	3[0,8] n=925	0.03

BPFAS=Behavioural Paediatric Feeding Assessment Scale; TFS=Total Frequency Score; TPS=Total Problem Score; BF=Breastfeeding; ASD=Autism Spectrum Disorder; Mdn=median. (Independent t-tests for differences between groups in TFS and Mann Whitney U test for TPS).

4.6.2 DICE and Risk Factors for and Concomitants of Feeding Issues

The DICE scores for groups who have/do not have risk factors for feeding issues are shown in Table 4.7. Mean±SD DICE scores were significantly better in children who did not have problems starting solids in infancy than in those who did. Medical status did not significantly affect DICE scores except for between yes and no groups with regard to

developmental delay and diagnosed eating difficulties. Diet restrictions did not appear to affect DICE scores between groups (Table 4.7).

Table 4.7 Comparison of Dietary Index for a Child's Eating Scores Between Groups With and Without Risk Factors for a Feeding Issue or Dietary Restriction

Risk Factors		DICE		
		Yes group mean±SD	No group mean±SD	p-value
Risk Factors for Feeding Issues in Infancy	Problems with breastfeeding	88.7±11.2 n=413	90.1±10.7 n=740	0.04
	Reflux	88.7±11.4 n=332	90.0±10.7 n=811	0.06
	Allergy	87.4±12.1 n=125	89.9±10.6 n=1012	0.01
	Intolerance	88.2±11.0 n=205	89.9±10.8 n=937	0.05
	Problems starting solids	84.9±11.5 n=118	90.1±10.7 n=1014	<0.001
	Preterm birth	89.1±12.3 n=105	89.6±10.8 n=1050	0.62
Medical History	Developmental Delay	82.8±12.9 n=24	89.7±10.9 n=1132	0.002
	ASD	86.5±11.7 n=5	89.6±10.9 n=1149	0.53
	Medical conditions affecting feeding	86.1±17.2 n=16	89.6±10.8 n=1138	0.43
	Medical conditions not affecting feeding	86.1±14.1 n=53	89.8±10.7 n=1089	0.07
	Eating Difficulties	80.9±14.5 n=18	89.8±10.8 n=1114	0.02
	Allergy	87.02±12.0 n=87	89.7±10.8 n=1059	0.03
Diet Restrictions	Intolerance	88.1±11.6 n=99	89.7±10.9 n=1041	0.16
	Sensitivity	89.0±11.5 n=92	89.6±10.9 n=1044	0.63
	Restrict for another reason (e.g: religious)	91.2±9.76 n=194	89.2±11.1 n=956	0.02

DICE=Dietary Index for a Child's Eating; ASD=Autism Spectrum Disorder. Independent t-tests for differences between groups.

4.6.3 CEBQ Fussiness Sub Scale and Risk Factors for and Concomitants of Feeding Issues

There were no significant differences between groups for risk factors and concomitants of feeding issues in mean \pm SD CEBQ fussiness sub scale scores except between children who had developmental delay 3.00 \pm 0.34 and those who did not 2.87 \pm 0.27 ($t = 2.56$, 1357 df, $p = 0.01$).

4.6.4 Parental Perception of Fussiness and Risk Factors for and Concomitants of Feeding Issues

Only children who had problems starting solids had worse scores on the Parental Perception of Fussiness LTIS than children who did not have these risk factors for feeding issues in infancy. With regard to medical history, children with diagnosed eating difficulties and ASD were perceived to be fussier by their parents compared to children without eating difficulties or ASD. Diet restriction did not appear to influence Parental Perception of Fussiness LTIS (Table 4.8).

Table 4.8 Comparison of Parental Perception of Fussiness LTIS Between Groups With and Without Risk Factors for Feeding Issues and Medical History

Risk Factors		Parental Perception of Fussiness LTIS		
		Yes group Mdn [25,75]	No group Mdn [25,75]	p-value
Risk Factors for Feeding Issues in Infancy	Problems with breastfeeding	3[2,6] n=494	3[1,5] n=887	0.001
	Reflux	3[2,6] n=410	3[2,6] n=961	0.09
	Allergy	3[1,5] n=163	3[2,6] n=1195	0.52
	Intolerance	3[2,6] n=255	3[2,6] n=1111	0.78
	Problems starting solids	5[2,7] n=143	3[1,5] n=1212	<0.001
	Preterm birth	3[1,6] n=126	3[2,6] n=1254	0.56
Medical History	Developmental Delay	3[2,7] n=31	3[2,6] n=1353	0.33
	ASD	8[4,10] n=5	3[2,6] n=1377	0.03
	Medical conditions affecting feeding	4.5[2,7] n=18	3[2,6] n=1364	0.20
	Medical conditions not affecting feeding	3[2,7] n=63	3[2,6] n=1304	0.08
	Eating Difficulties	5[2.5,7] n=21	3[2,6] n=1338	0.04

ASD=Autism Spectrum Disorder; Mdn=median. Mann Whitney U test for differences between groups.

4.7 Associations Between BPFAS, DICE, CEBQ-FSS and Parental Perception of Fussiness LTIS

As discussed above, there were strong correlations between the Parental Perception of Fussiness LTIS and both TPS and TFS, as well as between TFS and TPS. DICE had moderately strong inverse relationships with TFS, TPS and Parental Perception of Fussiness LTIS (Table 4.9).

Table 4.9 Associations Between Behavioural Paediatric Feeding Assessment Scale, Dietary Index for a Child's Eating, Children's Eating Behaviour Questionnaire Fussiness Sub Scale Score and Parental Perception of Fussiness LTIS

	CEBQ-FSS	TFS	TPS	DICE
CEBQ-FSS	-	-	-	-
TFS	-0.06 ^Σ	-	-	-
TPS	-0.04	0.77**	-	-
DICE	-0.03 ^Σ	-0.45** ^Σ	-0.33**	-
PP Fussiness	0.01	0.72**	0.69**	-0.42**

CEBQ-FSS=Child Eating Behaviour Questionnaire Fussiness Subscale; TFS= Total Frequency Score; TPS=Total Problem Score; DICE=Dietary Index for a Child's Eating; PP Fussiness=Parental Perception of Fussiness Likert Type Item.*Indicates a significant result at $p<0.05$ **Indicates a significant result at $p<0.01$ (Spearman's r used for non-parametric data except data marked by ^Σ which used Pearson's r). NB: Although TPS and TFS are part of the same tool, they are separate scores and independent.

Correlations between outcome measures remained significant although weaker even when the normative and clinical feeding issue groups were separated and analysis repeated on each group (Table 4.10).

Table 4.10 Relationship Between Total Frequency Score, Total Problem Score, CEBQ Fussiness Sub Scale and Parental Perception of Fussiness LTIS in Normative and Clinical Feeding Problem Groups

	All	Normative Group	Clinical Feeding Problem Group
TFS and PPFussiness	0.72**	0.56**	0.46**
TPS and PPFussiness	0.69**	0.50**	0.44**
CEBQ-FSS and PPFussiness	0.01	0.06	0.17
DICE and TFS	-0.45** ^Σ	-0.24** ^Σ	-0.32** ^Σ
DICE and PPFussiness	-0.42**	-0.28**	-0.33**

CEBQ-FSS=Child Eating Behaviour Questionnaire Fussiness Subscale; TFS=Total Frequency Score; TPS=Total Problem Score; PP Fussiness=Parental Perception of Fussiness Likert Type Item. **Indicates a significant result at $p<0.01$ (Spearman's r used for non-parametric data except data marked by ^Σ which used Pearson's r).

4.8 Effect of Parental Perception of Weight on BPFAS, DICE, CEBQ-FSS and Parental Perception of Fussiness LTIS

One-way ANOVA was conducted to determine if TFS, DICE, CEBQ-FSS and Parental Perception of Fussiness LTIS were different for children with different parentally perceived weights. Participants were classified into three groups: parentally perceived to be underweight, parentally perceived to be of average weight and parentally perceived to be overweight. No significant difference was found between groups in CEBQ-FSS scores.

4.8.1 TFS and Parentally Perceived Weight

TFS was significantly different between parentally perceived weight groups, $F(2,1231) = 30.6$, $p < 0.001$. Children who were perceived to be underweight scored higher on the TFS than those perceived to be overweight. Post hoc analysis (Tukey's) revealed that the mean difference in TFS from overweight to underweight (10.8, 95% CI [5.57, 16.0]) was statistically significant ($p < 0.001$), as was the difference from average weight to underweight (9.84, 95% CI [6.84, 12.8], $p < 0.001$), but no statistically significant difference was found between children perceived to be of average weight and overweight (Table 4.11).

4.8.2 DICE and Parentally Perceived Weight

DICE scores were significantly different between parentally perceived weight groups, $F(2,1151) = 10.6$, $p < 0.001$. Children who were perceived to be underweight scored lower on the DICE than those perceived to be overweight. Post hoc analysis (Tukey's) revealed that the mean difference in DICE from underweight to average weight (4.12, 95% CI [6.26, 1.98]) was statistically significant ($p < 0.001$), as was the difference from underweight to overweight (4.74, 95% CI [1.07, 8.41], $p = 0.007$), but no statistically significant difference was found between children perceived to be of average weight and overweight (Table 4.11).

Kruskal-Wallis H tests were run to determine if there were differences in TPS and Parental Perception of Fussiness LTIS between the three parentally perceived weight groups. Distributions of TPS and parental perception of fussiness were similar for all groups, as assessed by visual inspection of a boxplot. Median TPS scores were significantly different between groups, $\chi^2(2) = 25.3$, $p < 0.001$. Median Parental Perception of Fussiness LTIS were also significantly different between groups, $\chi^2(2) = 29.7$, $p < 0.001$.

4.8.3 TPS and Parentally Perceived Weight

Post hoc analysis (Dunn's procedure with a Bonferroni correction for multiple comparisons) revealed statistically significant differences in TPS between the underweight and average groups ($p < 0.001$) but not between underweight and overweight groups and average and overweight groups (Table 4.11).

4.8.4 Parental Perception of Fussiness LTIS and Parentally Perceived Weight

Post hoc analysis (Dunn's procedure with a Bonferroni correction for multiple comparisons) revealed statistically significant differences in parentally perceived weight between the underweight and average groups ($p < 0.001$) but not between underweight and overweight groups and average and overweight groups (Table 4.11).

Table 4.11 Effect of Parental Perception of Weight on Behavioural Paediatric Feeding Assessment Scale, Dietary Index for a Child's Eating, Children's Eating Behaviour Questionnaire Fussiness Sub Scale Score and Parental Perception of Fussiness

Measure	PP underweight group	PP average weight group	PP overweight group	p-value between groups
TFS	77.8±17.9 n= 179 [♯]	68.0±15.2 n=986 [♯]	67.0±16.2 n=69 [♯]	<0.001
TPS	6[1,13] n=152 [♯]	2[0,8] n=753 [♯]	4[0, 9.5] n=57	<0.001 [♯]
DICE	86.0±11.9 n=168 [♯]	90.12±10.7 n=918 [♯]	90.7±10.0 n=68 [♯]	<0.001
CEBQ-FSS	2.84±0.27 n=194	2.87±0.27 n=1088	2.92±0.29 n=76	0.08
PPFussiness	4[2,7] n=199 [♯]	3[1,5] n=1106 [♯]	3[2,6] n=78	<0.001 [♯]

TFS=Total Frequency Score; TPS=Total Problem Score; DICE=Dietary Index for a Child's Eating; CEBQ-FSS=Child Eating Behaviour Questionnaire Fussiness Subscale; PP Fussiness=Parental Perception of Fussiness; PP Underweight=Parentally perceived to be underweight; PP Average Weight=Parentally perceived to be average weight; PP Overweight=Parentally perceived to be overweight. (One-way ANOVA with Tukey's post hoc tests used except for data marked by [♯] which used Kruskal-Wallis test and Dunn's procedure with a Bonferroni correction for multiple comparisons for posthoc tests). Differences between groups marked with [♯] and [♯]

4.9 Effect of Parental Concern About Weight on BPFAS, DICE, CEBQ-FSS and Parental Perception of Fussiness LTIS

Independent t-tests were performed to determine whether any significant differences in TFS, DICE and CEBQ-FSS existed between children whose parents were and were not concerned about their weight. No significant difference was found between groups in CEBQ-FSS. There was a significant difference in TFS ($t = -8.91, 161 \text{ df}, p < 0.001$) and

DICE ($t = 4.70$, 154 df, $p < 0.001$) between concerned and not concerned groups (Table 4.12).

Mann-Whitney U tests were performed to determine whether any significant differences in TPS and Parental Perception of Fussiness LTIS existed between children whose parents were and were not concerned about their child's weight. Median TPS scores ($U = 28953$, $p < 0.001$) and Parental Perception of Fussiness LTIS differed significantly ($U = 54460$, $p < 0.001$) between children whose parents were and were not concerned about their child's weight (Table 4.12).

Table 4.12 Effect of Parental Concern About Weight on Behavioural Paediatric Feeding Assessment Scale, Dietary Index for a Child's Eating, Children's Eating Behaviour Questionnaire Fussiness Sub Scale Score and Parental Perception of Fussiness LTIS

Measure	Unconcerned group	Concerned group	p-value between groups
TFS	67.8±15.0 n=1100	82.1±18.1 n=138	<0.001
TPS	2[0,7] n=849	8[3,15] n=118	<0.001 ^c
DICE	90.2±10.5 n=1026	84.7±12.9 n=132	<0.001
CEBQ-FSS	2.87±0.27 n=1208	2.88±0.29 n=154	0.82
PPFussiness	3[1,5] n=1229	6[3,7] n=157	<0.001 ^c

TFS= Total Frequency Score; TPS=Total Problem Score; DICE=Dietary Index for a Child's Eating; CEBQ-FSS=Child Eating Behaviour Questionnaire Fussiness Subscale; PP Fussiness=Parental Perception of Fussiness; Unconcerned=Parent unconcerned about child's weight; Concerned=Parent concerned about child's weight. Independent t-tests for parametric data except data marked by ^c which used Mann Whitney U test.

4.10 Factors Contributing to DICE Scores

A multiple regression was run to determine the contribution of TFS, age in months, parental perception of fussiness, having a mother with university education and having problems starting solids to DICE scores based on theoretical assumption that these factors would affect adherence to MOH Food and Nutrition Guidelines. The regression was undertaken to investigate whether associations between TFS and DICE found in the Pearson's chi-square test (figure 4.2 and Table 4.9) remained even when other factors were held constant. These variables significantly contributed to DICE, $F(5,1036) = 69.6$, $p < 0.001$, adjusted $R^2 = 0.25$. All five variables contributed significantly, $p < 0.05$. (Table

4.13). All assumptions for regression analysis were met. There was independence of residuals as assessed by a Durbin-Watson statistic of 1.70. Multicollinearity statistics show that the predictors were not closely associated. A histogram showed that the residuals were normally distributed and the variance of the dependent variable appeared to be the same for all values of the independent variable when viewed in a scatterplot. The assumptions of linearity, independence of errors, homoscedasticity, unusual points and normality of residuals were met for in this regression.

Table 4.13 Summary of Multiple Regression for Factors Contributing to Dietary Index for a Child's Eating Score (n = 1389)

Variable	Coefficient (B)	Standard Error B	95% CI B	Standardised β	p-value
Intercept	100	2.16	96.1, 104		
TFS	-0.17	0.03	-0.22, 0.11	-0.24	<0.001
Age in months	0.10	0.04	0.02, 0.19	0.07	0.02
Parental perception of fussiness	-1.12	0.17	-1.46, -0.79	-0.26	<0.001
University	2.28	0.61	1.10, 3.47	0.10	<0.001
Solids	-2.05	0.98	-3.97, -0.13	-0.06	0.04

TFS=Total Frequency Score; University=Mother having a university degree; Solids=Having problems starting solids. Enter technique.
 **F(5,1036) = 69.6

5. Discussion

The primary aim of this study was to determine if the Behavioural Paediatric Feeding Assessment Scale (BPFAS) can be used to identify young children who are fussy eaters and at risk of not adhering to the current New Zealand Ministry of Health (MoH) Food and Nutrition Guidelines. The secondary aim was to identify risk factors for poor adherence to MoH food and nutrition guidelines, and higher incidence of problem mealtime behaviours. The objectives developed to answer these aims were to a) determine whether a higher score on the BPFAS facilitates the identification of young children as fussy eaters, b) determine whether a higher score on the BPFAS and/or parental perception of their child as a fussy eater relates to poor adherence to MoH food and nutrition guidelines and c) identify risk factors for poor adherence to MoH food and nutrition guidelines and higher incidence of problem mealtime behaviours.

While the BPFAS has been used in other studies as a measure of clinical feeding problems in children, it has not to our knowledge been used to identify fussy eating. Adherence to MoH food and nutrition guidelines for children was assessed using the Dietary Index for a Child's Eating (DICE). This tool was developed by the research team to assess adherence to MoH food and nutrition guidelines for children in the current study. We also assessed food fussiness using the Children's Eating Behaviour Questionnaire Fussiness Sub Scale (CEBQ-FSS) and parental perceptions of fussiness using a Likert type item score (LTIS).

Parents of 24 to 47 month old children were invited to take part for developmental reasons and because fussy eating appears to be a particular issue in pre-school age children. The decision to collect data as an online questionnaire was made in an attempt to ensure nationwide participation over a wide range of backgrounds in this exploratory study. As far as we know, this is one of only a handful of studies investigating fussy eating in young children in New Zealand, particularly with regard to determining whether a simple diagnostic tool can identify children who are at risk of poor adherence to MoH food and nutrition guidelines.

5.1 Characteristics of Study Population

The total study population of 1959 was recruited through a variety of national online and print media over 7 months beginning in April 2014. The number of participants who remained in the study after self-screening based on child's age in years and residence, who consented to take part and were not excluded based on a second question checking age in months was 1389. Of these participants, 1240 completed the BPFAS, 1159 completed the DICE, 1364 completed the CEBQ-FSS and 1239 completed the Parental Perception of Fussiness LTIS. There were no significant differences with respect to socio-economic indicators between participants who did and did not complete each section respectively.

A total of 267 people failed to complete the questionnaire which may have been due to its length. A pilot test showed that the questionnaire took approximately 15 minutes to complete and this detail was displayed on the information page. However, some parents may have found the number of questions off-putting or stopped partway through and forgotten to complete the questionnaire from where they left off, although this was possible even if their browser had been closed. 198 parents were excluded based on a question toward the end of the questionnaire which asked for age in months. This was a quality control measure to ensure that the participant's child was within the appropriate age range. It is unclear why participants would continue with the questionnaire despite the self-screening question based on age in years. It is possible that parents may have misunderstood the screening question on their child's age or chosen to continue knowing that their child did not fit the criteria in order to take part in the study as they were interested in the topic.

The 24 - 47 month age range for children in the study was narrow and chosen to reflect the age range where fussy eating is most commonly identified (Hafstad, Abebe et al. 2013; Li, Wang et al., 2014). The mean age of the children in the study was almost 3 years (35.2 months) which means that there was no skew toward either end of the age range. In accordance with recommendations from Statistics New Zealand, participants in the study were allowed to self-identify with regards to their child's ethnicity (Statistics NZ, 2005). Many participants identified their child as belonging to more than one ethnic group and therefore the total of all ethnic groups exceeds the total number of participants. Data on ethnicity was collected to describe the population who took part in the study and not to

undertake any sub-group analysis according to ethnicity. When compared to national data, this self-selecting sample was over-representative of New Zealanders who were identified as NZ European (94.4%). The sample was slightly under-representative of Māori when compared to national data (13% of participants compared to 15% of the wider population) and markedly under-representative of Asian (3.9%) and Pacific (4.7%) people who make up 12% and 7% of the New Zealand population respectively. Other ethnicities were over-represented in the cohort (6.3%) when compared to national data (1%).

The majority of mothers (61.2%) held a university degree, a diploma from a polytechnic (12%) or went through a college of education (4.1%) with the remaining children having mothers who had completed a range of schooling up to completion of secondary school. National data from 2008 shows that 40.9% of New Zealanders have either no qualification or have completed at least secondary school, 37.2% have completed a certificate or diploma and 21.8% have a Bachelor's degree or higher and therefore this sample is extremely over-representative of participants with a university education (Ministry of Education, 2009). This may have had an effect on the nutrition knowledge of participants, or their ability to access resources related to child feeding and resulted in a health bias.

Close to 60% of participants had a household income before tax of more than \$75,000 per annum with the rest in lower income brackets. The sample was therefore slightly over-representative of higher income households than national data (median household income \$85,588) (Statistics NZ, 2013). However 19.1% of children had mothers who did not complete any tertiary education and more than 40% of children came from households with a lower income than the national median, capturing a reasonably diverse range of children.

While efforts to include numbers of Māori that are representative of the national population were made for ethical reasons and were fairly successful, a large sample was considered more important than a representative sample in order to answer the primary aim of this study. That is, a large sample is more likely to report greater range in eating habits and adherence to MoH food and nutrition guidelines than a smaller, random sample and therefore the study design allowed for a self-selected sample. Future research is needed to ensure that the BPFAS is suitable for use in different ethnic and socio-economic groups in New Zealand.

5.2 Behavioural Paediatric Feeding Assessment Scale (BPFAS)

The BPFAS is short and easy for parents to self-complete. It has been validated for use in the paediatric population and used in many studies that address clinical feeding issues (section 3.6.3) (Patton, Dolan et al. 2006; Piazza-Waggoner, Driscoll et al. 2008; Dovey & Martin 2012).

The TFS was the key marker of problematic feeding behaviours in this study. The TFS for all participants in this study ranged from 36 to 141 and mean \pm SD TFS for all participants was 69.4 \pm 16.0. The TPS, which was the key measure of parental feelings about their child's eating behaviours, ranged from 0 to 29 with a median [25,75] score for all participants of 3 [0, 9]. The range in both TFS and TPS indicated that participants displayed a range of feeding behaviours which also corresponded with a range in parental feelings about how they handle these behaviours.

In Dovey's (2013) study, a cut-off point of 81 out of a possible 175 for TFS and eight out of a possible total of 35 for the TPS above which children were likely to have clinically significant feeding problems was set. Nearly 23% of participants who completed the TFS measure exceeded the cut-off point and were stratified into the clinical feeding problem group. More than 28% of participants exceeded the cut-off for TPS. These numbers suggest that clinical problem feeding behaviours are an issue in many young children. The discrepancy between those who exceed the TFS cut-off and those who exceed the TPS cut-off indicates that many participants find mealtimes stressful and problematic even when clinical feeding problems are not present.

The majority of children (77%, n = 959) were below the TFS cut-off point used to define children with a clinical feeding problem and were classed as the normative feeding group. As expected, the TFS in the clinical feeding problem group was higher than in the the normative group in this study (mean \pm SD: 92.4 \pm 10.5 vs 62.6 \pm 9.98) which indicates that both children and parents in the clinical feeding problem group experience a much higher incidence of problem mealtime behaviours than children in the normative group. This result is in line with the results from both Crist & Napier (2001) and Dovey (2013).

The strong positive correlation between TPS and TFS ($r_s(911) = 0.77, p < 0.001$), suggests that the higher the incidence of problem mealtime behaviours, the more parents feel that it is a problem for them to handle. Higher TFS scores suggest that problematic parental mealtime strategies such as forcing their child to eat are more commonly used. Because parental pressure to eat (Galloway, Fiorito et al. 2005; Powell, Farrow et al. 2011) is associated with the development of fussy eating, this is a cause for concern. A higher percentage of Parent Problem Scores (32.5%) were above the cut-off (section 4.2.1) than Child Problem Scores (27.8%) which may indicate that parents are more concerned about their own strategies at mealtimes than they are about their child's behaviours at mealtimes. These strategies may include the feelings of anger and frustration at mealtime, measured by the TFS.

Table 5.1 compares normative and clinical feeding problem group Child Frequency Scores, Parent Frequency Scores and Total Frequency Scores from this study with two other studies. The data displayed for the clinical feeding problem groups in Crist & Napier (2001) and Dovey (2013) are from children whose feeding problem did not have an organic cause. Criteria for normative and clinical feeding problem groups vary between the two aforementioned studies and this study. Crist & Napier compared their normative group with two other groups: children who attended their feeding clinic and required medical intervention (clinical/medical) and those who did not require it (clinical/non-medical). Dovey compared their normative group with children referred from a paediatric psychology service and confirmed the diagnosis of clinical feeding problem with two separate psychologists based on a set of criteria (Bryant-Waugh, Markham et al. 2010). Our study used the clinical cut-offs from the Dovey study to stratify between normative and clinical feeding problem groups. Reported mean CFS, PFS and TFS for the normative groups appear similar between these studies and our study. Despite children in the normative range being recruited through different strategies and these studies being international, the mean values are very similar. This could indicate that the incidence of problem feeding behaviours in normative children may be similar between these countries although research with a more appropriate study design would be required to confirm this. The clinical scores show more variation than the reported normative scores. This may in part be due to different criteria for stratification but also because there are a range of clinical feeding problems, and children in the studies with clinical feeding problems were recruited differently.

Table 5.1 Comparison of Frequency Scores from the Current Study and the Literature

Measure	CFS			PFS			TFS		
Group	Crist 2001	Dovey 2013	Current study	Crist 2001	Dovey 2013	Current study	Crist 2001	Dovey 2013	Current study
Normative group	46.6 ±10.3	45.6 ±12.4	46.0 ±7.6	17.3 ±4.8	16.9 ±5.6	16.7 ±3.42	63.9 ±14.2	N/A	62.6 ±9.98
Clinical feeding problem group	69.9 ±12.6	72.4 ±15.5	66.5 ±7.44	28.5 ±5.9	27.5 ±8.7	25.9 ±4.59	98.4 ±17.1	N/A	92.4 ±10.5

Crist 2001=Crist, W. and A. Napier-Phillips (2001) "Mealtime Behaviours of Young Children: A Comparison of Normative and Clinical Data"; Dovey 2013=Dovey, T., C. Jordan et al. (2013) "Screening for Feeding Disorders. Creating Critical Values Using the Behavioural Paediatric Feeding Assessment Scale"; Current study=Using the Behavioural Paediatric Feeding Assessment Scale to Identify Fussy Eaters, and Their Adherence to Dietary Guidelines Study; CFS=Child Frequency Score; PFS=Parent Frequency Score; TFS=Total Frequency Score; N/A=not presented in study results.

5.3 Dietary Index for a Child's Eating (DICE) Score

Adherence to MoH food and nutrition guidelines in this study were measured using the DICE score. Ideal adherence to the guidelines would result in a score of 120, which indicates children would meet the recommendations for their age group. The mean±SD DICE score for all participants was 89.6±10.9 and their scores ranged between 49 to 114. This suggests that there was a wide range in adherence to MoH food and nutrition guidelines in this study and that the average adherence is less than ideal.

Children stratified into the clinical feeding problem group scored significantly lower (mean ±SD: 81.9±12.3) than normative children (91.8±9.23) on the DICE score. These results indicate that children with clinical feeding problems adhere less closely to MoH food and nutrition guidelines than children classified as normative eaters and may be at risk of developing poor eating habits due to the importance of early childhood in the development of dietary preferences (Savage, Fisher et al. 2007). Poor adherence to food and nutrition guidelines is also likely to mean that these children are at risk of nutritional insufficiency (Golley, McNaughton et al. 2015). On the DICE, half of the available points are allocated to dietary intake measures, while the other half are divided between behavioural and diet quality measures which reflects the relative importance of the former. When recommendations for a main food group are met, this is equivalent to 10 points on the scoring. Therefore, a loss of 10 points could mean that a child does not have any servings

per day of a main food group such as vegetables. Alternative scenarios for a 10 point loss on the DICE score could be partially meeting guidelines for servings of main food groups but not meeting other recommendations such as providing healthy snacks or adhering to behavioural aspects of DICE such as eating family meals. The low adherence of many of the children who took part in the research is of concern. Children who do not meet these recommendations are at risk of deficiencies in critical nutrients, dehydration and having high intakes of sugar, fats and salt. Because the MoH food and nutrition guidelines promote eating a diverse range of foods (MoH 2012), low adherence may also result in poorer dietary diversity and therefore increase the risk of adverse health outcomes in later life (Barker 2012). Further research using DICE is required to determine whether there is a cut-off value which can be applied to the tool to identify those children at severe risk of nutritional insufficiency. There is also the potential for separate scores to be applied to the dietary component of DICE and the diet quality measures/behavioural aspects of the tool.

The moderate inverse relationship ($r = -0.45$, $p < 0.001$) between the DICE and TFS overall suggests that as feeding problems increase, the likelihood of adhering to MoH food and nutrition guidelines decreases. Even when the correlation is repeated using data from only the normative group, a weak inverse correlation remains ($r = -0.24$, $p < 0.001$). These findings suggest that the higher the incidence of problem mealtime behaviours, the poorer the adherence to MoH food and nutrition guidelines no matter what level of problem eating behavior children display. The correlation between DICE and TFS remained after adjustment for parental perception of fussiness, age, mother's university education and problems with solids in infancy in the regression model and for each increase of 1 point in TFS score, there is a decrease in DICE of 0.17 points. This suggests that the BPFAS can be used to facilitate identification of children who do not adhere to MoH food and nutrition guidelines.

The weak inverse correlation between DICE and TPS overall ($r = -0.33$, $p < 0.001$) suggests that the more parents experience problems with feeding behaviours the less likely they are to adhere to MoH food and nutrition guidelines. This may be because parents who experience a high incidence of problematic eating behaviours avoid them by feeding their children only foods that they know will be accepted, thereby limiting dietary diversity. This could mean parents who struggle at mealtimes are unknowingly allowing their children to

develop long term poor eating habits as they try to deal with problematic mealtime behaviours in the short term.

5.4 Children's Eating Behaviour Questionnaire Fussiness Sub Scale (CEBQ-FSS)

The CEBQ Fussiness Sub Scale (CEBQ-FSS) was chosen as a key measure of fussy eating behaviours in this study. No significant differences in CEBQ-FSS score between normative and clinical feeding problem groups were found. The stratification of these groups was based on the TFS, a tool that measures incidence of problem mealtime behaviours, of which fussy eating behaviours are part and thus it was expected that higher CEBQ-FSS scores would be observed in the clinical feeding group.

Hendy (2010) observed that autistic fussy eaters had significantly higher CEBQ-FSS scores 4.1 ± 0.9 than the mean in the Wardle (2001) study (3.1 ± 0.9) and that these children only maintained a normal BMI when parents prepared special meals (Hendy, Williams et al. 2010). Thus, it was hypothesised that children in the above mean CEBQ-FSS group would have lower adherence to MoH food and nutrition guidelines, higher incidence of problem mealtime behaviours and would be perceived by their parents as fussier than those in the below mean group. The significant differences that were expected in TFS, TPS, DICE and Parental Perception of Fussiness LTIS scores were not found however.

There were also no significant correlations between this measure and the TFS, TPS, DICE or Parental Perception of Fussiness LTIS. The strong correlation between TPS and TFS ($r = 0.77, p < 0.001$) shows that the higher the incidence of problem mealtime behaviours, the more problems parents have dealing with them. A similar trend was expected between the TPS and CEBQ-FSS. These results may have been due to the fact that the sub scale was not designed to function as a stand-alone scale despite its usefulness in the Hendy (2010) study and the Principal Components Analysis (Sleddens, Kremers et al. 2008) which showed that each scale was explained by a single factor which explained 50-84% of the variance (section 2.7.1). The mean itself may not have been an appropriate cut-off point to distinguish between fussy and non-fussy eaters. Unfortunately, we were unable to locate any studies that calculated a cut-off point for the sub scale above which children were likely to be fussy. It is noteworthy that the highest CEBQ-FSS score in this study was only 4, while in other studies at least some children are reportedly extremely fussy (mean score > 4.5) (Taylor, Wernimont et al. 2015).

5.5 Parental Perception of Fussiness Likert Type Item Score (LTIS)

A 10 point Likert type item score was used to measure parental perceptions of food fussiness in their children. A score of ten indicated that the parent perceived their child to be extremely fussy. The significantly higher ($p < 0.001$) median for the clinical feeding problem group (7 [6,8]) compared to the normative group (2 [1,4]) with regard to this measure indicates that more parents in the clinical feeding problem group perceived their child to be a fussy eater than parents in the normative group. The moderate inverse correlation between DICE and Parental Perception of Fussiness LTIS ($r = -0.42$, $p < 0.001$) suggests that the more parents perceive their child to be a fussy eater, the less well they adhere to MoH food and nutrition guidelines. This supports research that has shown that parental perception of fussiness is an accurate indicator of problem feeding behaviour (Boquin, Smith-Simpson et al. 2014; Jacobi, Agras et al. 2003).

The strong positive correlations between Parental Perception of Fussiness LTIS and both TFS ($r = 0.72$, $p < 0.001$) and TPS ($r = 0.69$, $p < 0.001$) suggest that the more that parents perceive their child to be a fussy eater, the more they experience a higher incidence of problem mealtime behaviours and have a problem with the situation. When the correlations were repeated using only data from the normative group, these correlations remained moderately strong; for the TFS ($r = 0.56$, $p < 0.001$) and ($r = 0.50$, $p < 0.001$) for TPS. Thus, normal children who have a higher incidence of problem mealtime behaviours and who are parentally perceived as fussy could be classed as fussy eaters. Furthermore, a weak to moderate inverse correlation remained between the DICE and Parental Perception of Fussiness LTIS when performed only on the normative group (Table 4.10). This suggests that children who are parentally perceived as fussy have poorer adherence to MoH food and nutrition guidelines than other children. This puts them at risk for nutritional insufficiency and developing poor eating habits. These findings support research that shows subjective parental perceptions of fussiness are related to objective measures of food fussiness (Boquin, Smith-Simpson et al. 2014).

5.6 Effect of Risk Factors, Medical History and Dietary Restrictions on Mealtime Behaviours, Adherence to MoH Food and Nutrition Guidelines and Parental Fussiness Perceptions

Risk factors for feeding issues in infancy, medical history associated with feeding issues and dietary restrictions were stratified into have and have not groups to ascertain the effect

these had on BPFAS scores, DICE scores, Parental Perceptions of Fussiness LTIS and CEBQ-FSS scores.

5.6.1 Risk Factors for Feeding Issues in Infancy

Preterm birth is a significant issue in New Zealand and 10.4% of infants in New Zealand are born preterm (Pot, Sadler et al. 2012). Consumption of amniotic fluid by the foetus and breastmilk or formula by the infant stimulates suck/swallow reflexes in the brain stem (Bingham 2009). Preterm infants who are tube-fed often have immature swallowing and sucking reflexes because of the resultant oral sensory deprivation (Gisel, Birnbaum et al. 1998). Preterm birth has thus been associated with feeding issues, particularly in infants born before 32 - 34 weeks of gestation (Kuehn, Miller et al. 2014). The degree to which oral sensory deprivation contributes to feeding problems in these patients in later life is unclear however (Bingham 2009). Nevertheless, it may be useful to provide parents of preterm infants with information about the potential for later feeding problems and parental strategies for coping with them in order to avoid the establishment of resultant poor dietary patterns.

Despite preterm birth being associated with feeding issues we did not find a significant difference in TFS between children who were and were not born preterm. However, because preterm birth was defined in this questionnaire as “gestation of less than 37 weeks” it is possible that most or all children identified as preterm were moderate to late preterm. This would mean that they were likely to have already developed suck/swallow reflexes at birth and did not require tube feeding. A number of other risk factors for feeding issues in infancy did affect the main measures, including problems with breastfeeding, starting solids, and reflux (Tables 4.6 - 4.8). Identification of risk factors for poor adherence to MoH food and nutrition guidelines and higher incidence of problem mealtime behaviours was not the primary aim of the study however, so this data needs to be interpreted with caution.

5.6.1.1 Problems with Breastfeeding

Problems with breastfeeding can deter mothers from breastfeeding (Sims, Long et al. 2015). Participants who had issues with breastfeeding in infancy scored higher on the TFS (n = 438, 72.1±16.5 vs n = 796, 67.8±15.5) and TPS (n = 341, 4 [1,11] vs n = 620, 2 [0,7])

than children who did not, which is in line with research that shows that problems with breastfeeding in infancy are a risk factor for feeding issues in children (Galloway, Lee et al. 2003; Shim, Kim et al. 2011). If problems with breastfeeding are a deterrent and exposure to new flavours in breastmilk may influence later eating behaviour, then children of mothers who have problems breastfeeding could be more likely than their peers to be at risk for feeding problems. Any strategies that support mothers with breastfeeding problems would potentially improve health outcomes for the baby in both the short and long term.

5.6.1.2 Reflux, Food Allergy and Food Intolerance in Infancy

Food allergy and intolerance generally manifest as gastro-intestinal discomfort and/or pain. Pain and discomfort following eating is associated with food avoidance and fussy eating behaviours (Tharner, Jansen et al. 2015; Timimi, Douglas et al. 1997). Food refusal, dysphagia, reduced volume and reduced variety of intake are common complaints associated with reflux in children (Haas & Maune 2009). Children with medical issues such as cardiopulmonary and neurological problems, renal disease and anatomical anomalies are predisposed to gastro-oesophageal reflux associated with food refusal (Field, Garland et al. 2003). Children in this study who experienced reflux as infants had slightly higher TFS ($n = 374, 71.9 \pm 16.5$ vs $n = 849, 68.1 \pm 15.6$) and TPS ($n = 270, 3 [1,10]$ vs $n = 682, 2 [0,8]$) than children who had not. This suggests that children who experienced reflux as infants may be at higher risk for problem mealtime behaviours than children who do not, and that their parents have problems dealing with this although the evidence is weak.

5.6.1.3 Problems Starting Solids in Infancy

The period when complementary solid foods are introduced is a vulnerable time when infants transition from breast feeding to eating family foods. Often the focus during this period is ensuring nutritional adequacy to meet high energy and nutrient requirements for growth and development. Results from this study indicate that difficulties around the time of starting solid foods may be an indicator of later feeding problems. TFS, TPS, DICE and Parental Perception of Fussiness LTIS scores were significantly poorer in children who had difficulty starting solids than those who did not in this study (Tables 4.6 to 4.8). There were at least 100 children in the “had problems starting solids groups” to compare with those who did not for each of the above measures which gives weight to these findings.

One explanation for these poorer scores is that parents whose children accept solid foods without difficulty in infancy are likely to offer an increased variety and amount at mealtimes than parents whose children have difficulty. Negative mealtime experiences when starting solids may also influence later eating behaviours. There is evidence that infants introduced to lumpy solids between the ages of 6 and 9 months are more likely than those introduced at 10 months or later to be eating family foods by 15 months (Northstone, Emmett et al. 2001). The same study also showed that infants introduced later to lumpy solids were more difficult to feed and had more definite likes and dislikes at 15 months (Northstone, Emmett et al. 2001). In our study we did not collect data on the specific details of what problems parents faced when starting their infant on solid foods. In future studies it would be interesting to determine the nature of problems around starting solid foods in infancy and later feeding habits.

5.6.2 Medical History Associated with Feeding Problems

An association between problems with feeding and behavioural problems such as attention deficit disorder (ADD) has been established (Hemmi, Wolke et al. 2011). In this study however, only one participant had been diagnosed with ADD and therefore comparisons between ADD and non-ADD groups could not be made.

Participants with a reported medical history of eating difficulties had worse scores than participants without a history of eating difficulties: TFS ($n = 20, 84.9 \pm 19.4$ vs $n = 1192, 69.1 \pm 15.8$), TPS ($n = 17, 9 [1.5, 18]$ vs $n = 925, 3 [0, 8]$), DICE ($n = 18, 80.9 \pm 14.5$ vs $n = 1114, 89.8 \pm 10.8$) and Parental Perception of Fussiness LTIS ($n = 21, 5 [2.5, 7]$ vs $n = 1338, 3 [2, 6]$). Although the numbers for children in the eating difficulty groups are small, this suggests that a medical history of eating difficulties may result in a higher incidence of problem feeding behaviours and parent's problems with handling them, increased parental perception of their child's food fussiness and decreased adherence to food and nutrition guidelines. Future research could include further investigation into the specific eating difficulties which may result in the above problems in order to develop strategies to improve mealtime experiences and dietary diversity in this vulnerable group.

5.6.2.1 Autism

It is well-established that autism spectrum disorders (ASD) negatively affect eating behaviour (Sharp, Berry et al. 2013). TFS and Parental Perception of Fussiness LTIS were

much higher in children who had ASD ($n = 4, 85.0 \pm 25.0$) and $n = 5, 8 [4,10]$ respectively) than children who did not ($n = 1230, 69.2 \pm 15.93$) and $n = 1377, 3 [2,6]$ respectively). While very small numbers of children in this study had ASD, this is in line with research that shows that parents of ASD children report more problems with feeding issues (Rogers, Magill-Evans et al. 2012), more negative perception of their child's dietary habits and more often report them to be fussy eaters (Lockner, Crowe et al. 2008) than parents of non-ASD children.

5.6.2.2 Medical Problems and Developmental Delay

Medical issues specifically related to feeding such as dysphagia commonly result in feeding problems (Benfer, Weir et al. 2014). Medical problems that are not specifically related to feeding such as developmental delay and anatomical anomalies are also known to contribute to the development of feeding issues (Field, Garland et al. 2003). TFS was higher in children who had medical problems which affected feeding than those without ($n = 17, 80.9 \pm 18.2$ vs $n = 1219, 69.2 \pm 16.0$) and children who had problems that did not affect feeding than those without ($n = 56, 75.5 \pm 17.0$ vs $n = 1167, 69.1 \pm 15.9$) which suggests medical issues generally may contribute to higher incidences of problem mealtime behaviours.

DICE scores were negatively affected by the presence of developmental delay ($n = 24, 82.8 \pm 12.9$ vs $n = 1132, 89.7 \pm 10.9$). This indicates that children with developmental delays may have poorer adherence to food and nutrition guidelines than children who do not. These findings are of concern because sufficient nutrition for growth and development is likely to be particularly important in these vulnerable groups. Parents of children with these medical issues could benefit from information on how to deal with problem mealtime behaviours and improve dietary habits that could be distributed by health practitioners.

5.7 Parental Perceptions and Concern About their Child's Weight

Children who were perceived by their parents to be underweight appear to have the highest incidence of problem mealtime behaviours, adhere least closely to MoH food and nutrition guidelines and are perceived by their parents to be fussier than children who are parentally perceived to be of average weight or overweight (Table 4.11). Food fussiness as measured by CEBQ-FSS was not affected by parental perceptions of weight.

It is plausible that parental perceptions of their child's underweight cause them to worry that their mealtime behaviours are problematic. It is also possible that this perception may cause an increase in parental feeding strategies associated with an increase in problematic mealtime behaviours in children, such as threatening, forcing or using food as a reward. Because anthropometric measurements were not taken, we were unable to confirm whether parental perceptions of their child's weight were accurate or not. Further research in this area is warranted.

CEBQ-FSS, the main measure of food fussiness, was not affected by parental concern about weight. However TFS (67.8 ± 15.0 vs 82.1 ± 18.1), TPS (2 [0,7] vs 8 [3,15]), DICE (90.2 ± 10.5 vs 84.7 ± 12.9) and Parental Perception of Fussiness LTIS (3 [1,5] vs 6 [3,7]) were all higher in the concerned about child's weight group when compared to the not concerned group. This suggests that parents who are concerned about their child's weight experience a higher incidence of problem mealtime behaviours and more problems handling them, and perceive their child to be fussier about food than parents who are not concerned about their child's weight. Better DICE scores in the group "unconcerned about their child's weight" indicate that children of these parents adhere more closely to MoH food and nutrition guidelines than children whose parents are concerned about their weight. It is unclear whether this is cause or effect; it is possible that parents may feel less concerned about their child's weight if they perceive them to be eating healthfully.

There appears to be good evidence that the BPFAS could be used to identify children who are fussy eaters and at risk of not adhering to MoH food and nutrition guidelines based on the results of this study which will be of use to parents, health professionals and early childhood professionals. This research has identified a number of risk factors associated with poor adherence to food and nutrition guidelines and higher incidence of mealtime behaviours which are worthy of further exploration.

6. Conclusion

6.1 Summary of the Study

This study was designed to determine whether the Behavioural Paediatric Feeding Assessment Scale (BPFAS) can be used to identify young children who are fussy eaters and at risk of not adhering to Ministry of Health (MoH) food and nutrition guidelines. The secondary aim was to identify risk factors for poor adherence to MoH food and nutrition guidelines, and higher incidence of problem mealtime behaviours. Data on feeding behaviour, adherence to MoH food and nutrition guidelines, food fussiness and parental perception of child's food fussiness from 1389 participants was collected using an online questionnaire and analysed for this study. Parental perception of and concern about child's weight and data on the presence of risk factors for feeding issues was also collected in this manner. Statistical analysis using independent t-tests, Mann Whitney U tests, chi-square tests, bivariate correlations, one-way ANOVA, Kruskal-Wallis tests and linear regression were performed. A p -value of <0.05 was considered statistically significant in all tests other than one-way ANOVA and Kruskal Wallis tests where a more conservative p -value of <0.01 was considered statistically significant.

The primary objective of this study was to determine whether a higher score on the BPFAS facilitates the identification of young children as fussy eaters. Results from this research show that children who are in the higher end of the normative range of TFS are also parentally perceived to be fussier eaters.

The secondary objective of this study was to determine whether a higher score on the BPFAS and/or parental perception of their child as a fussy eater relates to poor adherence to MoH food and nutrition guidelines. The study found that both higher TFS scores and parental perceptions of fussiness were moderately inversely correlated with adherence to MoH food and nutrition guidelines. This relationship remained after adjustment for other factors including age in months, parental perception of fussiness, mother's university attendance and problems with solids in infancy.

The final objective of this study was to identify risk factors for poor adherence to MoH food and nutrition guidelines as measured by the Dietary Index for a Child's Eating (DICE), and

higher incidence of problem mealtime behaviours as measured by the BPFAS. Results from this research suggest that risk factors for poor adherence to MoH food and nutrition guidelines are likely to include parental concern about weight, developmental delay, problems starting solids in infancy and eating difficulties. Parental perception of underweight, problems with breastfeeding in infancy, food allergy and intolerance, and food restriction due to allergy may also be included and need further research. This study also indicates that risk factors for higher incidence of problem mealtime behaviours include parental concern about weight, parental perception of underweight, problems with breastfeeding, starting solids and reflux in infancy, autism and medical problems.

6.2 Conclusions

Despite fussy eating being a common concern for parents, there are a lack of tools to assess whether these concerns are based on reasonable expectations about their child's mealtime behaviours or an unrealistic ideal. If children who are fussy eaters' mealtime behaviours mean they are not adhering to MoH food and nutrition guidelines, then concern is warranted. Otherwise, they are likely to be meeting evidence based recommendations that will ensure appropriate nutrition for growth and development, and assist in the establishment of good dietary habits. Normal growth is not necessarily a sign that children eat a diverse and healthful diet as many fussy eaters who are of normal height and weight still consume fewer vegetables (Li, Wang et al. 2014), protein (Dubois, Farmer et al. 2007), calcium (Sharp, Berry et al. 2013) and have higher intakes of sweet and savoury snack foods (Tharner, Jansen et al. 2014) than their peers. Because poor childhood eating habits tend to continue into adulthood (Craigie, Lake et al. 2011), this puts fussy eaters at risk of nutritional insufficiency and developing poor dietary habits that could lead to avoidable chronic diseases and obesity in later life.

This study shows that many parents in the cohort experience a high incidence of problem mealtime behaviours and struggle with strategies to deal with mealtimes. Although this was not a random sample, based on the the large number of participants in this study, these are likely to be concerns shared by a significant number of parents throughout the country. Further research to develop behavioural interventions that address problem mealtime behaviours and fussy eating in young children could help reduce long-term diet-related disease by improving eating habits at this seminal time. Parental feeding practices and family eating environment have a major influence on the development of eating

behaviours (Bryant-Waugh, Markham et al. 2010; Leung, Marchand et al. 2012) and coaxing, threatening and forcing children to eat can exacerbate refusal behaviours (Leung, Marchand et al. 2012), as can using food as reward (Ainuki & Akamatsu 2013). The BPFAS can highlight whether parental feeding strategies may be hindering the development of good eating habits.

Results from this study indicate that parental perceptions of fussiness are associated with poorer adherence MoH food and nutrition guidelines and higher incidence of problem mealtime behaviours. Consequently, the BPFAS may be a useful and simple screening tool for health providers to administer to parents who express concerns about their child's eating behaviour so that they can either be reassured that their child is likely to be meeting recommendations or referred for further help. These findings will be relevant to parents who are concerned about their child's food fussiness and their health professionals who need to ascertain whether this concern puts the child at risk of poor adherence to MoH food and nutrition guidelines and the development of poor dietary habits. This research will also be of interest to researchers in the field of feeding problems and fussy eating whose future research may develop the findings of this preliminary study.

Parental concern about weight, parental perception of underweight, problems with starting solids, developmental delay and diagnosed eating difficulties may be important red flags for poor adherence to MoH food and nutrition guidelines. Indicators for high incidence of problematic mealtime behaviours may include: parental perception of underweight, parental concern about weight, problems with breastfeeding and starting solids, autism spectrum disorders, diagnosed eating difficulties and medical conditions. These findings will be of assistance to health professionals who work with new mothers, other primary healthcare providers, early childhood professionals and parents who need to be aware of these risk factors in order to monitor the development of children's dietary habits.

6.3 Limitations

Due to the subjective nature of parentally-reported measures, there is an inherent risk of bias in the use of a participant-report questionnaire. There are differences in judgement between parents, and even the same parent can report inconsistent results over time (Boquin, Smith-Simpson et al. 2014).

The overrepresentation of children with highly educated mothers may have had an effect on the nutrition knowledge of participants or their ability to access resources related to child feeding, which may have resulted in a health bias. Because recruitment was not conducted randomly, more parents with concerns regarding their child's feeding habits may have been interested in participating in this study. This had the potential to increase the number of children with feeding issues in this sample relative to the population. Nevertheless, the significant differences between children with and without clinical feeding problems suggests that the BPFAS is a robust enough tool to withstand potential recruitment bias. For the same reason, we cannot extrapolate results to the rest of the population or estimate prevalence of feeding issues and fussy eating in New Zealand. As we were unable to compare data between ethnicities, this study cannot provide information about the prevalence of these problems within certain segments of the population.

Another limitation was that only parental perception of fussy eating was able to be assessed. The Children's Eating Behaviour Questionnaire (CEBQ) is an instrument developed to assess eating style in children. Dimensions measured include satiety responsiveness, food enjoyment, slowness in eating, food enjoyment and fussiness (Wardle, Guthrie et al. 2001). It has been validated for use in a number of countries including Australia (Mallan, Liu et al. 2013) and Sweden (Svensson, Lundborg et al. 2011). In order to reduce respondent burden, only the Fussiness Sub Scale of the CEBQ (CEBQ-FSS) rather than the entire CEBQ questionnaire was used. The intention was to use it as a more objective measure of food fussiness in order to complement the subjective Parental Perception of Fussiness LTIS. However, there were no differences in CEBQ-FSS scores in this study between normative and clinical feeding groups and between have and do not have risk factors for feeding issues groups. Neither did the CEBQ-FSS correlate with BPFAS, DICE or Parental Perception of Fussiness LTIS which indicates that the CEBQ-FSS alone was insufficiently sensitive to measure food fussiness. Observation may have been a more robust way to measure food fussiness objectively.

The Dietary Index for a Child's Eating (DICE) was developed for use in this study and both its validity and reliability have been addressed in a separate study. However, due to time constraints, the completed validation has not yet been published. A score of 120 on the DICE indicates adherence to the MoH food and nutrition guidelines. In this study, anything below this score had to be classed as poor adherence because we lacked a statistically

determined cut-off value below which adherence could be considered poor. Although this was partially handled by correlating the DICE with other measures, a cut-off point needs to be developed in order to differentiate children who are likely to be adequately nourished from those who are at risk of nutritional sufficiency.

Data from nearly 200 participants who completed the questionnaire based on a question about their child's age in years during the screening stage had to be excluded from analysis based on a quality control question ensuring child's age in months was within the age range. This may have been avoided if the quality control question was placed closer to the beginning of the questionnaire and any answer outside of the age range used question logic to redirect participants to the thank-you page. Also, the questionnaire was designed so that respondents could skip questions for ethical reasons, which resulted in missing data. This may have been avoided if the questionnaire was designed in such a way that the respondent could not continue unless they had answered the previous question, except perhaps for in the case of particularly sensitive questions.

The identification of risk factors for feeding issues was a secondary aim which developed after data collection and during exploratory data analysis. These could have been tested more robustly using a case-control study design. Nevertheless, it was decided that the exploration of risk factors for feeding issues in infancy which may influence later feeding habits was worthwhile due to the large study population. Cause and effect could not be demonstrated but these results could form the basis for further studies and hypotheses and contributes to the limited evidence available in the New Zealand context.

6.4 Strengths

There is currently a dearth of research on the prevalence of feeding issues that have few immediate health effects but the potential to develop into poor eating habits, such as fussy eating, in New Zealand. This study confirms that many parents here face high incidences of problematic mealtime behaviours and feel that this is a problem for them. This study also provides valuable insight into the risk factors for feeding issues and poor adherence to food and nutrition guidelines that health professionals should be aware of. In addition, it provides evidence for the use of the BPFAS as a tool to identify children who are fussy eaters and at risk of failing to meet MoH food and nutrition guidelines.

One strength of this study was the use of an online questionnaire to collect data. This meant that data could be collected from parents throughout the country and delivery was standardised, minimising potential interviewer bias. The collection of a wide range of data provides valuable information on which to base the direction of future research.

The large number of participants is also an important strength. Although the results of this study cannot be extrapolated to the wider population, the results pertain to a large sample. This means that a range of people were represented and findings may have application internationally.

Associations between Parental Perception of Fussiness LTIS and both BPFAS measures, and between DICE and both TFS and Parental Perception of Fussiness remained even after sub-analysis using only the normative group. This is also a strong point of this study. It shows that the associations that were found in this study are robust even when the more extreme results from children with clinical feeding problems are taken out. Furthermore, the use of the BPFAS which measures not only child eating behaviours but also parental strategies also adds to the strengths of this study.

Another strength of this study was the development of DICE. It is a tool that is useful in measuring adherence to food and nutrition guidelines and may also be useful for assessing nutritional insufficiency. The benefits of using a diet quality indicator over other forms of dietary assessment are numerous. Unlike single nutrient analyses, diet quality indices allow the relationship between the whole diet (which includes both nutrient and non-nutrient components of food) and health outcomes to be assessed (Kant 1996; Wirt & Collins, 2009; McNaughton, Ball et al. 2008). This type of tool can be used in health assessment screening, to measure markers for risk assessment and as a tool for health education (Alkerwi 2014). Although validation was completed prior to the completion of this study, it has not yet been published.

Finally, this study included children between 24 and 47 months of age. This was a strength because eating habits are formed early in life and therefore early intervention is crucial in avoiding the development of poor eating patterns. Fussy eating can occur at any age but this is the time when it is commonly a problem for many parents

The study of fussy eating in children is an exciting area of research in its infancy. The large number of parents who completed the questionnaire demonstrates the interest that parents have around feeding their children. This interest can be taken as an opportunity for health professionals to improve long-term health outcomes in the population by offering information to parents on how to improve their strategies at and around mealtimes. If positive mealtime experiences can be fostered for greater numbers of young children, incidences of problem mealtime behaviours may be reduced and adherence to food and nutrition guidelines improved.

6.5 Recommendations for Future Studies

1. Statistically determine a cut-off for the BPFAS within the normative feeding range above which fussy eating is likely to be present.
2. To determine the prevalence of fussy eating and feeding issues in New Zealand.
3. Statistically determine a cut-off for the DICE below which nutritional insufficiency is likely to be a risk.
4. Investigate differences in adherence to MoH food and nutrition guidelines between fussy and non-fussy eaters using a case-control study design.
5. Further study of the DICE to determine which areas of MoH food and nutrition guidelines fussy eaters have particularly poor adherence to.
6. Examination of the novel issue of overweight and food fussiness as opposed to the conventional view that food fussiness results in underweight.
7. Long term study of food fussiness and later health risks.

7. Reference List

- Ainuki, T. and R. Akamatsu (2013). "Development of the child mealtime feeding behavior questionnaire." *ICAN: Infant, Child & Adolescent Nutrition* 5(1): 14-21.
- Alkerwi, A. (2014). "Diet quality concept." *Nutrition* 30(6): 613-618.
- Archer, L. A., P. L. Rosenbaum and D. L. Streiner (1991). "The Childrens Eating Behavior Inventory - reliability and validity results." *Journal of Pediatric Psychology* 16(5): 629-642.
- Arimond, M. and M. T. Ruel (2004). "Dietary diversity is associated with child nutritional status: Evidence from 11 Demographic and Health Surveys." *Journal of Nutrition* 134(10): 2579-2585.
- Ashcroft, J., C. Semmler, S. Carnell, C. H. M. van Jaarsveld and J. Wardle (2008). "Continuity and stability of eating behaviour traits in children." *European Journal of Clinical Nutrition* 62(8): 985-990.
- Babbitt, R. L., T. A. Hoch, D. A. Coe, M. F. Cataldo, K. J. Kelly, C. Stackhouse and J. A. Perman (1994). "Behavioral-assessment and treatment of pediatric feeding disorders." *Journal of Developmental and Behavioral Pediatrics* 15(4): 278-291.
- Barker, D. J. P. (2012). "Developmental origins of chronic disease." *Public Health Nutr.* 126(3): 185-189.
- Beautrais, A. L., D. M. Fergusson and F. T. Shannon (1982). "Family-life events and behavioral-problems in preschool-aged children." *Pediatrics* 70(5): 774-779.
- Benfer, K. A., K. A. Weir, K. L. Bell, R. S. Ware, P. S. W. Davies and R. N. Boyd (2014). "Oropharyngeal dysphagia in preschool children with cerebral palsy: Oral phase impairments." *Research in Developmental Disabilities* 35(12): 3469-3481.
- Berlin, K. S., W. H. Davies, D. J. Lobato and A. H. Silverman (2009). "A biopsychosocial model of normative and problematic pediatric feeding." *Children's Health Care* 38(4): 263-282.
- Bigornia, S. J., M. P. LaValley, S. E. Noel, L. L. Moore, A. R. Ness and P. K. Newby (2015). "Sugar-sweetened beverage consumption and central and total adiposity in older children: a prospective study accounting for dietary reporting errors." *Public Health Nutr.* 18(7): 1155-1163.
- Bingham, P. M. (2009). "Deprivation and dysphagia in premature infants." *Journal of Child Neurology* 24(6): 743-749.
- Birch, L. (1999). "Development of food preferences." *Annu Rev Nutr* 19(1): 41 - 62.
- Birch, L. L., S. L. Johnson, G. Andresen, J. C. Peters and M. C. Schulte (1991). "The variability of young childrens energy-intake." *New England Journal of Medicine* 324(4): 232-235.

- Boquin, M., S. Smith-Simpson, S. M. Donovan and S.-Y. Lee (2014). "Mealtime behaviors and food consumption of perceived picky and nonpicky eaters through home use test." *Journal of Food Science* 79(12): S2523-S2532.
- Boutelle, K. N., A. S. Birnbaum, L. A. Lytle, D. M. Murray and M. Story (2003). "Associations between perceived family meal environment and parent intake of fruit, vegetables, and fat." *Journal of Nutrition Education and Behavior* 35(1): 24-29.
- Bryant-Waugh, R., L. K. Markham, R. E. Kreipe, B. T. Walsh (2010). "Feeding and eating disorders in childhood." *International Journal of Eating Disorders* 43(2): 98-111.
- Burklow, K. A., A. N. Phelps, J. R. Schultz, K. McConnell and C. Rudolph (1998). "Classifying complex pediatric feeding disorders." *Journal of Pediatric Gastroenterology and Nutrition* 27(2): 143-147.
- Carifio, J., R. J. Perla (2007). "Ten common misunderstandings, misconceptions, persistent myths and urban legends about likert scales and likert response formats and their antidotes." *Journal of Social Sciences* 3(3): 106-116.
- Carnell, S., C. M. A. Haworth, R. Plomin and J. Wardle (2008). "Genetic influence on appetite in children." *International Journal of Obesity* 32(10): 1468-1473.
- Carnell S., J. Wardle (2007). "Measuring behavioural susceptibility to obesity: Validation of the Child Eating Behaviour Questionnaire." *Appetite* 48: 104-113.
- Carruth, B. R., J. D. Skinner, K. Houck, J. Moran, F. Coletta and D. Ott (1998). "The phenomenon of "picky eater": A behavioural marker in eating patterns of toddlers." *J Am Coll Nutr.* 17: 180-186.
- Carruth, B. R., P. J. Ziegler, A. Gordon and K. Hendricks (2004). "Developmental milestones and self-feeding behaviors in infants and toddlers." *Journal of the American Dietetic Association* 104(1): S51-S56.
- Carruth, B. R., P. J. Ziegler, A. Gordon, S. I. Barr, (2004). "Prevalence of picky eaters among infants and toddlers and their caregivers' decisions about offering a new food." *J. Am. Diet. Assoc.* 104: 57-64.
- Cashdan, E. (1998). "Adaptiveness of food learning and food aversions in children." *Social Science Information Sur Les Sciences Sociales* 37(4): 613-632.
- Caton, S. J., P. Blundell, S. M. Ahern, C. Nekitsing, A. Olsen, P. Moller, H. Hausner, E. Remy, S. Nicklaus, C. Chabanet, S. Issanchou and M. M. Hetherington (2014). "Learning to eat vegetables in early life: the role of timing, age and individual eating traits." *Plos One* 9(5): e97609. doi: 10.1371/journal.pone.0097609
- Cerro, N., S. Zeunert, K. N. Simmer and L. A. Daniels (2002). "Eating behaviour of children 1.5-3.5 years born preterm: Parents' perceptions." *Journal of Paediatrics and Child Health* 38(1): 72-78.
- Chatoor, I. (2002). "Feeding disorders in infants and toddlers: diagnosis and treatment." *Child and Adolescent Psychiatric Clinics of North America* 11(2): 163-169.

- Chatoor, I., R. Hirsch, J. Ganiban, M. Persinger and E. Hamburger (1998). "Diagnosing infantile anorexia: The observation of mother-infant interactions." *Journal of the American Academy of Child and Adolescent Psychiatry* 37(9): 959-967.
- Cooke, L. J., C. M. Haworth and J. Wardle (2007). "Genetic and environmental influences on children's food neophobia." *The American Journal of Clinical Nutrition* 86(2): 428-433.
- Coon, K. A., J. Goldberg, B.L. Rogers, K.L. Tucker (2001). "Relationships between use of television during meals and children's food consumption patterns." *Pediatrics* 107(1): e7.
- Coyne, T., T. Ibiebele, S. McNaughton, I. Rutishauser, K. O'Dea, A. Hodge, C. McClintock, M. Findlay and A. Lee (2005). "Evaluation of brief dietary questions to estimate vegetable and fruit consumption using serum carotenoids and red-cell folate." *Public Health Nutr* 8(3): 298 - 308.
- Craigie, A. M., A. A. Lake, S. A. Kelly, A. J. Adamson and J. C. Mathers (2011). "Tracking of obesity-related behaviours from childhood to adulthood: A systematic review." *Maturitas* 70(3): 266-284.
- Crist, W. and A. Napier-Phillips (2001). "Mealtime behaviors of young children: A comparison of normative and clinical data." *Journal of Developmental and Behavioral Pediatrics* 22(5): 279-286.
- D'Souza, A. and D. Jolliffe (2014). "Food insecurity in vulnerable populations: coping with food price shocks in Afghanistan." *American Journal of Agricultural Economics* 96(3): 790-812.
- de Lauzon-Guillain, B., A. Oliveira, M. A. Charles, E. Grammatikaki, L. Jones, N. Rigal, C. Lopes, Y. Manios, P. Moreira, P. Emmett and S. Monnery-Patris (2012). "A review of methods to assess parental feeding practices and preschool children's eating behavior: The need for further development of tools." *Journal of the Academy of Nutrition and Dietetics* 112(10): 1578-1602: e1578.
- Dillman, D. (2000). *Mail and internet surveys: The Tailored Design Method*. New York, John Wiley & Sons.
- Doom, J. R., M. R. Gunnar, M. K. Georgieff, M. G. Kroupina, K. Frenn, A. J. Fuglestad and S. M. Carlson (2014). "Beyond stimulus deprivation: Iron deficiency and cognitive deficits in post-institutionalized children." *Child Development* 85(5): 1805-1812.
- Dovey, T. M., C. Jordan, V. K. Aldridge and C. I. Martin (2013). "Screening for feeding disorders. Creating critical values using the behavioural pediatrics feeding assessment scale." *Appetite* 69(0): 108-113.
- Dovey, T. M. and C. I. Martin (2012). "A quantitative psychometric evaluation of an intervention for poor dietary variety in children with a feeding problem of clinical significance." *Infant Mental Health Journal* 33(2): 148-162.
- Dovey, T. M., P. A. Staples, E. L. Gibson and J. C. G. Halford (2008). "Food neophobia and 'picky/fussy' eating in children: A review." *Appetite* 50(2-3): 181-193.

- Drewett, R. F., M. Kasese-Hara and C. Wright (2003). "Feeding behaviour in young children who fail to thrive." *Appetite* 40(1): 55-60.
- Dubois, L., A. P. Farmer, M. Girard and K. Peterson (2007). "Preschool children's eating behaviours are related to dietary adequacy and body weight." *European Journal of Clinical Nutrition* 61(7): 846-855.
- Dunn, O. J. (1964). "Multiple comparisons using rank sums." *Technometrics* 6: 241-252.
- Eddy K.T., T. J. Hastings, K. Edkins, E. Lamont, C.M. Nevins, R.M. Patterson, H.B Murray, R. Bryant-Waugh, A.E. Becker (2014). "Prevalence of DSM-5 Avoidant/Restrictive Food Intake Disorder in a pediatric gastroenterology healthcare network." *Int J Eat Disord*. doi: 10.1002/eat.22350
- Ekstein, S., D. Laniado and B. Glick (2010). "Does picky eating affect weight-for-length measurements in young children?" *Clinical Pediatrics* 49(3): 217-220.
- Evans, A., J. G. Seth, S. Smith, K. K. Harris, J. Loyo, C. Spaulding, M. Van Eck and N. Gottlieb (2011). "Parental feeding practices and concerns related to child underweight, picky eating, and using food to calm differ according to ethnicity/race, acculturation, and income." *Maternal and Child Health Journal* 15(7): 899-909.
- Fanning, E. (2005). "Formatting a paper-based survey questionnaire: Best practices. practical assessment research & evaluation." 10(12). Retrieved from: <http://pareonline.net/getvn.asp?v=10&n=12>
- Field, A. (2009). *Discovering Statistics Using SPSS*. London, Sage.
- Field, D., M. Garland and K. Williams (2003). "Correlates of specific childhood feeding problems." *Journal of Paediatrics and Child Health* 39(4): 299-304.
- Fildes, A., C. Llewellyn, C. H. M. v. Jaarsveld, A. Fisher, L. Cooke and J. Wardle (2014). "Common genetic architecture underlying food fussiness in children, and preference for fruits and vegetables." *Appetite* 76 (Abstracts of the 23rd European Childhood Obesity Group (ECOG) Congress): 200-200.
- Finistrella, V., M. Manco, A. Ferrara, C. Rustico, F. Presaghi and G. Morino (2012). "Cross-sectional exploration of maternal reports of food neophobia and pickiness in preschooler-mother dyads." *Journal of the American College of Nutrition* 31(3): 152-159.
- Fisher, J., D. Mitchell, H. Smiciklas-Wright and L. Birch (2002). "Parental influences on young girls' fruit and vegetable, micronutrient, and fat intakes." *J Am Diet Assoc* 102: 58-64.
- Fisher, J. O. and L. L. Birch (1995). "Fat preferences and fat consumption of 3-year-old to 5-year-old children are related to parental adiposity." *Journal of the American Dietetic Association* 95(7): 759-764.
- Fisher, M. M., D. S. Rosen, R. M. Ornstein, K. A. Mammel, D. K. Katzman, E. S. Rome, S. T. Callahan, J. Malizio, S. Kearney and B. T. Walsh (2014). "Characteristics of Avoidant/Restrictive Food Intake Disorder in children and adolescents: A "new disorder" in DSM-5." *Journal of Adolescent Health* 55(1): 49-52.

- Fung, T. T., F. B. Hu, M. L. McCullough, P. K. Newby, W. C. Willett and M. D. Holmes (2006). "Diet quality is associated with the risk of estrogen receptor-negative breast cancer in postmenopausal women." *Journal of Nutrition* 136(2): 466-472.
- Galloway, A. T., L. Fiorito, Y. Lee and L. L. Birch (2005). "Parental pressure, dietary patterns and weight status among girls who are "picky eaters"." *Journal of the American Dietetic Association* 105(4): 541-548.
- Galloway, A. T., Y. Lee and L. L. Birch (2003). "Predictors and consequences of food neophobia and pickiness in young girls." *Journal of the American Dietetic Association* 103(6): 692-698.
- Gisel, E. G., R. Birnbaum and S. Schwartz (1998). "Feeding impairments in children: diagnosis and effective intervention." *The International Journal of Orofacial Myology* 24: 27-33.
- Golley, R. K., S. A. McNaughton and G. A. Hendrie (2015). "A dietary guideline adherence score is positively associated with dietary biomarkers but not lipid profile in healthy children." *Journal of Nutrition* 145(1): 128-133.
- Gottfried, R. J., J. P. Gerring, K. Machell, G. Yenokyan and M. A. Riddle (2013). "The iron status of children and youth in a community mental health clinic is lower than that of a national sample." *Journal of Child and Adolescent Psychopharmacology* 23(2): 91-100.
- Haas, A. M. and N. C. Maune (2009). "Clinical presentation of feeding dysfunction in children with eosinophilic gastrointestinal disease." *Immunology and Allergy Clinics of North America* 29(1): 65-68.
- Hafstad, G. S., D. S. Abebe, L. Torgersen and T. von Soest (2013). "Picky eating in preschool children: The predictive role of the child's temperament and mother's negative affectivity." *Eating Behaviors* 14(3): 274-277.
- Hann, C. S., C. L. Rock, I. D. King and A. Drewnowski (2001). "Validation of the Healthy Eating Index with use of plasma biomarkers in a clinical sample of women." *American Journal of Clinical Nutrition* 74(4): 479-486.
- Harlow, L. L. (2005). *The Essence of Multivariate Thinking: Basic Themes and Methods*. New Jersey, Taylor and Francis.
- Harmon, B. E., C. J. Boushey, Y. B. Shvetsov, R. Ettienne, J. Reedy, L. R. Wilkens, L. Le Marchand, B. E. Henderson and L. N. Kolonel (2015). "Associations of key diet-quality indexes with mortality in the Multiethnic Cohort: the Dietary Patterns Methods Project." *American Journal of Clinical Nutrition* 101(3): 587-597.
- Haszard, J. J., P. M. L. Skidmore, S. M. Williams and R. W. Taylor (2015). "Associations between parental feeding practices, problem food behaviours and dietary intake in New Zealand overweight children aged 4-8 years." *Public Health Nutrition* 18(6): 1036-1043.
- Hausner, H., A. Olsen and P. Miller (2012). "Mere exposure and flavour learning increase 2-3 year-old children's acceptance of a novel vegetable." *Appetite* 58(3): 1152-1159.

- Haycraft, E., C. Farrow, C. Meyer, F. Powell and J. Blissett (2011). "Relationships between temperament and eating behaviours in young children." *Appetite* 56(3): 689-692.
- Hemmi, M. H., D. Wolke and S. Schneider (2011). "Associations between problems with crying, sleeping and/or feeding in infancy and long-term behavioural outcomes in childhood: A meta-analysis." *Archives of Disease in Childhood* 96(7): 622-629.
- Hendy, H. M., K. E. Williams, K. Riegel and C. Paul (2010). "Parent mealtime actions that mediate associations between children's fussy-eating and their weight and diet." *Appetite* 54(1): 191-195.
- Holmes, B., K. Dick and M. Nelson (2008). "A comparison of four dietary assessment methods in materially deprived households in England." *Public Health Nutrition* 11(5): 444-456.
- Ilich, J. Z., N. E. Badenhop and V. Matkovic (1996). "Primary prevention of osteoporosis: Pediatric approach to disease of the elderly." *Women's Health Issues* 6(4): 194-203.
- Jacka, F. N., P. J. Kremer, M. Berk, A. M. de Silva-Sanigorski, M. Moodie, E. R. Leslie, J. A. Pasco and B. A. Swinburn (2011). "A prospective study of diet quality and mental health in adolescents." *Plos One* 6(9). doi: 10.1371/journal.pone.0024805.
- Jacobi, C., W. S. Agras, S. Bryson and L. D. Hammer (2003). "Behavioral validation, precursors, and concomitants of picky eating in childhood." *Journal of the American Academy of Child and Adolescent Psychiatry* 42(1): 76-84.
- Jacobi, C., G. Schmitz and W. Stewart Agras (2008). "Is picky eating an eating disorder?" *International Journal of Eating Disorders* 41(7): 626-634.
- Jae Eun, S., K. Juhee and R. A. Mathai (2011). "Associations of infant feeding practices and picky eating behaviors of preschool children." *Journal of the American Dietetic Association* 111(9): 1363-1368.
- Kant, A. K. (1996). "Indexes of overall diet quality: a review." *Journal of the American Dietetic Association* 96(8): 785-791.
- Knoops K.T., L.C. de Groot, F. Fidanza, A. Alberti-Fidanza, D. Kromhout and W.A van Staveren (2006). "Comparison of three dietary scores in relation to 10-year mortality in elderly European subjects: The HALE project." *Eur J Clin Nut* 60(6):746-55
- Kuehn, D., S. Miller, C. Schwemmler, M. Jungheim and M. Ptok (2014). "Infantile swallowing." *Laryngo-Rhino-Otologie* 93(4): 231-236.
- Lal A., M. Moodie, T. Ashton, M. Siahpush, B. Swinburn (2012). "Health care and lost productivity costs of overweight and obesity in New Zealand." *Aust N Z J Public Health*. 36(6):550-6.
- Lane, A. E., M. E. Geraghty, G. S. Young and J. L. Rostorfer (2014). "Problem eating behaviors in autism spectrum disorder are associated with suboptimal daily nutrient intake and taste/smell sensitivity." *ICAN: Infant, Child Adolescent Nutrition* 6(3): 172-180.

- Leal, L. O., R. R. P. Salto, L. T. Cardona, J. A. Williams, B. J. Marriage, R. R. Debeza, E. C. Bueso, J. d. C. Yubero and L. R. Mar (2012). "Dietary habits and nutrient intakes of a cohort of healthy children in Spain." *The Open Nutrition Journal* 6: 123-130.
- Leung, A. K. C., V. Marchand, R. S. Sauve and S. Canadian Paediat (2012). "The 'picky eater': The toddler or preschooler who does not eat." *Paediatrics & Child Health* 17(8): 455-457.
- Lewinsohn, P. M., J.M. Denoma, J.M Gau, T. E. Joiner, R. Striegel-Moore, P. Bear, B. Lamoureaux (2005). "Problematic eating and feeding behaviour of 36-month old children". *Int. J. Eat. Disord.* 38(3): 208-219.
- Li, Z. Y., J. Z. Wang, Y. R. Zhang, K. Yu, W. Y. Si-Tu, L. L. You, C. Chen, W. J. Li, P. Y. Wang and Y. M. Zhang (2014). "Assessment of accuracy of parents' perception of their 4-36 months old children's picky eating behavior." *Journal of Peking University. Health Sciences* 46(3): 383-388.
- Lockner, D. W., T. K. Crowe and B. J. Skipper (2008). "Dietary intake and parents' perception of mealtime behaviors in preschool-age children with autism spectrum disorder and in typically developing children." *Journal of the American Dietetic Association* 108(8): 1360-1363.
- Lozoff, B., J. Beard, J. Connor, B. Felt, M. Georgieff and T. Schallert (2006). "Long-lasting neural and behavioral effects of iron deficiency in infancy." *Nutrition Reviews* 64(5): S34-S43.
- Madan, N., U. Rusia, M. Sikka, S. Sharma and N. Shankar (2011). "Developmental and neurophysiologic deficits in iron deficiency in children." *Indian Journal of Pediatrics* 78(1): 58-64.
- Mallan, K. M., W.-H. Liu, R. J. Mehta, L. A. Daniels, A. Magarey and D. Battistutta (2013). "Maternal report of young children's eating styles. Validation of the Children's Eating Behaviour Questionnaire in three ethnically diverse Australian samples." *Appetite* 64: 48-55.
- Marchi, M. and P. Cohen (1990). "Early childhood eating behaviors and adolescent eating disorders." *Journal of the American Academy of Child and Adolescent Psychiatry* 29(1): 112-117.
- Marshall, J., M. Raatz, E.C. Ward, P. Dodrill (2014). "Use of parent report to screen for feeding difficulties in young children." *J. Paediatrics and Child Health* 51(3): 307-313.
- Martins, Y., R. L. Young and D. C. Robson (2008). "Feeding and eating behaviors in children with autism and typically developing children." *Journal of Autism and Developmental Disorders* 38(10): 1878-1887.
- Mascola, A. J., S. W. Bryson and W. S. Agras (2010). "Picky eating during childhood: A longitudinal study to age 11 years." *Eating Behaviors* 11(4): 253-257.
- McNaughton, S., K. Ball, D. Crawford, G.D Mishra (2008). "An index of diet and eating patterns is a valid measure of diet quality in an Australian population." *The Journal of Nutrition* 138: 86-93.

- Mennella, J. A., Jagnow, C. P., Beauchamp, G. K. (2001). "Prenatal and Postnatal Flavor Learning by Human Infants." *Pediatrics* 107(6): e88.
- Mennella, J. A., Trabulsi, J. C. (2012). "Complementary foods and flavor experiences: setting the foundation." *Annals of nutrition metabolism* Extramural(2): 40-50.
- Micali, N., J. Holliday, A. Karwautz, M. Haidvogel, G. Wagner, F. Fernandez-Aranda, A. Badia, L. Gimenez, R. Solano and M. Breclj-Anderluh (2007). "Childhood eating and weight in eating disorders: A multi-centre European study of affected women and their unaffected sisters." *Psychotherapy and Psychosomatics* 76(4): 234-241.
- Ministry of Education (2009). *Tertiary Education Strategy 2007-2012: A Framework for Monitoring*. Wellington: Ministry of Education.
- Ministry of Health (2003). *Food and Nutrition Guidelines for Healthy Adults: A Background Paper*. Wellington: Ministry of Health.
- Ministry of Health (2014) *Ala Mo'ui: Pathways to Pacific Health and Wellbeing 2014-2018*. Wellington: Ministry of Health.
- Ministry of Health (2002). *He Korowai Oranga: Māori Health Strategy*. Wellington: Ministry of Health.
- Ministry of Health (2012). *Food and Nutrition Guidelines for Healthy Children and Young People (Age 2-18 years): A Background Paper*. Wellington: Ministry of Health.
- Ministry of Health and National Health and Medical Research Council (2005). *Nutrient Reference Values for Australia and New Zealand*. Wellington: Ministry of Health.
- Morrison, H., T. G. Power, T. Nicklas and S. O. Hughes (2013). "Exploring the effects of maternal eating patterns on maternal feeding and child eating." *Appetite* 63(0): 77-83.
- Murdoch, M., A. B. Simon, M. A. Polusny, A. K. Bangerter, J. P. Grill, S. Noorbaloochi and M. R. Partin (2014). "Impact of different privacy conditions and incentives on survey response rate, participant representativeness, and disclosure of sensitive information: a randomized controlled trial." *BMC Medical Research Methodology* 14:90 doi: 10.1186/1471-2288-14-90
- National Research Bureau (2008). *New Zealand Children's Food and Drinks Survey*. Auckland: Health Sponsorship Council.
- Nicely, T. A., S. Lane-Loney, E. Masciulli, C. S. Hollenbeck, R.M Ornstein (2014). "Prevalence and characteristics of Avoidant/Restrictive Food Intake Disorder in a cohort of young patients in day treatment for eating disorders." *Journal of Eating Disorders* 2(21). doi: 10.1186/s40337-014-0021-3
- Nolan, G. A., A. L. McFarland, J. M. Zajicek and T. M. Waliczek (2012). "The effects of nutrition education and gardening on attitudes, preferences, and knowledge of minority second to fifth graders in the Rio Grande Valley toward fruit and vegetables." *Horttechnology* 22(3): 299-304.

- Northstone, K., P. Emmett, F. Nethersole and A. S. Team (2001). "The effect of age of introduction to lumpy solids on foods eaten and reported feeding difficulties at 6 and 15 months." *Journal of Human Nutrition and Dietetics* 14(1): 43-54.
- Osler, M., B. L. Heitmann, L. U. Gerdes, L. M. Jorgensen and M. Schroll (2001). "Dietary patterns and mortality in Danish men and women: a prospective observational study." *British Journal of Nutrition* 85(2): 219-225.
- Patton, S. R., L. M. Dolan and S. W. Powers (2006). "Parent report of mealtime behaviors in young children with Type 1 Diabetes Mellitus: Implications for better assessment of dietary adherence problems in the clinic." *Journal of Developmental and Behavioral Pediatrics* 27(3): 202-208.
- Piazza-Waggoner, C., K. A. Driscoll, D. K. Gilman and S. W. Powers (2008). "A comparison using parent report and direct observation of mealtime behaviors in young children with cystic fibrosis: Implications for practical and empirically based behavioral assessment in routine clinical care." *Childrens Health Care* 37(1): 38-48.
- Pliner, P. and E. R. Loewen (1997). "Temperament and food neophobia in children and their mothers." *Appetite* 28(3): 239-254.
- Pot, S., L. Sadler, J. McDougall, M. Harilall, M. Battin (2012). *National Women's Annual Clinical Report 2012*. Auckland: Auckland District Health Board.
- Potts, H. W. W. and J. Wardle (1998). "The list heuristic for studying personality correlates of food choice behaviour: a review and results from two samples." *Appetite* 30(1): 79-92.
- Powell, F. C., C. V. Farrow and C. Meyer (2011). "Food avoidance in children. The influence of maternal feeding practices and behaviours." *Appetite* 57(3): 683-692.
- Powers, S. W., S. R. Patton, K. C. Byars, M. J. Mitchell, E. Jelalian, M. M. Mulvihill, M. F. Hovell and L. J. Stark (2002). "Caloric intake and eating behavior in infants and toddlers with cystic fibrosis." *Pediatrics* 109(5).
- Provost, B., T. K. Crowe, P. L. Osbourn, C. McClain and B. J. Skipper (2010). "Mealtime behaviors of preschool children: comparison of children with autism spectrum disorder and children with typical development." *Physical Occupational Therapy in Pediatrics* 30(3): 220-233.
- Raine, A., J. Portnoy, J. Liu, T. Mahomed and J. R. Hibbeln (2014). "Reduction in behavior problems with omega-3 supplementation in children aged 8–16 years: a randomized, double-blind, placebo-controlled, stratified, parallel-group trial." *Journal of Child Psychology and Psychiatry*. 56(5): 509-520.
- Rastam, M. (1992). "Anorexia-nervosa in 51 Swedish adolescents - premorbid problems and comorbidity." *Journal of the American Academy of Child and Adolescent Psychiatry* 31(5): 819-829.
- Reau, N. R., Y. D. Senturia, S. A. Lebailly and K. K. Christoffel (1996). "Infant and toddler feeding patterns and problems: Normative data and a new direction." *Journal of Developmental and Behavioral Pediatrics* 17(3): 149-153.

- Rigal, N., C. Chabanet, S. Issanchou and S. Monnery-Patris (2012). "Links between maternal feeding practices and children's eating difficulties. Validation of French tools." *Appetite* 58(2): 629-637.
- Rogers, L. G., J. Magill-Evans and G. R. Rempel (2012). "Mothers' challenges in feeding their children with autism spectrum disorder-managing more than just picky eating." *Journal of Developmental and Physical Disabilities* 24(1): 19-33.
- Rosenstein, D. and H. Oster (1988). "Differential facial responses to 4 basic tastes in newborns." *Child Development* 59(6): 1555-1568.
- Royo-Bordonada, M. A., L. Gorgojo, M. de Oya, C. Garces, F. Rodriguez-Artalejo, R. Rubio, J. L. del Barrio and J. M. Martin-Moreno (2003). "Dietary variety and diversity of Spanish children: Four Provinces Study." *Medicina Clinica* 120(5): 167-171.
- Samara, M., S. Johnson, K. Lamberts, N. Marlow and D. Wolke (2010). "Eating problems at age 6 years in a whole population sample of extremely preterm children." *Developmental Medicine and Child Neurology* 52(2): e16-e22.
- Savage, J. S., J. O. Fisher and L. L. Birch (2007). "Parental influence on eating behavior: Conception to adolescence." *Journal of Law Medicine Ethics* 35(1): 22-34.
- Schmid, G., A. Schreier, R. Meyer and D. Wolke (2011). "Predictors of crying, feeding and sleeping problems: a prospective study." *Child Care Health and Development* 37(4): 493-502.
- Sharp, W. G., R. C. Berry, C. McCracken, N. N. Nuhu, E. Marvel, C. A. Saulnier, A. Klin, W. Jones and D. L. Jaquess (2013). "Feeding problems and nutrient intake in children with autism spectrum disorders: A meta-analysis and comprehensive review of the literature." *Journal of Autism and Developmental Disorders* 43(9): 2159-2173.
- Shim, J. E., J. Kim and R. A. Mathai (2011). "Associations of infant feeding practices and picky eating behaviors of preschool children." *Journal of the American Dietetic Association* 111(9): 1363-1368.
- Shmayaa, Y., S. Eilat-Adar, Y. Leitner, S. Reif and L. Gabis (2015). "Nutritional deficiencies and overweight prevalence among children with Autism Spectrum Disorder." *Research in Developmental Disabilities* 38: 1-6.
- Signal L, J. Martin, F. Cram, B. Robson (2008). *Health Equity Assessment Tool: A User's Guide*. Wellington: Ministry of Health.
- Sims, A. M., S. A. Long, J. A. F. Tender and M. A. Young (2015). "Surveying the knowledge, attitudes, and practices of district of Columbia ACOG members related to breastfeeding." *Breastfeeding Medicine* 10(1): 63-68.
- Sleddens, E. F. C., S. P. J. Kremers, C. Thijs (2008). "The Children's Eating Behaviour Questionnaire: Factorial validity and association with Body Mass Index in Dutch children aged 6–7." *International Journal of Behavioral Nutrition and Physical Activity* 5(49). doi: 10.1186/1479-5868-5-49

- Smith, A. A., S. Roux, N. T. Naidoo and D. J. L. Venter (2005). "Food choices of tactile defensive children." *Nutrition* 21(1): 14-19.
- Statistics New Zealand (2013). *Household Economic Survey 2013*. Wellington: Statistics New Zealand.
- Statistics New Zealand (2013). *New Zealand Census of Population and Dwellings*. Wellington: Statistics New Zealand.
- Statistics New Zealand (2005). *Understanding and working with ethnicity data: A technical paper*. Wellington: Statistics New Zealand.
- Sullivan, P. B., B. Lambert, M. Rose, M. Ford-Adams, A. Johnson and P. Griffiths (2000). "Prevalence and severity of feeding and nutritional problems in children with neurological impairment: Oxford Feeding Study." *Developmental Medicine and Child Neurology* 42(10): 674-680.
- Svensson, V., L. Lundborg, Y. Cao, P. Nowicka, C. Marcus and T. Sobko (2011). "Obesity related eating behaviour patterns in Swedish preschool children and association with age, gender, relative weight and parental weight - factorial validation of the Children's Eating Behaviour Questionnaire." *International Journal of Behavioral Nutrition and Physical Activity* 8(134). doi: 10.1186/1479-5868-8-134
- Tan, C. C. and S. C. Holub (2012). "Maternal feeding practices associated with food neophobia." *Appetite* 59(2): 483-487.
- Taylor, C.M., S.M. Wernimont, K. Northstone, P.M. Emmett (2015). "Picky/fussy eating: Review of definitions, assessment, prevalence and dietary intakes." *Appetite* 95:349-359.
- Tharner, A., P. W. Jansen, J. C. K.-d. Jong, H. A. Moll, A. Hofman, V. W. V. Jaddoe, H. Tiemeier and O. H. Franco (2015). "Bidirectional associations between fussy eating and functional constipation in preschool children." *Journal of Pediatrics* 166(1): 91-96.
- Tharner, A., P. W. Jansen, J. C. Kiefte-de Jong, H. A. Moll, J. van der Ende, V. W. V. Jaddoe, A. Hofman, H. Tiemeier and O. H. Franco (2014). "Toward an operative diagnosis of fussy/picky eating: a latent profile approach in a population-based cohort." *International Journal of Behavioral Nutrition and Physical Activity* 11-14.
- Timimi, S., J. Douglas and K. Tsiftopoulou (1997). "Selective eaters: A retrospective case note study." *Child Care Health and Development* 23(3): 265-278.
- UNICEF (1990). *Convention on the Rights of the Child*. London: UNICEF
- Utter, J., R. Scragg, D. Schaaf and C. N. Mhurchu (2008). "Relationships between frequency of family meals, BMI and nutritional aspects of the home food environment among New Zealand adolescents." *International Journal of Behavioral Nutrition and Physical Activity* 5(1): 50.
- Waijers, P. M., E. J. M. Feskens and M. C. Ocke (2007). "A critical review of predefined diet quality scores." *British Journal of Nutrition* 97(2): 219-231.

- Wardle, J., S. Carnell and L. Cooke (2005). "Parental control over feeding and children's fruit and vegetable intake: How are they related?" *Journal of the American Dietetic Association* 105(2): 227-232.
- Wardle, J., L. J. Cooke, E. L. Gibson, M. Sapochnik, A. Sheiham and M. Lawson (2003). "Increasing children's acceptance of vegetables; a randomized trial of parent-led exposure." *Appetite* 40(2): 155-162.
- Wardle, J., C. A. Guthrie, S. Sanderson and L. Rapoport (2001). "Development of the Children's Eating Behaviour Questionnaire." *Journal of Child Psychology and Psychiatry* 42(7): 963-970.
- Wiggins, S. (2013). "The social life of 'eugh': Disgust as assessment in family mealtimes." *British Journal of Social Psychology* 52(3): 489-509.
- Williams, K. E., B. G. Gibbons and K. A. Schreck (2005). "Comparing selective eaters with and without developmental disabilities." *Journal of Developmental and Physical Disabilities* 17(3): 299-309.
- Wirt, A. and C. E. Collins (2009). "Diet quality: what is it and does it matter?" *Public Health Nutrition* 12(12): 2473-2492.
- World Cancer Research Fund and American Institute for Cancer Research (2007). *Food, Nutrition, Physical Activity, and the Prevention of Cancer: A Global Perspective*. Washington: AICR.
- World Health Organization (2003a). *Diet, Nutrition and the Prevention of Chronic Diseases. Report of a Joint WHO/FAO Expert Consultation*. Geneva: World Health Organization.
- World Health Organization (2004). *Global Strategy on Diet, Physical Activity and Health*. Geneva: World Health Organization.
- World Health Organization (2008). *Action plan for the global strategy for the prevention and control of noncommunicable diseases 2008–2013*. Geneva: World Health Organisation.
- World Health Organization (2009b). *Interventions on Diet and Physical Activity: What Works – Summary report*. Geneva: World Health Organisation.
- Wright, C. M., K. N. Parkinson, D. Shipton and R. F. Drewett (2007). "How do toddler eating problems relate to their eating behavior, food preferences, and growth?" *Pediatrics* 120(4): e1069-e1075.
- Xia, W., Y. Zhou, C. Sun, J. Wang and L. Wu (2010). "A preliminary study on nutritional status and intake in Chinese children with autism." *European Journal of Pediatrics* 169(10): 1201-1206.
- Zhu, K. and R. L. Prince (2012). "Calcium and bone." *Clinical Biochemistry* 45(12): 936-942.

8. Appendices

Appendix A

Advertisement posters for recruitment



IS YOUR CHILD AGED 2 TO 4 YEARS?

We are interested in finding out about mealtime behaviours of young children, and what foods they eat

Participation in this research involves completing an online questionnaire which will take about 15 minutes, click here to find out more: <https://www.surveymonkey.com/s/YES-official>

Or contact the researcher, Saya Hashimoto:

email: lussyeatingresearch@gmail.com

phone: 022-089-4985

address: Saya Hashimoto c/o

IFNHH

Massey University

Private Bag 102904

North Shore City

Auckland 0745

This project has been reviewed and approved by the Massey University Human Ethics Committee: Northern, Application 13/056. If you have any concerns about the conduct of this research, please contact Dr Andrew Chrystall, Acting Chair, Massey University Human Ethics Committee: Northern, telephone 09 414 0800 x 43317 email humanethic-snorth@massey.ac.nz

Appendix B

News release

50
YEARS



MEDIA RELEASE

What do young Kiwi kids eat?

Do you have a child that eats everything or are mealtimes a battleground in your household?

Researchers from the College of Health at Massey University would like to hear from parents of 2 to 4 year olds. They want to uncover what Kiwi kids are eating and whether parents have any worries about feeding their children.

Master of Nutrition student Saya Hashimoto was inspired by the

ACTIVE eating programme run by Massey University's Institute of Food, Nutrition and Human Health (IFNHH). The programme deals with children who are extremely fussy eaters, but as no two children are the same Ms Hashimoto wants to find out more.

"We want to know what Kiwi kids are eating and what the common eating issues are that parents are dealing with."

At some point most parents will be concerned about whether their child is eating enough or too much, and whether they are eating the right foods or not. At the end of the survey parents will be provided with guidelines on how to feed their children.

As part of the survey parents will answer questions on the foods their child eats and whether they have any concerns about behaviours around mealtimes or eating. Dr Pam von Hurst from the research team says there is no national nutritional survey data available for this age group. "We know so little about this age group, and whether they are meeting our current national guidelines"

Lead researcher Dr Cath Conlon is hoping that parents from across New Zealand will respond, and help reflect New Zealand's growing diversity.

"We're looking for parents of children aged two to four from all ethnic backgrounds across New Zealand to fill in the online survey. We're aiming for over 1000 participants to complete the survey and we've already had more than 700 people take 20 minutes out of their day to help out."

The team say the research will ultimately help build some simple diagnostic tools for health professionals to identify if young children are at risk of a poor nutritional intake.



Appendix C

Questionnaire



Young Children's Eating Study

Thank you for accessing this online questionnaire for the Young Children's Eating Study.

This research study is looking at mealtime behaviours in young children. There are no right or wrong answers. We want to know about how parents feel about mealtimes and what young children eat - this will help us to understand any concerns parents may have.

We are looking for parents who currently live in New Zealand, have a young child aged over 2 years but less than 4 years (24 to 47 months) old and are willing to complete an online questionnaire. We want to ask you questions about mealtimes, what your child eats and whether you have any concerns about feeding your child. There are also some questions about your child's medical history; these are to identify factors which are known to be related to feeding issues.

The questionnaire will take less than 15 minutes to complete. You do not have to answer any questions you are uncomfortable with, and you can opt out of the questionnaire at any time. We apologise that some questions may seem repetitive - please understand that this is important for accurate data collection. Only completed questionnaires will be included in the study.

We are collecting the data online, and we will not collect any information which could identify you or your child. However, we want to make sure that the findings of the study are available to you, so we will be posting a summary of the findings on our website around the end of 2014. Bookmark this page (http://www.massey.ac.nz/massey/learning/departments/institute-food-nutrition-human-health/human-nutrition/pifan/pifan_home.cfm) and visit it for updates on the study.

Once we have finished the study and analysed the data, the spreadsheet containing all the responses will be archived and securely stored for five years.

This research is part of my Masters in Nutrition. It's an area in which some parents may need more support, so thank you for taking part. Please contact me or my supervisors if you would like any help or more information.

Researcher: Saya Hashimoto email: fussyeatingresearch@gmail.com

phone: 022-089-4985

Supervisors: Dr Cath Conlon email: c.conlon@massey.ac.nz

phone: 09-414-0800 ext: 41206

Dr Pam von Hurst email: p.r.vonhurst@massey.ac.nz

phone: 09-414-0800 ext: 41205

This project has been reviewed and approved by the Massey University Human Ethics Committee: Northern, Application 13/056. If you have any concerns about the conduct of this research, please contact Dr Andrew Chrystall, Acting Chair, Massey University Human Ethics Committee: Northern, telephone 09 414 0800 x 43317 email humanethicsnorth@massey.ac.nz

1. Just to check

Do you live in New Zealand and is your child aged between 2 and 4 years old?

Yes No



MASSEY UNIVERSITY
COLLEGE OF HEALTH
TE KURA HAUORA TANGATA

Young Children's Eating Study

2. I agree to take part in this research study

Yes

No



Young Children's Eating Study

3. My child enjoys tasting new foods

1. Never

2.

3. Sometimes

4.

5. Always

4. My child enjoys a wide variety of foods

1. Never

2.

3. Sometimes

4.

5. Always

5. My child is interested in tasting food s/he hasn't tasted before

1. Never

2.

3. Sometimes

4.

5. Always

6. My child refuses new foods at first

1. Never

2.

3. Sometimes

4.

5. Always

7. My child decides that s/he doesn't like food without even without tasting it

1. Never

2.

3. Sometimes

4.

5. Always

8. My child is difficult to please with meals

1. Never

2.

3. Sometimes

4.

5. Always



Young Children's Eating Study

Finding out about mealtimes

Below are a series of phrases that describe children's eating. Please click on the number describing how often the behaviour currently occurs, and click on the "Yes" or "No" to indicate whether the behaviour is currently a problem for you.

9. My child eats fruit

1. Never

2.

3. Sometimes

4.

5. Always

10. Is this a problem for you?

Yes

No

11. My child has problems chewing food

1. Never

2.

3. Sometimes

4.

5. Always

12. Is this a problem for you?

Yes

No

13. My child enjoys eating

1. Never

2.

3. Sometimes

4.

5. Always

14. Is this a problem for you?

Yes

No

15. My child chokes or gags at mealtimes

1. Never

2.

3. Sometimes

4.

5. Always

16. Is this a problem for you?

Yes

No

17. My child will try new foods

1. Never

2.

3. Sometimes

4.

5. Always

18. Is this a problem for you?

Yes

No

19. My child eats meats and/or fish

1. Never

2.

3. Sometimes

4.

5. Always

20. Is this a problem for you?

Yes

No

21. My child takes longer than 20 minutes to finish a meal

1. Never

2.

3. Sometimes

4.

5. Always

22. Is this a problem for you?

Yes

No

23. My child drinks milk

1. Never

2.

3. Sometimes

4.

5. Always

24. Is this a problem for you?

Yes

No

25. My child comes readily to mealtime

1. Never

2.

3. Sometimes

4.

5. Always

26. Is this a problem for you?

Yes

No

27. My child eats junky snack foods but will not eat at mealtime

1. Never

2.

3. Sometimes

4.

5. Always

28. Is this a problem for you?

Yes

No

29. My child vomits just before, at, or just after mealtime

1. Never

2.

3. Sometimes

4.

5. Always

30. Is this a problem for you?

Yes

No

31. My child eats only ground, strained or soft food

1. Never

2.

3. Sometimes

4.

5. Always

32. Is this a problem for you?

Yes

No

33. My child gets up from the table or tries to get out of his/her highchair during a meal

1. Never

2.

3. Sometimes

4.

5. Always

34. Is this a problem for you?

Yes

No

35. My child lets food sit in his/her mouth & does not swallow it

1. Never

2.

3. Sometimes

4.

5. Always

36. Is this a problem for you?

Yes

No

37. My child whines or cries at feeding time

1. Never

2.

3. Sometimes

4.

5. Always

38. Is this a problem for you?

Yes

No

39. My child eats vegetables

1. Never

2.

3. Sometimes

4.

5. Always

40. Is this a problem for you?

Yes

No

41. My child has tantrums at mealtimes

1. Never

2.

3. Sometimes

4.

5. Always

42. Is this a problem for you?

Yes

No

43. My child eats starches (example, potato, noodles)

1. Never

2.

3. Sometimes

4.

5. Always

44. Is this a problem for you?

Yes

No

45. My child has a poor appetite

1. Never

2.

3. Sometimes

4.

5. Always

46. Is this a problem for you?

Yes

No

47. My child spits out food

1. Never

2.

3. Sometimes

4.

5. Always

48. Is this a problem for you?

Yes

No

49. My child delays eating by talking

1. Never

2.

3. Sometimes

4.

5. Always

50. Is this a problem for you?

Yes

No

51. My child would rather drink than eat

1. Never

2.

3. Sometimes

4.

5. Always

52. Is this a problem for you?

Yes

No

53. My child refuses to eat but requests food immediately after the meal

1. Never

2.

3. Sometimes

4.

5. Always

54. Is this a problem for you?

Yes

No

55. My child tries to negotiate what he/she will eat and what he/she will not eat

1. Never

2.

3. Sometimes

4.

5. Always

56. Is this a problem for you?

Yes

No

57. My child has required nasal-gastric feeds to maintain proper nutritional status

1. Never

2.

3. Sometimes

4.

5. Always

58. Is this a problem for you?

Yes

No



Young Children's Eating Study

Your feelings

Please click on the circle which identifies how you feel and whether this is a problem for you.

59. I get frustrated &/or anxious when feeding my child

1. Never

2.

3. Sometimes

4.

5. Always

60. Is this a problem for you?

Yes

No

61. I coax my child to get him/her to take a bite

1. Never

2.

3. Sometimes

4.

5. Always

62. Is this a problem for you?

Yes

No

63. I use threats to get my child to eat

1. Never

2.

3. Sometimes

4.

5. Always

64. Is this a problem for you?

Yes

No

65. I feel confident my child gets enough to eat

1. Never

2.

3. Sometimes

4.

5. Always

66. Is this a problem for you?

Yes

No

67. I feel confident in my ability to manage my child's behaviour at mealtime

1. Never

2.

3. Sometimes

4.

5. Always

68. Is this a problem for you?

Yes

No

69. If my child does not like what is being served, I make something else

1. Never

2.

3. Sometimes

4.

5. Always

70. Is this a problem for you?

Yes

No

71. When my child refuses to eat, I put the food in his/her mouth by force if necessary

1. Never

2.

3. Sometimes

4.

5. Always

72. Is this a problem for you?

Yes

No

73. I disagree with other adults (example, my spouse, the child's grandparents) about how to feed my child

1. Never

2.

3. Sometimes

4.

5. Always

74. Is this a problem for you?

Yes

No

75. I feel that my child's eating pattern hurts his/her general health

1. Never

2.

3. Sometimes

4.

5. Always

76. Is this a problem for you?

Yes

No

77. I get so angry with my child at mealtimes that it takes me a while to calm down after the meal

1. Never

2.

3. Sometimes

4.

5. Always

78. Is this a problem for you?

Yes

No



MASSEY UNIVERSITY
COLLEGE OF HEALTH
TE KURA HAUORA TANGATA

Young Children's Eating Study

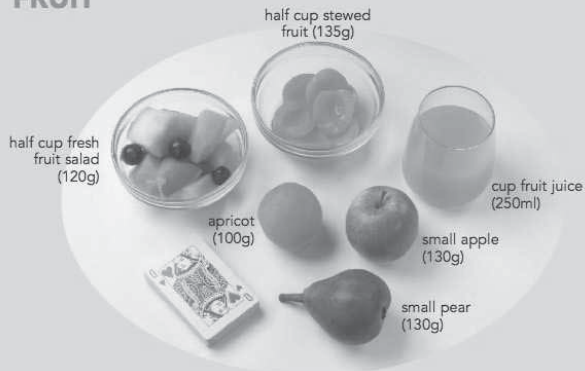
What your child eats?

We want to find out about the number of servings of different foods your child eats. Below is a guide as to what a serving looks like.

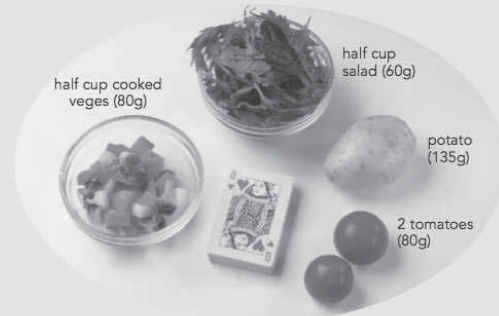
WHAT DOES A "SERVING" LOOK LIKE?

We see a lot of information about "servings" in nutrition advice and on food packaging. If you've ever wondered what a "serving" of a particular food looks like, here's a guide to help you. These are the recommendations from the Ministry of Health for the main food groups. The playing cards are there to give you an idea of the size of each item.

FRUIT



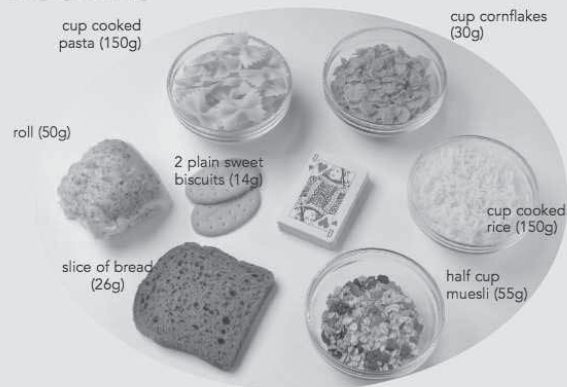
VEGETABLES



MILK, YOGHURT, CHEESE



BREAD, CEREAL, RICE, PASTA, NOODLES



OILS AND FATS



MEAT, POULTRY, FISH, EGGS, LEGUMES



WATER AND OTHER FLUIDS



Published in *Healthy Food Guide* January 2006. *Healthy Food Guide* is a monthly magazine available at supermarkets and bookstores for just \$5.50. To subscribe, go to www.healthyfood.co.nz

NEW ZEALAND
healthyfood GUIDE
IDEAS FOR REAL LIFE

Your child may not consume an entire serving size in one sitting - eg: a serving of milk is a 250ml glass but they may have 125ml portion of milk at breakfast and another portion again at morning tea. This counts as one serving. Please see the serving size examples above for examples of serving sizes.

79. How many servings of fruit does your child eat each day?

Examples of servings are:

- 1 apple, pear, banana or orange
- 2 small apricots or plums
- ½ cup of fresh fruit salad
- ½ cup of stewed or canned fruit

- None
- ½ serving
- 1 serving
- 1 and ½ servings
- 2 servings or more

80. How many servings of vegetables does your child eat each day?

Examples of servings are:

- 1 medium potato, taro or kūmara
- ½ cup of cooked vegetables eg: peas, carrots, broccoli
- ½ cup of salad eg: lettuce, cucumber
- 1 tomato

- None
- ½ serving
- 1 serving
- 1 and ½ servings
- 2 servings or more

81. Fruits come in many different colours. How many different types does your child eat from the following colour groups?

	0	1	2	3	4	5 or more types
Red fruits (eg: red apples, cherries, red grapes, strawberries, watermelon)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Orange/yellow fruits (eg: yellow apples, apricots, oranges, mandarins, peaches)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Green fruits (eg: green apples, green grapes, kiwi fruit)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Blue/purple fruits (eg: blackberries, blueberries, plums, purple grapes, raisins)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
White fruits (eg: bananas, pears, white peaches)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

82. Vegetables come in many different colours. How many different types does your child eat from the following colour groups?

	0	1	2	3	4	5 or more types
Red vegetables (eg: red potatoes, red capsicums, tomatoes, yams)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Orange and yellow vegetables (eg: carrots, pumpkin, sweet corn, gold or orange kumara)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Green vegetables (eg: avocados, green beans, broccoli, green cabbage, cucumber, peas, spinach, puha, watercress, kamokamo, bok choi)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Blue/purple vegetables (eg: eggplant, red cabbage)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
White vegetables (eg: cauliflower, mushrooms, onions, parsnips, potatoes, taro, cassava, breadfruit)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

83. How many servings of bread and cereals does your child eat each day?

Examples of servings are:

- 1 roll
- 1 medium slice of bread
- 1 medium slice of rēwena bread
- 1 pita pocket or tortilla
- 4 crackers
- ½ cup of muesli
- 1 cup of cornflakes or rice bubbles or 2 breakfast wheat biscuits
- ½ cup of cooked cereal (eg: porridge)
- 1 cup of cooked pasta, noodles or rice
- 1 cup of cassava or tapioca
- 2 plain sweet biscuits

- None
- 1 serving
- 2 servings
- 3 servings
- 4 servings or more

84. How often does your child eat wholegrain versions of these foods?

- Never
- Rarely
- Some days
- Most days
- Every day

85. How many servings of milk, milk products and calcium-fortified milk alternatives does your child eat each day?

Examples of servings are:

- 1 cup of milk
- 1 pottle of yoghurt
- 2 slices or $\frac{1}{2}$ cup of grated cheese

- None
- $\frac{1}{2}$ serving
- 1 serving
- 1 and $\frac{1}{2}$ servings
- 2 servings or more

86. How often does your child eat reduced or low-fat versions of these foods?

- Never
- Rarely
- Some days
- Most days
- Every day

87. How many servings of meats, chicken, seafood, eggs, legumes, nuts and seeds does your child eat each day?

Examples of servings are:

- 2 slices of cooked lean meat (eg: lamb, chicken, beef or pork)
- $\frac{3}{4}$ cup of mince or casserole
- 1 medium fillet of fish
- 2 chicken drumsticks or 1 chicken leg
- 1 medium pāua or kina
- 1 egg
- $\frac{3}{4}$ cup of cooked dried beans (eg: baked beans)
- $\frac{1}{3}$ cup of nuts or seeds
- $\frac{3}{4}$ cup of tofu
- $\frac{1}{2}$ cup canned tuna or salmon

- None
- $\frac{1}{2}$ serving
- 1 serving or more

88. Please tell us about any cultural or traditional foods which are important to your child

89. Does your child eat

	Never	Rarely	Some days	Most days	Every day
Breakfast	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Mid morning snack	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lunch	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Mid afternoon snack	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Dinner	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

90. How often do you prepare or choose low fat food, snack and/or drink options for your child?

- Never
- Rarely
- Some days
- Most days
- Every day

91. How often do you prepare or choose low salt food, snack and/or drink options for your child?

- Never
- Rarely
- Some days
- Most days
- Every day

92. How often do you chose low sugar food, snack and/or drink options for your child?

- Never
- Rarely
- Some days
- Most days
- Every day

93. Is your child

	Yes	No
Vegetarian	<input type="radio"/>	<input type="radio"/>
Vegan	<input type="radio"/>	<input type="radio"/>

94. How many cups/glasses of the following options does your child usually drink each day?

	None	1	2	3	4 or more cups/glasses
Water	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cow's milk (or alternative)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Flavoured milk based drinks	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fruit juice	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fizzy drinks (including diet drinks)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cordial or fruit drinks	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Tea or coffee	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sports or energy drinks	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Other (please specify)

95. How often does your child eat meals with family or whanau?

- Never
- Rarely
- Some days
- Most days
- Every day

96. How often do you involve your child with shopping, growing and/or cooking family meals?

- Never
- Rarely
- Some days
- Most days
- Every day

97. How often does your child do moderate to vigorous physical activity (eg: running around outside, playing on the playground) for at least 60 minutes a day?

Please note: this can be 60 minutes spread over the course of the day

- Never
- Rarely
- Some days
- Most days
- Every day

98. How often does your child spend more than two hours a day in front of television, computers and gaming consoles?

- Never
- Rarely
- Some days
- Most days
- Every day



Young Children's Eating Study

When your child was a baby

99. When your child was a baby did you have any problems with the following:

	Yes	No
Breast feeding	<input type="radio"/>	<input type="radio"/>
Reflux	<input type="radio"/>	<input type="radio"/>
Food allergies	<input type="radio"/>	<input type="radio"/>
Food intolerances	<input type="radio"/>	<input type="radio"/>
Starting solids	<input type="radio"/>	<input type="radio"/>

100. Was your child born preterm (before 37 weeks gestation)?

- Yes
 No



Young Children's Eating Study

In this section we are going to ask you about common feeding concerns in young children

101. How would you describe a fussy eater?

- Refuses many foods
- Refuses fruit
- Refuses vegetables
- Refuses meat/fish/poultry and other protein-rich foods
- Refuses food of particular texture
- Refuses new foods
- Eats the same few foods only
- Eats limited amount (quantity) of food

Other (please specify)

102. Do you think your child is a fussy eater?

	1. Not at all fussy	2	3	4	5	6	7	8	9	10. Extremely fussy
My child is	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Please comment if you want to

103. Does your child have any of the following?

	Yes	No
Developmental Delay	<input type="radio"/>	<input type="radio"/>
Autism	<input type="radio"/>	<input type="radio"/>
Attention Deficit Disorders	<input type="radio"/>	<input type="radio"/>
A medical condition that affects feeding	<input type="radio"/>	<input type="radio"/>
A medical condition that does NOT affect feeding	<input type="radio"/>	<input type="radio"/>

104. Do you restrict what your child eats due to a food allergy, sensitivity or intolerance?

	Yes	No
Food allergies	<input type="radio"/>	<input type="radio"/>
Food intolerances (eg: gluten intolerance)	<input type="radio"/>	<input type="radio"/>
Food sensitivity	<input type="radio"/>	<input type="radio"/>

If you have answered yes, has the food allergy or intolerance being diagnosed by a medical practitioner?

105. Do you restrict your child's diet for any other reason?

- Yes
 No

Other (please describe)

106. Has your child been diagnosed with any eating difficulties?

- Yes No

Please comment and tell us who has diagnosed the eating difficulty

107. Compared to other children of the same age and sex, how would you rate your child's weight:

- Underweight
- A little underweight
- About right
- A little overweight
- Overweight

108. How concerned are you about your child's weight?

- Not at all concerned
- Not concerned
- A little concerned
- Quite concerned
- Very concerned



Young Children's Eating Study

About you and your child

109. Finding out about the age of your child:

	Month of birth	Year of birth
My child was born in	<input type="text"/>	<input type="text"/>

110. To which ethnic group(s) does your child belong? Please tick all that apply:

	New Zealand European	Māori	Samoaan	Cook Islands Maori	Tongan	Niuean	Chinese	Indian	Prefer not to say
Which ethnic group does your child belong to?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Other, please state, eg: Dutch, Japanese, Tokelauan

111. Does your child currently take any supplements?

- Yes
 No

Please list what type (eg: child's multivitamin, vitamin c)

112. What is the mother's highest level of education? Please tick one circle only

- Primary school
- Some high school
- School Certificate or NCEA level 1
- Sixth Form Certificate or NCEA Level 2
- Bursary or Higher School Certificate or NCEA Level 3
- College of Education Certificate
- Polytechnic Diploma
- University Degree

Other (please describe)

113. Tick the box which applies to you

What is the combined average total income of your household per year before tax?

Less than \$25,000

\$25,000-\$50,000

\$50,001-\$75,000

Over \$75,000

Prefer not to say



MASSEY UNIVERSITY
COLLEGE OF HEALTH
TE KURA HAUORA TANGATA

Young Children's Eating Study

If you have any concerns about feeding your child please consult you Plunket Nurse/Tamariki Ora Nurse or General Medical Practitioner.

More information about healthy eating for children can be found here: <https://www.healthed.govt.nz/resource/eating-healthy-children-aged-2-12nga-kai-totika-mo-te-hunga-kohungahunga>

114. I understand that by submitting this questionnaire, I am agreeing to participate in this study

Yes

No



MASSEY UNIVERSITY
COLLEGE OF HEALTH
TE KURA HAUORA TANGATA

Young Children's Eating Study

115. If you would like to take part in another study which is going to look at children's diets in more detail please leave us your contact details and we will be in touch shortly. A researcher will contact you, tell you about the next study and then you can decide whether you would like to take part or not.

Name

Contact (email or
telephone number)

Appendix D

Permission to use Behavioural Paediatric Feeding Assessment Scale (BPFAS) from Dr. William Crist



William Crist <wcrist07@gmail.com>

to me ▾

Hi Saya -

Thank you for your interest in the BPFAS. It sounds like you have an interesting study planned. The BPFAS is a copyrighted measure, but I give you my permission to use the scale in your clinical work and research as long as it is properly referenced in any publications. I will send you the materials and information in two emails.

I have attached to this email a copy of the BPFAS itself (in pdf format) and have also included a hand scoring form. The scale is constructed with both positively and negatively phrased items. Because of this, the scoring of the positively phrased items need to be reversed so that the higher the total score, the more problems it reflects.

I have also designed a scoring program built into an Access database. If you are not familiar with the Access database, it is part of the Microsoft office package and the data is easy to export (into SPSS for windows for example). The Access file, however, is often blocked by an institution's firewall which sometimes blocks only the Access file attachment and sometimes the entire email. Thus, I will send this file to you in a second email. If you don't receive the second email and would like the Access database scoring program - let me know and there are few tricks that I can try. For example, if you have a yahoo or gmail account, I will send it to you that way. If you have an older version of Access (before 2007), let me know and there is a different file that I can send you.

We have been using the measure in own feeding clinic (with a broad spectrum of feeding difficulties) for the last twenty years or so and several years ago published normative and clinical data (Journal of Developmental and Behavioral Pediatrics, 2001, vol 22, no. 5, pgs. 279-286) . Our first use of the measure in a study was actually back in the early 1990's when we looked at meal time issues for young children with cystic fibrosis (Journal of Developmental and Behavioral Pediatrics, 1994, vol 15, no. 3, pgs. 157-161) . At a consensus conference on Pediatric Nutrition for Patients with Cystic Fibrosis (Borowitz d et al., Journal of Pediatric Gastroenterology and Nutrition, vol 35(3),2002, pgs. 246-259), it was recommended that the measure be used as a routine screening measure in CF clinics. We continue to use the measure both pre and post treatment to look at treatment outcome (see our 2011 paper, Bandstra et al.).

Below is a list of studies that have used the BPFAS. I am sure I have missed a few studies and a few others are in the publication process such as the one by Jeanne Marshall and her colleagues.

📧 05/09/2014 ☆



People (3)

William Crist

wcrist07@gmail.com



[Show details](#)