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Food Security in New Zealand

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Abstract

There was growing concern in New Zealand in the 1990's that Food Security: access by all people at all times to enough food for an active healthy life, was not being achieved, despite an abundant food supply. A study of a convenience sample of 40 families with children (58 adults and 92 children) whose sole income was a government welfare benefit was undertaken. Two-thirds of these households regularly relied on a limited variety of food; one-half did not have a sufficient amount of food because of lack of money and outstanding debts. Over the previous year two-thirds had sourced food from a food bank and one-third had been gifted food from friends or relatives. Women's intakes were compromised regularly but not children's. All of the women experienced worry about feeding their household. One-fifth were overweight and over 40% obese despite low reported daily energy intakes (median (SE) 5.7 (0.5) MJ) compared to national data. Six repeated 24-hour diet recalls collected randomly over a two-week period enabled calculation of usual daily intake and the prevalence of inadequate intake for eight micronutrients which were disturbingly high. The children's growth patterns compared favourably with US population percentiles.

The National Nutrition Survey (NNS97) allowed the adaption of eight questions—developed by Reid using qualitative methods—to eight indicator statements about food security to be addressed by each participant on behalf of them or their household. Prevalence was significantly higher ($p < 0.05$) for females compared to males for the majority of indicator statements among New Zealand European and Others (NZEO) and Māori. NZEO reported the most food security; Pacific people reported the least

and Māori fell between the two. There was a significant increasing linear trend of food security with age ($p < 0.001$) after adjusting for gender.

Rasch analysis was performed on 1868 households where participants reported some food insecurity. The responses were ranked according to the proportion and ordering of their positive responses to eight indices of food security, achieving reliability (Cronbach's Alpha) close to the conventionally accepted level of 0.7. The eight indices were ranked on the same scale; the minimum score -1.66 was achieved by the index 'use special food grants/banks' (the index least reported and most severe) and the maximum score 1.86 was achieved by the index 'variety of foods eaten limited' (the index most reported and least severe).

Categories of food security were assigned using scale cut points: 'fully/almost fully food secure'; 'moderate food security'; 'low food security'. Category status was associated with consumption of recommended number of daily serves of fruit, vegetables, fruits and vegetables, consumption of leaner meats, fatty meats and daily serves of bread. By ANOVA and controlling for sex, ethnicity, Index of Deprivation, urban/rural location, age, level of education, income, and household size, category of household food security was associated with the level of daily intake of total fat, saturated, monounsaturated and polyunsaturated fat, cholesterol, glucose, fructose, lactose, vitamin B6, vitamin B12, and vitamin C. Dietary data were from the primary 24-hour diet recall of respondents. Participants in the fully/almost fully food secure category of households had a mean BMI of 28.7 compared to those moderately secure (29.2) and of low food security (29.5) ($p = 0.015$ for difference among categories).

In the Children's Nutrition Survey 2002 (CNS02) data set, the same eight indices were used and food insecurity was experienced significantly more often by children in the largest households, those in the most deprived areas of residence (NZDep01 Quintile) and those of Pacific and Māori ethnicity compared to NZEO children. Rasch analysis was performed on responses for 1561 households with children which reported some food insecurity. Subject reliability was close to 0.7 (the conventionally acceptable level). The distribution of the eight indices on the Rasch scale was similar to that observed among the NNS97 households and almost identical to the sub-set of households with children, from that dataset. Categories of food security status were assigned as in the NNS97 and they predicted daily nutrient intake levels of children: total sugars, lactose, vitamin A, β -carotene, vitamin B12 and calcium. A more rigorous assigning of categories at the low/moderate scale cut-off, resulted in a further association with level of intake of glucose, fructose and folate. Mean BMI across categories of food security did not differ.

Collectively these data provide unequivocal evidence that food insecurity exists in New Zealand, that it can be quantified and associated with nutrition outcomes. It has a negative impact on the nutrient intakes of both adults and children and a negative impact on the body weight status of adults.

These data have implications for nutrition and health professionals and policy makers in New Zealand. They also add to the world-wide body of knowledge of the experience of, and the measurement and predictive potential of food security in populations where the food supply appears plentiful.

Acknowledgments

I am indebted to my supervisors, Professor Jim Mann and Dr Noela Wilson. Jim assisted me through a decade of roadblocks towards completing this research, in the context of full-time employment. In particular he taught me to accept each roadblock as a challenge which could be surmounted. His critical appraisal of each Chapter was invaluable.

I am particularly grateful for the day-to-day support which Noela provided over the last year and for always engaging in lively debate over areas of data interpretation. Her constant encouragement, listening ear and editing skills were invaluable.

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During the process of researching and writing this work I have been profoundly aware of the support, cooperation and assistance I have received from so many people. The task could not have been achieved without each one.

Research Context

During the 1990's the emerging issue of the influence of poverty on nutritional status in developed countries came to the attention of the candidate. Although there was widespread concern expressed around this issue, there were few studies of the nature of the problem in New Zealand. Hence the study of 'the nutritional status of women and their children in food insecure New Zealand households was conceived. The candidate obtained funding from the Public health Commission, sufficient for the study and also the study referred to in this thesis 'Perceived Hunger in Schools'.

After obtaining ethical approval, the candidate planned the pilot study, assisted by Judith Hassink (MSc candidate from Wageningen Holland). On completion of this she refined the methodology and worked with church welfare agencies in the cities of Dunedin and Auckland to access a convenience sample of 'families on welfare benefit(s)'. The candidate trained and supervised research assistants in data collection techniques. Christine Govan and Sarah Bethell carried out the home visits and telephone interviews with participating families. Liaison with the welfare agencies and feedback of results to them was the responsibility of the candidate.

The candidate trained Sarinah Harmon and Carolyn Feasey to assist in data entry and nutrient analyses of the food records. The descriptive data from this study were presented at a conference in 1996 held in Germany and a paper drafted and subsequently published in the monograph 'Poverty and Food in Welfare Societies.' Editors M Kohler, E Feichtinger, E Barlosius and E Dowler, Sigma, Berlin, 1997. The candidate was responsible for further data analysis and interpretation and received statistical advice and assistance from Mark Wohlers.

Given the emergence of the concept and definitions of food security, the candidate recognized the need to develop a measurement tool for food insecurity in New Zealand. She encouraged Jenny Reid (Ministry of Health and MPH candidate) to commence the process of development of indices of food insecurity using qualitative methodologies. As a principal investigator of the National Nutrition Survey research team and the nutrition manager for the survey at its commencement, the candidate was able to adapt the questions prepared by Jenny Reid for use in the NNS97, working with the field staff piloting all survey questionnaires to refine them. Thus the 8 statements to which participants could respond emerged as the research tool of choice.

During NNS97 the candidate supervised interviewers in collection of the food security data, took responsibility for the data cleaning and analysis, interpreted the data, and wrote the descriptive food security section of the NNS97 report. Following this she further analysed the food security data with statistical assistance from Joanne McKenzie and authored the manuscript 'Food security: Is New Zealand a land of plenty?' which was published in the New Zealand Medical Journal (Parnell, Reid *et al.*, 2001).

The development of the US Core Food Security Model which involved taking 18 unique indices of food security, ranking them in order of severity (using Rasch analysis) and allowing food security status to predict nutrition and health outcomes, provided an example which could be trialled on the 8 indicators of food security used in NNS97.

The candidate, with statistical input from Andrew Gray (who carried out Rasch analysis on the NZ indicators), developed categories of household food security status and explored their relationship with food, nutrient intake and body weight status.

As a principal investigator and nutrition manager for the National Children's Nutrition Survey (CNS02) the candidate supervised the collection of food security data from NZ Households with children, using the indices developed and adapted for the NNS97, and as with the NNS97 data, developed categories of food security status, exploring their relationship with nutrient intake and body weight status.

Contents

| | |
|---|------|
| Abstract | i |
| Acknowledgments..... | iv |
| Research Content | v |
| Contents..... | viii |
| List of Tables | xii |
| List of Figures..... | xiii |
| List of Abbreviations | xiv |
| Relevant Publications..... | xv |
| Aims | xvi |
| 1 Current Knowledge of Food Security in Developed Countries..... | 1 |
| 1.1 What is Food Security? | 1 |
| 1.1.1 <i>The qualitative dimension.</i> | 3 |
| 1.1.2 <i>Quantitative dimension.</i> | 3 |
| 1.1.3 <i>Social dimension.</i> | 3 |
| 1.1.4 <i>Psychological dimension.</i> | 4 |
| 1.2 How can food security be measured. | 5 |
| 1.3 Prevalence of food insecurity..... | 13 |
| 1.4 Food insecurity indices as predictors of nutritional outcomes. | 17 |
| 1.4.1 <i>Influence on food and nutrient intake.</i> | 17 |
| 1.4.2 <i>Influence on body weight status.</i> | 20 |
| 1.4.3 <i>Other health outcomes of food insecurity.</i> | 25 |
| 1.5 Summary | 27 |
| 2 The Nutritional Status of Women and their Children in Food Insecure New Zealand Households. | 29 |
| 2.1 Introduction..... | 29 |

| | | |
|-------|--|----|
| 2.2 | Methods | 32 |
| 2.2.1 | <i>Questionnaire development</i> | 32 |
| 2.2.2 | <i>Ethical approval and pilot study</i> | 33 |
| 2.2.3 | <i>Dietary data collection</i> | 34 |
| 2.2.4 | <i>Recruitment of households</i> | 35 |
| 2.2.5 | <i>Data analyses</i> | 35 |
| 2.2.6 | <i>Statistical procedures</i> | 37 |
| 2.3 | Results..... | 38 |
| 2.3.1 | <i>Household characteristics and food practices</i> | 38 |
| 2.3.2 | <i>Household experiences of food insufficiency</i> | 40 |
| 2.3.3 | <i>Women's characteristics and food patterns</i> | 41 |
| 2.3.4 | <i>Women's experiences of food insufficiency</i> | 42 |
| 2.3.5 | <i>Nutrition of the women</i> | 42 |
| 2.3.6 | <i>Nutrition of the children</i> | 45 |
| 2.4 | Discussion..... | 51 |
| 2.5 | Conclusions..... | 56 |
| 3 | Development of an Instrument to Assess Aspects of Food Insecurity Among the New Zealand Population and Prevalence Rates of Aspects of Food Insecurity..... | 59 |
| 3.1 | Introduction..... | 59 |
| 3.2 | Methods | 61 |
| 3.2.1 | <i>Examination of the literature</i> | 62 |
| 3.2.2 | <i>Focus groups</i> | 62 |
| 3.2.3 | <i>Refinement of indicator questions/statements</i> | 63 |
| 3.2.4 | <i>Interviewer training</i> | 65 |
| 3.2.5 | <i>Statistical methods</i> | 66 |
| 3.3 | Results..... | 68 |
| 3.4 | Discussion | 72 |

| | | |
|-------|---|-----|
| 4 | The potential of Indices of Food Security Developed to Predict Nutrition Outcomes in the Adult Population. | 77 |
| 4.1 | Introduction..... | 77 |
| 4.2 | Methods | 80 |
| 4.2.1 | <i>Development of a New Zealand Food Security Model.</i> | 81 |
| 4.2.2 | <i>Assigning categories of household food security.</i> | 83 |
| 4.2.3 | <i>Prediction of nutrition outcomes by household food security category.</i> | 85 |
| 4.3 | Results..... | 86 |
| 4.3.1 | <i>Food security indices: ranking and categorization.</i> | 86 |
| 4.4 | Categories of Food Security..... | 92 |
| 4.4.1 | <i>Predictive ability of food security on food choice.</i> | 93 |
| 4.4.2 | <i>Predictive ability of food security on nutrient intake.</i> | 94 |
| 4.4.3 | <i>Food security category in relation to Body Mass Index (BMI).</i> | 96 |
| 4.5 | Discussion | 96 |
| 4.6 | Conclusions..... | 105 |
| 5 | Food Insecurity Among New Zealand’s Children: Prevalence and Association with Nutrition | 107 |
| 5.1 | Introduction..... | 107 |
| 5.2 | Methods | 111 |
| 5.2.1 | <i>Participant recruitment.</i> | 112 |
| 5.2.2 | <i>Dietary intake.</i> | 112 |
| 5.2.3 | <i>Anthropometry.</i> | 113 |
| 5.2.4 | <i>Demographic variables.</i> | 113 |
| 5.2.5 | <i>Food security.</i> | 114 |
| 5.2.6 | <i>Rasch analysis of food security indices.</i> | 114 |
| 5.2.7 | <i>Assigning categories of household food security.</i> | 114 |
| 5.2.8 | <i>Nutrient intake outcomes.</i> | 115 |
| 5.2.9 | <i>Prediction of nutrition outcomes by household food security status.</i> | 115 |
| 5.3 | Results..... | 115 |
| 5.3.1 | <i>Prevalence of food security.</i> | 115 |

| | | |
|-------|---|-----|
| 5.3.2 | <i>Food security of households with children: Rasch analysis</i> | 116 |
| 5.3.3 | <i>Categories of food security</i> | 120 |
| 5.3.4 | <i>Prediction of nutrient intake by level of food security</i> | 120 |
| 5.3.5 | <i>Relationship of primary food security category with Body Mass Index (BMI)</i> | 123 |
| 5.4 | Discussion..... | 123 |
| 5.5 | Conclusion..... | 127 |
| 6 | Overall Summary and Conclusions..... | 128 |
| 6.1 | Recommendations for the future..... | 132 |
| | Appendices..... | 134 |
| | Appendix A: Chapter 2 | |
| 1. | <i>Questionnaire</i> | 134 |
| 2. | <i>Survey Schedule and Consent Form</i> | 146 |
| | Appendix B: Chapter 4 | |
| 1. | <i>Rasch analysis for NNS—Males only</i> | 147 |
| 2. | <i>Rasch analysis for NNS—Females only</i> | 148 |
| | Appendix C: Chapter 5 | |
| 1. | <i>Executive Summary of ‘Final Report of the Public Health Commission on the Perceived Food Inadequacy among Children in Schools’</i> | 149 |
| 2. | <i>Food security among households with children: Data (tabulated and summarised) from the report ‘NZ Food: NZ Children: Key results of the 2002 National Children’s Nutrition Survey’</i> | 153 |
| 3. | <i>Rasch analyses for NNS---participants from households with children</i> | 165 |
| | References..... | 166 |

List of Tables

| | | |
|------------|---|-----|
| Table 2.1 | Age and sex distribution of the forty households. | 39 |
| Table 2.2: | Estimated weekly expenditure on major items (NZ dollars). | 40 |
| Table 2.3 | Body Mass Index (BMI) for women (n=38)..... | 43 |
| Table 2.4 | Usual Median Daily Intakes (SE) of women by food sufficiency status. | 44 |
| Table 2.5 | Prevalence of inadequate intake by food sufficiency status: | 45 |
| Table 2.6 | Mean (SD) daily intake of energy and selected nutrients for children. | 46 |
| Table 3.1: | Percent of households exhibiting different aspects of food insecurity across ethnic groups ¹ | 67 |
| Table 3.2: | Intakes of nutrients which differ by NZDep96 quartile within the New Zealand population. | 72 |
| Table 4.1: | Summary of Rasch analysis statistics for 1868 households. | 87 |
| Table 4.2: | Summary of Rasch analysis statistics for eight measured indices. | 88 |
| Table 4.3: | Indices of food security presented in measure order ie from least to most severe food insecurity..... | 88 |
| Table 4.4: | Rasch Model performance statistics comparing the assessment of household food security reported by males and females. | 92 |
| Table 4.5: | OR's (CI) for likelihood of meeting a food guideline by category of food security status, for the household. | 93 |
| Table 4.6: | Adults energy and nutrient intakes by category of household food security. | 95 |
| Table 5.1: | Summary of Rasch analyses statistics from 1561participants. | 117 |
| Table 5.2: | Summary of Rasch analyses statistics for eight food security indices..... | 117 |
| Table 5.3: | Indices of food security presented in measure order i.e. from least to most severe food insecurity. | 118 |
| Table 5.4: | Children's Energy and nutrient intakes by primary category of household food security..... | 121 |
| Table 5.5: | Children's Energy and nutrient intakes by secondary category of household food security..... | 122 |

List of Figures

| | | |
|-------------|---|-----|
| Figure 2.1: | Weight for age of all males. | 47 |
| Figure 2.2: | Stature for age of all males. | 48 |
| Figure 2.3: | Weight for age of all females. | 49 |
| Figure 2.4: | Stature for age of all females. | 50 |
| Figure 3.1: | Aspects of food insecurity by age for males in the NZ population..... | 69 |
| Figure 3.2: | Aspects of food insecurity by age for females in the NZ population. | 70 |
| Figure 3.3: | ‘Food runs out in my/our household due to lack of money’ by Quartile of NZDep96 for NZ European and Others, females and males ⁺ | 71 |
| Figure 4.1: | Ranking of households and indices on food security scale, by level of severity. | 90 |
| Figure 5.1: | Rasch analysis for Children’s Nutrition Survey (CNS02)..... | 119 |

List of Abbreviations

| | |
|-------------------|---|
| ANOVA | Analysis of Variance |
| BMI | Body Mass Index |
| BRFSS | Behavioral Risk Factor Surveillance System |
| CCHIP | Community Childhood Hunger Identification Project |
| CDC | US Centre for Disease Control |
| CNS02 | Children's Nutrition Survey, 2002 |
| CSFII | US Continuing Survey of Food Intake of Individuals |
| CPS | Current Population Survey |
| CSFM | Core Food Security Measure, Module or Model (All terms are used in the literature.) |
| C-SNAP | Children's Sentinel Nutrition Assessment Project |
| EARs | Estimated Average Requirements |
| ELSI | Economic Living Standard Index |
| FAO | Food and Agriculture Organisation |
| FNS | Food and Nutrition Service, US Department of Agriculture |
| FFQ | Food Frequency Questionnaire |
| HRQOL | Health-related quality of life |
| HEI | Healthy Eating Index |
| HFSS | Household Food Security Scale. |
| LINZ [®] | Life in New Zealand Activity & Health Research Unit, University of Otago, Dunedin, New Zealand. |
| LSRO | Life Sciences Research Office, Federation of American Societies for Experimental Biology |
| MNSQ | Mean Square Residuals |
| MUS Fat | Mono-unsaturated Fat |
| NCHS | National Centre for health Statistics of the Centres for Disease Control and Prevention |
| NHANES III | National Health and Nutrition Examination Survey |
| NNS97 | National Nutrition Survey, 1997 |
| NNSTAC | National Nutrition Survey Technical Advisory Committee |
| NPHS | National Population Health Survey |
| NZ | New Zealand |
| NZDep01 | New Zealand Index of Deprivation, 2001 |
| NZDep96 | New Zealand Index of Deprivation, 1996 |
| NZEO | New Zealand European and Others |
| NZFCD | New Zealand Food Composition Database |
| PUS Fat | Poly-unsaturated Fat |
| QFFQ | Qualitative Food Frequency Questionnaire |
| RDA | Recommended Dietary Allowance |
| RNI | Reference Nutrient Intake |
| SES | socio-economic status |
| USDA | US Department of Agriculture |
| UK | United Kingdom |
| US | United States of America |
| WIC | 'Women's, Infant's and Children's-WIC' programme |

Relevant Publications

Parnell WR (1997). Socio-economic disadvantage and nutritional status in New Zealand. *Poverty and Food in Welfare Societies*. Kohler B M, Feichtinger E, Barlosius E and Dowler E. Berlin, Sigma.

Parnell WR, Reid J, Wilson NC, McKenzie J & Russell DG (2001). Food security: is New Zealand a land of plenty? *NZ Med J* 114(1128): 141-5.

Aims

1. To describe the experience of food insecurity in low-income New Zealand households (low-income households); to develop an appropriate (robust) method of determining dietary intake of members of those households.
2. To develop and utilize indices of household food security which adequately capture the aspects of food insecurity experienced in New Zealand and so determine the prevalence of these aspects of food insecurity among the adult New Zealand population.
3. To determine whether the indices of household food insecurity applied to the New Zealand population can be ranked in order of severity and further whether categories of food insecurity will predict food and nutrient intakes and body weight status among the adult New Zealand population.
4. To further explore the potential of categories of household food insecurity to predict the nutrient intake and body weight status of New Zealand children.

1 Current Knowledge of Food Security in Developed Countries

1.1 What is Food Security?

The contemporary definition of food security accepted and used for over a decade by nutritionists in developed countries is that 'food security is assured access to nutritionally adequate and safe foods'. Conversely food insecurity exists when the availability of nutritionally adequate and safe foods or the ability to acquire such foods in socially acceptable ways is limited or uncertain (LSRO, 1990).

The origins of the term food security (or its converse food insecurity) came from non-industrialised or developing countries (Radimer, 2002), where the adequate food supply for a region or country (their food security) was under threat. The underlying causes of food insecurity could be political or climatic or a combination of these factors. Radimer reports that the awareness of hunger amidst affluence became an issue of public debate in the United States (US) in the 1980's (Radimer, 2002). In the US food production was adequate to feed the entire population with excess to export, but sectors of the population were manifestly not well fed. Definitions of hunger were proposed and debated. While it began to be recognized that there was a social underpinning to this 'hunger', evidence of its existence was often denied unless physical outcomes such as growth failure could be observed.

From qualitative work detailing the plight of women experiencing hunger, Radimer classified four dimensions of their responses to the condition of 'hunger': qualitative, quantitative, social and psychological. The women were members of households and their responses to hunger were both personal (eg their feelings, perceptions and

adaptions) and included strategies for adaption to the situation within their household (eg reductions in meal size or frequency) (Radimer, Olson *et al.*, 1992).

Radimer's work was seminal in the recognition that the experience of 'hunger' in a developed country was multifaceted and that financial constraints lay at the heart of the problem. The evidence for the unequivocal relationship between poverty and hunger has been repeatedly demonstrated in the US (Hamilton, Cook *et al.*, 1997) and United Kingdom (Dowler, 2001). While the use of the term 'hunger' lingered for some time, throughout the 1990's the term food security (or its converse food insecurity) gained credence as a recognizable descriptive term for a specific phenomenon. At the heart of this phenomenon (construct) is the acknowledgement that it is the subjective 'experience' of the person which is reported. In other words no outside observer can feel, or describe or report on the feelings engendered by or responses made to 'hunger'. External observations can be made of particular practices of those assumed to be hungry, for example, the frequency of sourcing food from charitable organizations (Vozoris & Tarasuk, 2003). Such external observations while they have been used as a surrogate for food insecurity, vastly underestimate the effects of the experience on an individual or household. They are evidence of last resort actions but the negative effects commenced long before food is sourced by means alternative to the usual practices within a population.

The manifestations of food insecurity can be categorized under the dimensions first described by Radimer, although no individual or household will necessarily experience all of the dimensions.

1.1.1 The qualitative dimension.

Dissatisfaction with the quality of food might vary with cultural background and expectations. In many developed countries fresh food is considered superior (Foltz-Gray, 1999) yet in others a canned item might be considered of higher quality either because no fresh counterpart is available or a long life imported item has prestige value (Harding, Russell *et al.*, 1986). Nevertheless, Dowler (Dowler & Dobson, 1997) argues that dietary aspirations are shared across all socio-economic groups within countries, so that dissatisfaction with food quality must have some real cause. This is likely to be an economic constraint. She cites in support of this view, numerous studies where the restriction of variety of foods consumed and lower consumption of the food items which health professionals would promote, is greatest among poorest households (Dowler & Dobson, 1997).

1.1.2 Quantitative dimension.

This dimension of food insecurity is consistently documented by households with financial constraints often on a periodic basis related to income fluctuations (McIntyre, Glanville *et al.*, 2003). When the amount of household food is constrained it is not necessarily all of the members who adjust their intake by reducing meal frequency, portion sizes or even missing meals. Consistent evidence demonstrates that women preferentially adjust their intakes and only in more extreme circumstances are their children affected (McIntyre, Glanville *et al.*, 2003; Rose, 1999).

1.1.3 Social dimension.

This dimension encompasses the sourcing of food. When the ability to purchase food from conventional food outlets is lacking, alternative sources are approached: friends,

relatives, charitable organizations such as food banks and in extreme circumstance, resorting to foraging or stealing (Booth & Smith, 2001).

1.1.4 Psychological dimension.

Household food provisioning is more often the prerogative of women and their anxiety about feeding their household can be constant or periodic (McIntyre, Glanville *et al.*, 2003; Radimer, Olson *et al.*, 1992). This anxiety can extend to the lack of ability to provide food for social occasions and celebrations, situations where participation in society around them is impaired (Dowler & Dobson, 1997). In some societies men in households can equally experience this stress (Parnell, Reid *et al.*, 2001).

Feichtinger (Feichtinger, 1997), endorses the definition of food security made in the US (LSRO, 1990) (based on the dimensions described by Radimer) and she further extends the social dimension. Influenced by Townsend's work on material and social deprivation (Townsend, Phillimore *et al.*, 1988) she defines social food deprivation as that which 'entails food and foodways which are not congruent with the socially and culturally approved foodways of a society and which therefore exclude from participation in social life as far as roles, relationships, customs, functions, rights or responsibilities are expressed by food and foodways. Social food deprivation also includes a lack of food entitlements caused by societal rules'.

Thus going beyond Radimer's thesis that food insecurity may be experienced both at an individual and at a household level, it might also be experienced at a societal level. As a result of food insecurity some will not participate fully in society. The converse is also true: namely that government policies and legislation, and the economy, can

impinge on food security status within a society. Societal norms, customs and status assignment Feichtinger believes will be shaped by food insecurity (Feichtinger, 1997).

1.2 How can food security be measured?

The US government, prompted initially by the Report of the President's Task Force on Food Assistance in 1984 (President's-Task-Force-on-Food-Assistance, 1984), accepted that food insecurity was an issue for developed countries and starting in 1992, took a team approach to develop 'a comprehensive benchmark measure' in order to document both the prevalence and severity of food insecurity in the population (Carlson, Andrews *et al.*, 1999). A detailed description of this process is provided in Hamilton *et al.*'s report 'Household Food Security in the United States in 1985: Technical Report of the Food Security Measurement Project' (Hamilton, Cook *et al.*, 1997).

The process which this vast interagency group undertook, under the leadership of the Food and Nutrition Service (FNS) of the US Department of Agriculture (USDA), is rigorous and specific. It has produced a measurement construct for the US. Although not intended as a universal scale, the construct has subsequently been used in Canada (Tarasuk & Beaton, 1999), and a modified shorter version prepared by Blumberg (Blumberg, Bialostosky *et al.*, 1999) used in the UK (Tingay, Tan *et al.*, 2003) and in Trinidad and Tobago (Gulliford, Mahabir *et al.*, 2003). It has recently been adapted for use in Brazil and the adapted version considered a valid instrument to assess and monitor national food security status (Perez-Escamilla, Segall-Correa *et al.*, 2004). Before exploring the issue of whether the US 'measure' should be used in other countries, it is important to describe the development process and principles used in the US project as these may be applicable to other settings (Wolfe & Frongillo, 2001).

The US project was informed by prior work (Carlson, Andrews *et al.*, 1999). The work of Radimer and colleagues (described earlier) at Cornell had led to the development of food security scales at household and individual level—work which began with detailed qualitative analysis of the self-reported experience of food insecurity. Also the Community Childhood Hunger Identification Project (CCHIP) had developed and validated an instrument to measure hunger among children of low income families (Carlson, Andrews *et al.*, 1999).

Further to this there was evidence to support the view that food insecurity might be manifest in a ‘graded way’ that is, have levels of severity. Carlson describes support for this in the Life Sciences Research Office (LSRO) report (LSRO, 1990) and by the work of Basiotis and Bickel (Carlson, Andrews *et al.*, 1999).

The view adopted in the US, was that the experience of food insecurity is ‘a sequence of stages reflecting increasingly severe deprivation of basic food needs and characterized by a managed process of decision making and behaviour in response to increasingly constrained household resources’ (Carlson, Andrews *et al.*, 1999).

Although food insecurity was recognized as having many dimensions it was believed to be able to be measured on a unidimensional scale. Starting with a conference convened by the FNS of the USDA and the National Centre for Health Statistics (NCHS) of the Centres for Disease Control and Prevention, a set of indicator items was developed to assess food security at all levels of severity, specific for US conditions. Carlson *et al.* describe in detail the trial of these indicator items on a

nationally representative sample of households, as part of the Current Population Survey (CPS) (Carlson, Andrews *et al.*, 1999). Subsequently, the FNS contracted to Abt Associates, Inc. the task of developing a statistical measurement model. This group first ascertained that most of the indicator items did fit a unidimensional measurement scale. Following this they applied the Rasch scaling model, which takes into account the intervals between items as well as their order. The 18-scale indicator items of aspects of food insecurity were now able to be 'ordered' by severity. All of the indicator items refer to household experiences of food insecurity over the previous twelve months and are specifically the outcome of inadequate financial resources (Hamilton, Cook *et al.*, 1997).

Given the will to ascertain and monitor the prevalence of food insecurity within the US population, further work was undertaken on the 18-item scale and four categorical variables developed to classify households:

- food secure;
- food insecure but hunger not evident;
- food insecure with moderate hunger;
- food insecure with severe hunger (Hamilton, Cook *et al.*, 1997).

The categorical variables provide a useful means to examine nutrition or health outcomes at varying levels of 'severity' of food insecurity (Tarasuk & Beaton, 1999; Vozoris & Tarasuk, 2003).

Frongillo provides a full description of the evidence that the Core Food Security Measure (CSFM) developed for the US does indeed provide a 'valid' assessment of

the phenomenon, both for use in a population and at the individual level (Frongillo, 1999). Beginning with a 'well-grounded construction' (in this case the extensive qualitative work of Radimer and the research team of the CCHIP), Frongillo goes on to describe the performance of the measures or indices. The US measures have demonstrated within populations that the concept of severity is reflected in the sequence of responses; that when exposed to cognitive testing, respondents understand the questions posed and can answer meaningfully. Because a subset of the measures have been trialled in five different surveys, it has also been possible to observe consistent patterns of response across different sub-population groups.

Precision (the extent to which repeated measures yield the same value), has been demonstrated. Evidence that the measures 'provide unbiased assessment of the phenomena' comes from several sources. Working independently, different researchers have personally interviewed respondents and have reached consensus in categorizing households. Additionally, household status categorized by the 'US National Food Security Measurement Index' has been associated with both determinants (eg income, education) and consequences (health outcomes) in the expected directions.

Derrickson and colleagues (Derrickson, Fisher *et al.*, 2000) extended the testing process of the Core Food Security Measure by testing to see whether it was valid and reliable in Hawaii. The US State is ethnically varied (50% of Asian or Pacific Island descent). They concluded that overall the measure was a good fit for ascertaining food security status in this US State but was less robust for the Samoan sub-sample.

They highlighted the poor fit of three questions on the scale and suggested a rewording of one.

It is important to understand that indices developed for use in the US are specific for that environment but the process of their development can be a model for other countries. Frongillo (Frongillo, Chowdhury *et al.*, 2003) has worked with a research team in Bangladesh to initiate the process of developing a valid local household food security index. The prevalence and experience of food insecurity in this developing country is much higher and volatile than in a developed country. Nevertheless, the research team wished to 'construct a direct measure of food insecurity, based on people's experience gained through in-depth qualitative investigation in a locality in which the measure is to be used'. From their qualitative investigation, nine themes emerged and four grades of food insecurity. The themes were consistent with those from the US experience and also with those from Quebec and the final set of 11 questions deemed to be 'well grounded' although validity has not yet been fully established (Frongillo, Chowdhury *et al.*, 2003).

Blumberg and co-workers (Blumberg, Bialostosky *et al.*, 1999) prepared a short form (6 questions) of the US Household Food Security Scale which classifies households reliably in the same way as the full 18-question scale, provided the prevalence of food insecurity in the population under examination is similar to the prevalence in the derivative population used by the CPS.

The shortened scale was used in the UK to assess the prevalence of household food security among patients attending general practices in the low-income area of a UK

city. The use of the questionnaire in this setting may not be appropriate as it assumes that the experiences of food insecurity in the UK will be manifest in the same way as they would be in the US and also the apparent prevalence of food insecurity in the UK was higher than among households in the US population from which the original scale was derived.

Tarasuk and Beaton (Tarasuk & Beaton, 1999) describe the use of the full US Food Security Scale in Canada, subject to some modification including removal of one question. Given the cultural similarities between Canada and the US, the demonstrated ability of the scale to discriminate between households experiencing food insecurity with and without hunger and further for women in these categories of households to show differences in energy and nutrient intake, it can be concluded that the US scale has been appropriately used. Interestingly, McIntyre and co-workers (McIntyre, Glanville *et al.*, 2002) used a forerunner to the US scale—the Cornell/Radimer Questionnaire to estimate prevalence of hunger and food insecurity in their group of low-income lone mothers and their children in Atlantic Canada.

In South Africa intensive qualitative interviews conducted with black South African families, exploring their food security status, lay a foundation for defining an instrument to assess the prevalence of food security among the black population (Lemke, Vorster *et al.*, 2003). Clearly this population has a vastly different social structure to the US and reports very different coping strategies. A unique measurement instrument grounded in their own experiences of food insecurity is required.

In Australia no multi-dimensional measurement index has been developed yet, but in 1995 their national nutrition survey included one single item question for adults: ‘in the last 12 months were there any times that you ran out of food and couldn’t afford to buy more?’ This question is similar to one in the 18 item US measure, and while Booth et al. (Booth & Smith, 2001) consider that it is an indicator of risk of food insecurity, responses to it are not a true measure of the prevalence of food insecurity, by currently accepted definitions of the phenomenon.

In Europe and in particular in the UK, the definitions of food security coined in the US have been accepted. However, effort has not been expended in developing valid measures of food security for population prevalence purposes. Rather the focus has been on measurement of poverty and of consequent inequalities in health. There has long been recognition that food and nutrition (or lack of it), contribute to the demonstrable differentials in health status across socio-economic groups (Davey-Smith & Brunner, 1997; Dowler & Dobson, 1997).

Dowler does state that ‘nutrition surveillance systems need to be structured so that conditions and outcomes in households at risk of poverty, and inequality can be measured and monitored (Dowler, 2001). The lack of a robust instrument for assessing food insecurity in the UK was no doubt the reason that Tingay et al. (Tingay, Tan *et al.*, 2003) used a US based instrument to assess food insecurity, regardless of its appropriateness to low-income UK residents experiencing ill-health.

The major reason for the lack of effort in devising a food security measurement index in the UK is likely to be that the socio-economic indicators (income, employment

status, social class designation) have been found to effectively predict nutritional status (Dowler & Dobson, 1997). This contrasts with the US experience where as noted by Murphy (Murphy & Bayer, 1997) 'National nutrition surveys in the US do not see large differences in dietary quality across income categories'. Also the buffer of US food assistance programmes is credited with mitigating the effects of poverty on nutrition outcomes.

In New Zealand (NZ) the development of a measurement tool for food security was begun by Reid (Reid, 1997), who conducted focus groups with low-income people in order to document and describe their experiences of food insecurity. This process identified the key themes of the experiences of the NZ food insecure. Subsequently, from these themes, eight 'indicators' of aspects of food insecurity were selected and then used in the National Nutrition Survey (NNS97) (Russell, Parnell *et al.*, 1999). When the indices were piloted prior to the survey, it was deemed necessary to present survey respondents with first an explanation of the underlying condition (not enough or not the desired quality of food, because of lack of money), and secondly statements about the experience of food insecurity with which they could agree or disagree that they applied to their household. A direct questioning approach met with refusal to answer by many New Zealanders (Parnell, Reid *et al.*, 2001). The ability of these indices to predict both degree of food insecurity and food and nutrition outcomes is under investigation in this thesis. Evidence for the validity of this group of indices is accumulating. They have a well grounded construction and some evidence of their accuracy comes from the fact that the individual index eg 'food runs out in my/our household due to lack of money' correlates in an expected way with the determinant deprivation index, NZDep96 (Parnell, Reid *et al.*, 2001).

1.3 Prevalence of food insecurity

Provided that a validated measurement tool has been developed, within-population estimates of the prevalence of food security are clearly possible. This has been demonstrated in the US. As Carlson, 1999 (Carlson, Andrews *et al.*, 1999) explains, the US government asked that ‘a comprehensive national measure of food insecurity and hunger’ be developed for the United States. This has been achieved and from the 1995 CPS data set, the following prevalence rates have been reported: 88.1% of households were food secure; 7.8% food insecure without hunger; 3.3% with moderate hunger; 0.8% with severe hunger. Only three-quarters of Black and Hispanic households were food secure compared to 90% of White households. The prevalence of food insecurity at all levels of severity was greatest among those living in central city metropolitan areas and those with the lowest income to poverty ratio^a (Carlson, Andrews *et al.*, 1999).

The prevalence rates quoted above have been ascertained on the proportion of the population which passed a screening test (an income and food security screener). This procedure assumes that since food security is primarily a consequence of ‘lack of money’, that food insecurity prevalence would be negligible above a certain income level. However, some aspects of food security, in particular the issues of accessibility of food and of culturally acceptable food, might be experienced by those above the ‘income screening level’. Thus the prevalence of food insecurity described above for the US underestimates true population prevalence.

Prevalence rates of food insecurity for sub-populations within the US have been determined using truncated indices of the official ‘US measurement model’. Adams

et al. (Adams, Grummer-Strawn *et al.*, 2003), used four questions from the US household food security model, to determine food insecurity among Californian women although the primary purpose of their study was to relate food insecurity to rates of obesity. They determined prevalence rates among the households of this group of women as follows: 13.9% food insecure without hunger; 4.3% food insecure with hunger. Despite the use of the truncated index, the prevalence rates for food insecurity with hunger are similar to those reported for households nationally, three years earlier (Adams, Grummer-Strawn *et al.*, 2003).

The number of questions within the US measurement model (18 for households with children and 10 for households without children), although they are believed to take four minutes to deliver, may contribute to respondent burden when the module is used within wider surveys. Blumberg and co-workers developed a short form Household Food Security Scale (6 questions) to counteract this (Blumberg, Bialostosky *et al.*, 1999). It has been used to assess the prevalence of food insecurity outside the US in Trinidad-Tobago (Gulliford, Mahabir *et al.*, 2003). The prevalence of food security in that 'relatively affluent' country was estimated as one-quarter of households. The authors believe this to be an underestimate, given that the study population included an over-representation of higher income groups. Frongillo questions these prevalence estimates (Frongillo, 2003), noting that the US derived measure was not validated for Trinidad-Tobago. He believes that 'cultural differences in perception and recording of food insecurity' lead to invalid data and that without a locally derived instrument the prevalence of food security cannot be determined. Prevalence estimates rely on the quality and 'local validity' of the instrument used to assess food security.

Several developed countries (including New Zealand) have used either short unvalidated or partially validated measurement indices to assess population prevalence of food insecurity or they have used proxy indicators. In Finland, Sarlio-Lahteenkorva and Lahelma (Sarlio-Lahteenkorva & Lahelma, 2001) report the use of a 'five question un-validated index' covering 'fears and experiences of food insecurity, during the past 12 months' due to economic problems. It was taken from a Canadian (Edmonton) Food Policy Council's Survey. They acknowledge that this measurement index has not been validated for use in Finland, but present the following prevalence estimates: 'buying cheaper food' due to economic problems was experienced by one-quarter of the population ('working' adults 25-64 years); 9% were afraid of running out of food; 11% experienced running out of money to buy food; 3% had too little food due to lack of money; and 2% reported having been without food for at least a day due to economic problems. Almost 3% (2.7%) replied affirmatively to at least four of the five questions posed and were considered the most food insecure group.

In New Zealand (Parnell, Reid *et al.*, 2001), an eight statement measurement tool was used in the 1997 National Nutrition Survey and the following household prevalence for males and females respectively, were reported: between 24 and 29% of households 'limited the variety of food they were able to eat due to lack of money', between 11 and 14% ate less because of lack of money, and between 2 and 6% had to access food banks/grants, ie use charitable means when they did not have enough money for food. Female as opposed to male members consistently reported higher prevalence of aspects of food insecurity in their household. This is the only reported national prevalence data set where an entire adult population was surveyed (no prior

screening) and where the different perspectives of males and females are given for their households.

Canada does not have a national monitoring system for food insecurity. A proxy measure of 'food insufficiency' was included in their National Population Health Survey (NPHS). Three questions were prepared, pertaining to the previous 12 months. If a respondent affirmed that their household had run out of food, they were further asked if household members had accessed food by charitable means and whether having enough food to eat was experienced always, sometimes or often. It was estimated that 3.9% of households were food insufficient and the remainder food sufficient, based on the 1996/1997 data set (Vozoris & Tarasuk, 2003).

Che and Chen (Che & Chen, 2001) used the 1998/1999 NPHS data set. Respondents were asked 'did anyone in your household: worry that there would not be enough to eat because of a lack of money?; not eat the quality or variety of foods that you wanted because of a lack of money?; not have enough food to eat because of a lack of money?' Ten percent of Canadians answered affirmatively to one or more of these questions; eight percent fell in the group who had experienced compromised quality or quantity.

Australian data on the prevalence of food security are also limited. Their 1995 National Nutrition Survey used a proxy measure, asking respondents 'in the last 12 months were there any times that you ran out of food and couldn't afford to buy any more?'. Just over five percent (5.2%) of adults over 19 years affirmed that this was the case (Australian-Bureau-of-Statistics, 1997b). The rate was higher among the

unemployed (11.3%). Rychetnik and co-workers believe that the true prevalence of food insecurity in Australia is underestimated because only 'one dimension' was assessed in their national survey, and also because such national surveys usually under-represent the most disadvantaged and vulnerable members of the population (Rychetnik, Webb *et al.*, 2003).

1.4 Food insecurity indices as predictors of nutritional outcomes

Food insecurity has been directly linked both to health consequences, including obesity and to impaired food and nutrient intakes. Health consequences may well be 'mediated' through changes in nutrient intake (Rose, 1999).

1.4.1 Influence on food and nutrient intake.

The evidence for the negative effect of food insecurity on food and consequently nutrient intake has accumulated and includes evidence from smaller studies of 'food insecure' groups and from national data sets. Kendall *et al.* (Kendall, Olson *et al.*, 1996) using the Radimer/Cornell index of food insecurity presented data from 193 rural US women living in households with children. Food and nutrient intake was assessed by qualitative food frequency questionnaire and two 24-hour diet recalls. The frequency of consumption of fruits, salads and vegetables declined along with food insecurity status. The food insecure consumed significantly less vitamin C and less desirable (although not statistically significant) levels of fat, calcium, iron, and fibre. The authors concluded that both food secure and food insecure groups within this rural sample consumed relatively poor quality diets. A study of a similar nature was carried out in Britain by Dowler and Calvert in 1993 (Dowler & Calvert, 1995), who explored the experience of 'food insecurity' among lone parent households. The women in these households who were claiming 'income support' compared with non-

claimants, had lower intakes of iron, folate, vitamin E, vitamin C and non-starch polysaccharides. In the group claiming income support, absolute intakes and mean intakes less than Reference Nutrient Intake Levels (RNI's) for iron, folate, vitamins A and C were of some concern, with iron intakes of particularly inadequate levels. This differential was not found among children in these households.

Tarasuk and Beaton (Tarasuk & Beaton, 1999), linked level of severity of food insecurity (assessed using the US Food Security Module) with nutrient intake among a sample of 153 Canadian women receiving emergency food assistance. They reported that this group of women had high prevalence of inadequate intakes of iron, magnesium, vitamin A and folate. Also when the group was separated into two (those reporting hunger vs those reporting no hunger over the past 30 days), the more severely constrained group had lower intakes of energy, protein, vitamin A, vitamin C, folate, calcium, iron, zinc, and magnesium. The authors presented the view that the low energy intakes which the women report were a reflection of 'actual food deprivation in the context of scarce household resources'.

Gulliford et al. (Gulliford, Mahabir *et al.*, 2003), used the short form of the US Household Food Security Scale (HFSS) and a qualitative food frequency questionnaire, with a sample of 531 adults in Trinidad and Tobago. Food insecure subjects chose fruit, and green vegetables and salads less frequently than the food secure. Using the same HFSS, Tingay and co-workers (Tingay, Tan *et al.*, 2003) reported that among a sample of patients attending inner London general practices, the food insecure were less likely to report eating fruit and vegetables or salads on a daily basis.

Despite some difficulties with the collection of dietary data, McIntyre et al. (McIntyre, Glanville *et al.*, 2002) examined the nutrition of low-income lone mothers and their children in Atlantic Canada. Over three-quarters of the group were deemed to be food insecure (using the Radimer/Cornell index). Similar to the findings of Tarasuk and Beaton (Tarasuk & Beaton, 1999), the authors reported that women had low energy intakes and that this reflected their actual intake. The highest prevalence of inadequate intake of nutrients was reported for folate (97%), vitamin C (63%), vitamin B6 and iron (42%), zinc (39%) and vitamin A (33%). Given that the children's diets in this sample were generally more than adequate, these authors conclude that 'mothers put their children's needs first'.

The earliest report of a relationship between food security status and food and nutrient intake at a national level, came from Cristofar and Basiotis (Cristofar & Basiotis, 1992) who reported on 1985-1986 data from the US Continuing Survey of Food Intake of Individuals (CSFII). Both food and nutrient intakes of women were affected negatively by level of reported food insufficiency. There was no similar clear relationship with children in this study. Similar results for the 1989-91 CSFII were reported by Rose and Oliveira (Rose & Oliveira, 1997). In their analysis they controlled for potentially confounding variables such as age, ethnicity and education. Using the definition of low intake as <50% of an individual's RDA, they found among food insufficient adult women, low intakes of energy and nutrients. This was also true among the elderly of both sexes, but not for pre-school children.

Rose (Rose, 1999), cautions that in cross sectional data sets, particularly national data sets, some underestimation of the effects of food insecurity on food and nutrient intakes occur. This is because food insecurity and hunger usually occur periodically in developed countries. Also it is difficult, as has already been noted, to recruit into such studies the subjects in the poorest economic circumstances who are most likely to be food insecure. Further, in national data sets, where household food insecurity is determined and then the intake of an individual within that household related to this status, it is not necessarily known how remaining household members are affected. Rose and Oliveira did examine this issue for the CSFII 1989-1991 data set (where intake data on all household members was available) and noted that overall mean household intakes were significantly lower for the households which were deemed food insufficient by one member, usually a woman. There are no studies reported where 'food insecurity' measures rather than food insufficiency are used which explore this issue for all members of households, at a national level.

1.4.2 Influence on body weight status.

Food insecurity has a paradoxical association with overweight status among women; a higher prevalence of overweight is frequently seen among the food insecure, in both small and large studies. The recognition of the association between poverty and overweight preceded the observation that poor families were more likely to be food insecure and might also have a disproportionate number of overweight members (Bayer & Murphy, 1997).

Tarasuk and Beaton (Tarasuk & Beaton, 1999) not only noted the high rate of obesity (49%) in their sample of Canadian women receiving emergency food assistance, but further explored this in relation to their (low) reported energy intakes (from 3-day

food records). The energy intake: basal energy expenditure ratio (EI/BMR_{rest}) fell below lower cut-off values for 55% of these women—and women in the most food insecure group of these households were twice as likely to have this ratio below the cut-off value. The most food insecure were the most obese and also reported the lowest energy intakes. Olson (Olson, 1999) reviewed the US literature for evidence that food insecurity (measured by proxy) might be related to weight status among women. She noted the studies where overweight was associated with low income, in particular Jeffery and French's study (Jeffery & French, 1996). This study focused on women's weight control practices and concluded that economic deprivation contributed to high rates of obesity over and above other dietary and behavioural factors. Olson (Olson, 1999) then presented data from the study of 193 upstate New York women—examining in detail the relationship between BMI and food security status. The group of women deemed moderately food insecure had significantly higher BMI's (2 units heavier than the food secure), after controlling for income, education level, single parent and employment status. However the most severely food insecure did not have higher BMI's than the food secure or moderately food insecure women.

Gulliford et al. (Gulliford, Mahabir *et al.*, 2003) in Trinidad and Tobago, explored the relationship between body weight status (BMI) and food insecurity (using the US short form HFSS). Underweight was defined as BMI <20kg/m², overweight as BMI 25-29kg/m² and obesity as BMI ≥30kg/m². After controlling for age, sex and ethnicity (but not income), the risk of being underweight among the food insecure was determined to be threefold (RR 3.21, CI 1.17-8.81). There was no association found between food insecurity and overweight or obesity, in this 'middle-income' country.

There is likely to be a point where a very constrained food intake promotes weight loss, and some evidence for this is provided by the studies cited above in Trinidad and Tobago and upstate New York.

Townsend et al. (Townsend, Peerson *et al.*, 2001) further explored the paradox of the relationship between food insecurity and overweight among women in the 1994-96 Continuing Survey of Food Intake of Individuals (CSFII) US national dataset. Overweight (BMI > 27.3kg/m²) prevalence among the food secure (34%) increased to 41% among the mildly food insecure and 52% for the moderately food insecure. There was no parallel trend among men. Furthermore, the relationship between severity of food security and weight status among women remained significant after adjusting for income, ethnicity, occupation, household size, exercise patterns and television/video watching. There was a very small number of very food insecure women in this sample (11/4537), who had a prevalence of overweight of only 20%, but they noted that the data of this small group should be interpreted with care, as over-riding health issues (not documented in the study protocol) could have influenced their nutrition.

The nature of food restriction among the mild and moderately food insecure is speculative. Townsend et al. noted that there was a high prevalence of overweight among 'food stamp recipients'. They proposed that acquisition of food might be cyclical; that is abundance of food supply and overeating could characterize the beginning of the cycle, followed by a period of lack of sufficient quantity of food prior to the distribution of the next supply of food stamps (Townsend, Peerson *et al.*,

2001). This cyclical nature to food acquisition might equally apply to other cultures or situations where access to food is dependent on income cycles from benefits or where income levels are too low to cover household needs ‘constantly’.

Vozoris and Tarasuk (Vozoris & Tarasuk, 2003) examined Canadian population data (1996/1997 NPHS) to determine whether household food insufficiency was associated with poorer health including body weight status. After adjusting for age, education and income adequacy, men in food insufficient households were found to be less likely to be overweight. This finding is in contrast to the US data reported by Townsend et al. (Townsend, Peerson *et al.*, 2001)—but it should be noted that the dependent variable was ‘food insufficiency’. While the construct of food insecurity was used by Townsend et al., they did not use the full Core Food Security Measure (CSFM) but selected only four questions from within it as proxy indices for food security.

The relationship between body mass index (BMI) and food security was examined in a national sample of Finnish adults (25-64 years) (Sarlio-Lahteenkorva & Lahelma, 2001). Food insecurity was determined by a positive response to four out of five of the components on their food security scale (taken from Canada) and BMI categories were designated: Thin (BMI < 20kg/m²), normal (BMI 20-24.9kg/m²), overweight (BMI 25-29.9kg/m²) and obese (BMI ≥ 30kg/m²). Controlling for age, educational attainment and sex, it was determined that both thinness and obesity were associated with food insecurity and the association was stronger among the thin group.

Laraia et al. (2004), explored the relationship between ‘concern about enough food’ and obesity in two US States: New York and Louisiana. They analysed data from the Behavioral Risk Factor Surveillance System (BRFSS) using the 1999 data set. The weight status categories differed from those usually used and were defined as: underweight ($\leq 18.4\text{kg/m}^2$), normal ($18.5\text{-}24.9\text{kg/m}^2$), overweight ($25\text{-}29.9\text{kg/m}^2$); obese ($30\text{-}34.9\text{kg/m}^2$) and morbidly obese ($\geq 35.0\text{kg/m}^2$). Although the prevalence of ‘concern about enough food’ was positively associated with morbid obesity in both States the association was non-significant after controlling for education, income, race/ethnicity, marital status and general health. The major limitations of this study were the nature of the data, in particular the self-reporting of height and weight, the lack of information on household numbers, and the relatively non-specific measure of food security.

Kaiser and co-workers examined the relationship between both food insufficiency and food security, and obesity in low-income Latino women in California. Controlling for length of residence in the US, income and parity, food insecurity (at the level of hunger) was related to obesity. Current food insufficiency was not related to obesity although prior severe past food insufficiency was related to obesity in the sub-group born in the US (Kaiser, Townsend *et al.*, 2004).

To date no national survey has explored the relationship between food security status and body weight status, using both a validated measure of food security and direct measures of height and weight. The studies reported strongly suggest that among women in particular there is a relationship but the hypothesis requires more rigorous testing.

Drewnowski and Specter (Drewnowski & Specter, 2004) have conducted a rigorous review of the literature in the area of poverty and obesity, exploring links with energy density and energy costs. They present the thesis that ‘limited economic resources may shift dietary choices towards an energy-dense, highly palatable diet that promotes maximum calories per the least volume and the least cost’. This is the dietary pattern which has been associated with obesity. The moderately food insecure (experiencing this condition because of economic constraints) might therefore be expected to gain weight by means of obesogenic food choices. Nonetheless, the severely food insecure might be expected by virtue of not just unhealthy choices, but also insufficient food quantity to be unable to meet their energy requirements and thus to tend to underweight.

1.4.3 Other health outcomes of food insecurity.

Campbell (Campbell, 1991) raised awareness of the issue that food insecurity can affect health and quality of life either directly or indirectly through nutritional status. She distinguished between the effects of poverty and low socio-economic status on health outcomes, acknowledging that food security status is likely to interact with socio-economic factors.

Vozoris and Tarasuk (Vozoris & Tarasuk, 2003) examined relationships between food insufficiency at household level in Canada and physical, mental and social health and selected chronic health conditions. They concluded that ‘household food insufficiency was significantly associated with poorer health status across multiple dimensions of health—including self-reported heart disease, diabetes, high blood pressure and food allergies’. Individuals in food insufficient households were more

likely to rate their health as poor or fair, have restricted activity, poor functional health and to have major depression, than those in food sufficient households.

The relationship between food security status and self-reported mental, physical and general health status of adults in the Lower-Mississippi Delta (a disadvantaged region of the US, was examined by Stuff and co-workers (Stuff, Casey *et al.*, 2004). They concluded that there was a relationship but they did not pursue the causal effects of food insecurity on the outcome variables.

The only population based study using a validated food security index to explore relationships between food security status and health outcomes is that of Cook *et al.* in the US (Cook, Frank *et al.*, 2004). These authors focused on health outcomes among infants and toddlers in the Children's Sentinel Nutrition Assessment Project (C-SNAP). Infants and toddlers ≤ 36 months in households which were deemed food insecure (with or without hunger) were at greater risk of poor health status, after adjusting for: race/ethnicity; health insurance and daycare status; caregiver's age; employment, marital and education status; and whether or not they received food assistance. There was no association between food security status and growth impairment (assessed by either weight for height Z-score below the 5th percentile or the 10th percentile).

This survey sample was not random; parents/caregivers were approached at healthcare facilities so that the results could be generalized. Nevertheless, the authors concluded that 'policies to reduce or prevent food insecurity, especially among families with young children are likely to prevent illness, reduce hospitalization and lower

healthcare costs'. They noted in their analyses that the receipt of food assistance moderated the effect of food insecurity on health.

1.5 Summary

The construct of food security/insecurity is well accepted in developed countries. It is measurable, but given the complexity of its nature, to date few rigorously validated measurement indices exist. Only in the US is there a fully validated measurement model, appropriate for monitoring prevalence within their population. Using validated, semi-validated and proxy measurement indices, attempts are being made worldwide to quantify and describe the outcomes of food insecurity in terms of health and nutrition. It appears clear that food choices are constrained by food insecurity with the consequence that nutrient intakes are negatively affected. Moderate food insecurity levels are an independent predictor of elevated body weight, but the severest levels of food insecurity are probably not.

In New Zealand, a developed country with a plentiful food supply, the following questions should then be addressed:

- Does food insecurity exist among the New Zealand population?
- If so, in what ways does it manifest itself and what sectors of the population does it most affect?
- What is the prevalence of food insecurity in New Zealand?
- Are those living in food insecure households less well nourished than those in food secure households?

Several studies have been undertaken to answer these questions.

Firstly, a case study of economically disadvantaged households was carried out to record the perceptions and experiences of the food insecure and to explore ways in which the usual food and nutrient intakes of this group could be documented (Chapter 2).

Secondly, the prevalence of food insecurity in the population was ascertained; indices of food insecurity relevant to the New Zealand population derived from focus group research were refined and trialled on a national sample of households (Chapter 3).

From these data, multiple indices of household food insecurity were subjected to Rasch analysis and collapsed into 'categories' of levels of severity of food insecurity. The nutrition of adults within these households (intake of nutrients and body weight status) was then compared across these categories (Chapter 4).

Using the same technique, the relevance of these indices of food security were trialled among households with children, and the predictive ability of categories of food insecurity were examined for their effect on nutrient intake and body weight status of children (Chapter 5).

2 The Nutritional Status of Women and their Children in Food Insecure New Zealand Households

An initial report of these data appears in: Parnell WR (1997). Socio-economic disadvantage and nutritional status in New Zealand. *Poverty and Food in Welfare Societies*. Kohler B M, Feichtinger E, Barlosius E and Dowler E. Berlin, Sigma.

Quotations throughout this chapter were random selections from the responses of women in the households studied, to two open-ended questions posed to them.

“I want it to end. I want it to get better.”

“As long as I’ve got a large sack of potatoes we’ll never go hungry.”

2.1 Introduction

Following three decades of relative economic prosperity, there was an economic downturn in New Zealand (NZ) influenced by restriction in overseas markets for agricultural produce in the 1980’s. This culminated in a decision to substantially reduce government funded welfare benefits during 1991. While there is debate about the ideal measurement of poverty, Krishnan (Krishnan, 1994) examining six different income related measures, concluded that between the late 1980’s and early 1990’s in New Zealand poverty increased significantly, and disproportionately affected beneficiary and sole parent households and households with children. Further to this Stephens et al. (Stephens, Waldegrave *et al.*, 1995) concluded that

using an absolute poverty standard (50% of median income) the incidence of poverty more than doubled (from 4.3 to 10.8% of households) between 1984 and 1993. Stephens and co-workers developed a focus-group derived poverty line using a group consensual approach and determined that in 1993, 10.8% of households fell below this level. Higher levels of morbidity were attributed to socio-economic disadvantage (Scragg, Baker *et al.*, 1991). As the role of nutrition on diminished health status had been considered in other developed countries (Davey-Smith & Brunner, 1997; James, Nelson *et al.*, 1997), it was pertinent to examine whether poverty was related to poorer nutrition in this country.

During the early 1990s, the Health Promotion Unit of the Auckland Area Health Board, as part of their growing concern for nutritional status in South Auckland (a low socio-economic area) commissioned a report of the food-related needs of families with children (Turner, Connally *et al.*, 1992). They determined that among their sample of 108 families, 53% reported insufficient food; 72% missed some meals due to lack of food or money; both fruit and vegetable intakes were compromised and one third of the families thought that their food was usually unhealthy. These families considered that they needed more money to improve food consumption. In the same time period concern was expressed regarding the rise in the number of charitable Food Banks throughout the country, providing non-perishable food to individuals and households in crisis situations (Smithies, 1996).

In the US, considering similar trends to those observed in New Zealand, Radimer approached the problem of 'hunger' among women and children and began to develop indicators to encapsulate the effects of lack of food consequent upon lack of money. She described the components of hunger at household level as qualitative

(food unsuitability); quantitative (food depletion), social (food acquisition via unacceptable means); and psychological (food anxiety) (Radimer, Olson *et al.*, 1992). This work subsequently gave rise to the adoption of the term 'food security', a term which was originally used in third world countries where food supplies were limited or inaccessible for reasons of climate, harvests or poverty. The terms 'food security' and its converse 'food insecurity' began to be seen as a useful means to describe the emergence of a similar phenomenon in developed countries, where poverty lay at the root of the inaccessibility of appropriate food by everyone in a population.

A growing number of studies in developed countries have linked the experience of food insecurity with poorer food choices and consequently poorer nutrient intakes (Cristofar & Basiotis, 1992; Dowler & Calvert, 1995; Gulliford, Mahabir *et al.*, 2003; Kendall, Olson *et al.*, 1996; McIntyre, Glanville *et al.*, 2002; Rose & Oliveira, 1997; Tarasuk & Beaton, 1999; Tingay, Tan *et al.*, 2003). Several studies targeting deprived groups have recorded low energy and nutrient intakes among women with children in food insecure households (Dowler & Calvert, 1995; McIntyre, Glanville *et al.*, 2002; Tarasuk & Beaton, 1999). Paradoxically more women than expected in these studies were likely to be overweight or obese. Several other population studies have found a significant relationship between mild or moderate food insecurity and higher BMI among women (Olson, 1999; Sarlio-Lahteenkorva & Lahelma, 2001; Townsend, Peerson *et al.*, 2001).

In the early 1990's the phenomenon which Radimer was describing in the US was believed to be emerging in New Zealand. No contemporary data existed on the nutrient intakes of socio-economically disadvantaged groups, although the 1989

Life in New Zealand (LINZ[®]) national dietary survey data set had provided some evidence that food choice was affected by employment status and percent energy derived from fat was higher among unemployed women than employed (Page, Horwath *et al.*, 1992).

Since at this time there appeared to be no recommended or optimal method of collecting dietary data from the individuals in socio-economically disadvantaged households, it was decided to explore the best possible way to obtain detailed data on the nutrient intakes of these households and particularly of women, given that they were more likely to deprive themselves than their children if food was in short supply (Campbell & Desjardins, 1989).

This study was therefore undertaken of members of New Zealand households with children, whose sole income was a government welfare benefit or benefits, in order to describe the food provisioning experiences, and to explore an appropriate means of dietary assessment.

2.2 Methods

2.2.1 Questionnaire development.

After a literature search of studies of the effect of poverty on food provisioning in households in developed countries, a questionnaire was developed for the principal food provider of a household. Questions included demographic data on household members, all sources of income and expenses, sources of food, food purchasing patterns, domestic amenities, and what adaptations were made in the light of available food. Detailed descriptions were sought of the adaptations made in response to any

food insufficiency, by women and their children, including open ended questions of the way the women felt about their situation. Women were asked to describe their consumption of four foods over the last week: meat, cheese, fruit, take-aways. These key foods were selected since there was anecdotal evidence that their consumption would be 'different' among the socio-economically deprived.

2.2.2 Ethical approval and pilot study.

Ethical approval for the study was provided by the Head of Department of the Department of Human Nutrition, University of Otago who held delegated authority from the Otago Ethics Committee. Funding was provided from the Public Health Commission, Wellington, New Zealand. Five households whose sole income was a government welfare benefit or benefits, and who were clients of a Dunedin social welfare agency, volunteered to pilot the questionnaire, to provide 24-hour diet recalls, and be weighed and measured, in return for a free consultation with a dietitian after participation.

Women from these households responded to the interviewer-administered questionnaire and dietary data were collected from each household member by multiple, interviewer-administered quantitative 24-hour diet recall. The 24-hour diet recall used the three pass technique of a quick list, detailed food description and review of the recall. Wherever possible, volumes of foods and beverages consumed were recorded in household measures. The first 24-hour diet recall was collected in the home to maximize identification of product brands and portion sizes consumed. Up to three of the subsequent recalls were conducted by telephone (where households had a telephone). Recalls were obtained on any day of the week, but not on consecutive days. During a second home visit, the heights and weights of all

household members were ascertained, with subjects lightly clad and in stockinged feet. Heights were measured to the nearest 0.5cm using a portable stadiometer. For children under one year supine length was measured. Weights were measured using Seca digital platform scales, to the nearest 0.1kg. Children under 2 years of age were weighed with their mothers and their weight calculated after subtraction of the mother's weight. One set of duplicate measures were taken and the results averaged.

After the process described above was piloted on the five households, the questionnaire was refined and the final version is shown in Appendix A-1. The anthropometric techniques were piloted satisfactorily and the dietary assessment process scrutinised.

2.2.3 Dietary data collection.

Based on the pilot study experience the researcher concluded that it was feasible to collect a total of six non-consecutive 24-hour diet recalls on random days from adult women in the households, including at least one weekend day. These would be collected over a two week period in order to take account of the fortnightly cycle of payment of welfare benefits. After completion of the woman's first 24-hour diet recall in the home up to three repeat recalls were feasible by telephone interview and the remainder by further home visits. When the household had no telephone, all recalls were carried out in the home. For male partners and for children two recalls only were possible, given the complexity of arranging for each male or child member to be present in the home for their first recall, and during subsequent visits. Telephone recalls were not attempted for males or for children. The reason for this was that while the women were able to describe the necessary detail of all of the

foods and beverages they consumed to enable calculation of nutrient content, males and children required assistance from the women. The process of obtaining the necessary detail from all members at one time was not possible by telephone.

2.2.4 Recruitment of households.

Following the pilot testing described above, a convenience sample of households was recruited through church social welfare agencies in two New Zealand cities; Dunedin in the South Island and Auckland in the North Island. Agreement was first obtained from the agencies to recruit households for the study, on the premise that they would receive a report on the study results. Such a report would not identify the participating households. Agencies identified households using the following criteria: total income was limited to one or more government welfare benefits; the household included one or more children of school or pre-school age; members were of Caucasian ethnicity. An adult member signed a consent form for household participation (Appendix A-2). Study recruitment and participation took place in Dunedin in 1994 during February to April and in Auckland from May to November. Twenty households in each centre completed the assessment process.

2.2.5 Data analyses.

For each individual in the households food intake data were converted to nutrient intake using the programme 'Diet Cruncher' for Macintosh, Version 1.9, which used food composition data from the New Zealand Institute for Crop and Food Research Ltd, to obtain mean daily intake of energy and nutrients per person (Crop-and-Food-Research, 1993).

All 24-hour diet recall data reported were accepted as valid. No corrections for under-reporting were deemed to be appropriate to apply to these participants, in

light of the constrained economic circumstances and experiences of food insufficiency which participants described.

Dietary intake (two-day mean intakes) data were grouped for children by age, for children between one and 15 years. There were insufficient numbers of children between 15 and 18 years and of male partners to consider the adequacy of their dietary intakes. For children one to 18 years, height for age and weight for age were calculated and compared to the US Centre for Disease Control (CDC) 2000 growth reference data (Kuczmarski, Ogden *et al.*, 2000).

For women, dietary data from the six 24-hour diet recalls were adjusted for intra-individual variability using the software package C-SIDE developed by Iowa State University, to estimate the usual intake distribution of nutrients (Russell, Parnell *et al.*, 1999). The energy intakes of New Zealand women in a similar age range from the group New Zealand European and Others (Russell, Parnell *et al.*, 1999) are presented for comparison. The adequacy of intake of the following nutrients was determined by probability analysis: calcium, iron, selenium, vitamin A, vitamin C and zinc. Comparison with the mean requirement: Estimated Average Requirements (EARs formulated by the UK Panel on Dietary Reference Values (UK-Department-of-Health, 1991)), enabled an estimate of the proportion of the group at risk of inadequate intake (Beaton, 1994).

A validated instrument to assess degree of food insecurity had not been developed in New Zealand when these data were collected. However, the questions posed to the participants (Questionnaire numbers 24-32) enabled some measure of the degree of household food insecurity to be made. These questions addressed the

experiences of both the adults and the children within the households, and ranged from 'perceiving that they had less food than they should' to reporting that they 'skipped meals' and in the case of children that they were 'going to bed hungry'. Two nutritionists independently examined the responses for the households and reached 100% agreement that they could be clearly assigned to the following categories: no food restricting practices (n=2); food restricting practices experienced by adults only (n=16); food restricting practices experienced by adults and also to some extent by children (n=20). These first two categories of households were considered 'most food sufficient' and the third category 'least food sufficient'.

The nutrient intakes and percent with inadequate intake of women in households considered 'least food sufficient' (the group who reported that both adults and children restricted meals or meal size), were compared to those in households considered 'most food sufficient' (the group where the adults only restricted meals or meal size, or where no such restrictions were reported).

For adult females Body Mass Index (BMI) was calculated (weight kg/height m²), and results presented for all women and by severity of food insufficiency of the household.

2.2.6 Statistical procedures.

Statistically significant differences in nutrient intake medians were calculated using the pivotal quantity

$$Q = \frac{T_1 - T_2}{\sqrt{S_{T_1}^2 + S_{T_2}^2}}$$

Where T_1 and T_2 are estimates of the medians from the two subgroups and ST_1 and ST_2 are the Standard errors for these estimates. The pivotal quantities were then tested for significance by comparing the observed quantity with that of the two-tailed normal critical value at the 95-percent level of significance.

Hypothesis testing for differences between the proportions of women with 'inadequate intakes' of selected nutrients, was not appropriate as the small sample size contributed to very large standard errors.

The hypothesis that the mean BMI of the least food sufficient group of women was lower than for the most food sufficient group was tested by a two-tailed t-test for difference in means, assuming constant variance.

2.3 Results

2.3.1 Household characteristics and food practices.

The age and sex distribution of the forty households (58 adults and 92 children) is provided in Table 2.1. Household number averaged 3.8 (range 2-7), and the average number of children per household was 2.3 (range 1-6). Fifteen (37%) of households had a male spouse or partner. For the two thirds of households who provided information on the length of time they had been in their 'current' economic circumstances, this was on average 4.5 years.

Table 2.1 Age and sex distribution of the forty households.

| | Age (yrs) | Male (n) | Female (n) |
|----------|-----------|----------|------------|
| Adults | > 18 | 17 | 41 |
| Children | 16 – 18 | 3 | 2 |
| | 12 – 15 | 9 | 8 |
| | 8 – 11 | 11 | 14 |
| | 4 – 7 | 16 | 7 |
| | 1 – 3 | 9 | 11 |
| | < 1 | - | 2 |

“It’s bordering on desperation. I don’t know how to get out of it.”

Estimated weekly expenditure on major items was provided by 38 households and the data are presented in Table 2.2. Data contemporary to this (an estimate of minimum adequate expenditure) are presented for comparison. These were estimated expenditures considered by low income focus group members as the minimum adequate weekly expenditure for low income single-parent households of four members (Cody & Robinson, 1993).

Food costs were estimated on average to constitute 27% of weekly expenditure. Supermarkets were the venue of first choice for purchasing food for all households. Sixteen households ‘shopped’ only every two weeks, fifteen weekly and the remainder more than once per week. Purchasing pre-cooked or prepared meals (including take-aways) was reported as never or hardly ever by 26 households

(65%), once per month by five (12.5%) and once per week by nine (22.5%). No households reported doing this more than once per week.

Table 2.2: Estimated weekly expenditure on major items (NZ dollars).

| | 38 Households ⁺ | | Minimum adequate expenditure estimated by single-parent households* |
|--------------|----------------------------|---------|---|
| | Range | Average | |
| Food | 25-175 | 89 | 100 |
| Housing | 73-300 | 146 | 100 |
| Power | 6-50 | 22 | 20-25 |
| Transport | 0-50 | 16 | 15 |
| Medical Care | 0-60 | 12 | 5 |

⁺ Average 3.8 persons per household.
^{*}Data reported by Cody & Robinson (1993), for 4 persons, single-parent households.

2.3.2 Household experiences of food insufficiency.

Two-thirds (27) of the households 'always' had to rely on a limited variety of food because of running out of money and a further eight experienced this 'sometimes'. Further to this, one-half of the households reported that they did not have a sufficient amount of food for their household, sometimes or often. The main reasons given for the household experiencing this problem were 'lack of money' (22 households) and 'outstanding debts' (nine households).

In addition to purchasing food over the previous year, about one-third had been gifted food from friends or relatives and 28 (70%) had visited a charitable food bank (at least once). Five households belonged to a food cooperative, where bulk purchase of foods for participating households minimized the cost.

**“It’s quite degrading going to the Salvation Army ... but they have
been very helpful.”**

About one-half of the households (21) owned their own car and two-thirds (27) lived in rental accommodation. Most households (37) owned a deep freeze and one-fifth (8) grew some food for their own needs.

2.3.3 Women’s characteristics and food patterns.

In the forty households there were a total of 41 females over 18 years. Thirty-nine households were provisioned with food by a woman and one of these was pregnant. Therefore, data on food energy and nutrient intake were included for the remaining 38 women. These women ranged in age from 20 to 48 years, with a mean age of 34 (SD, 7) years. The majority of women participants (34) reported their ethnicity as NZ European and four as NZ Māori. All were born in New Zealand. Three-quarters of them (28) had received no tertiary level education. Almost one half (18) of the women were current smokers and 11 of these 18 rolled their own cigarettes.

Recalling the women’s intake ‘during the previous week’ 55% had not had any ‘take-aways’ and 40% had had them once. Fish and chips were the predominant take-away: only one-fifth had meat daily and the meats chosen most often were chicken, sausages and mince. Over a week almost one-fifth had no cheese and about 40% ate it only once or twice. One woman had no fruit, 45% had fruit only once, and less than one-third had fruit at least daily.

2.3.4 Women's experiences of food insufficiency.

Most women (37) thought that the food they ate was healthy; however 12 (30%) ate less than two meals per day; 28 (70%) cut down on the size of their meal; six skipped meals on a daily basis. While ten ate less food than they thought they should, on a daily basis, over one-half of the women did this some of the time. Further to this, many women (38%) said that their children at times ate less food than they thought they should. Despite this, only two women reported that their children ever had a reduced meal size, skipped meals or went to bed hungry.

“Upsets me that I'm not feeding the kids food I want to and that they want to eat.”

Forty percent of the women worried constantly about money and about feeding their household and all of the rest of the women worried about this issue at some time. The degree of difficulty of feeding their household was described as 'really bad' by one-quarter of the women.

2.3.5 Nutrition of the women.

Their mean body mass index (BMI) was 29 ± 7 ; almost one-fifth were classified as overweight (BMI range 26-30) and over forty percent (16) as obese (BMI > 30) (Table 2.3). The usual median daily intakes of the women for energy and selected intakes are presented for all women and by food sufficiency status in Table 2.4. For selected nutrients, the percent of women with inadequate intake is shown in Table 2.5; for all women, and by food sufficiency status.

“I stay up late in bed worrying what I’m going to do for the next day. It’s very hard. There is never enough.”

Table 2.3 Body Mass Index (BMI)* for women (n=38).

| BMI* | All Women n=38 | | Most Food Sufficient n=18 | Least Food Sufficient n=20 | |
|---|-------------------|-----|------------------------------|-------------------------------|-------|
| | | | | | |
| <20.0 | 3 | 8% | 2 (11%) | 1 | (5%) |
| 20.0 – 25.0 | 12 | 32% | 3 (17%) | 9 | (45%) |
| 25.1 – 30.0 | 7 | 18% | 3 (17%) | 4 | (20%) |
| >30.0 | 16 | 42% | 10 (55%) | 6 | (30%) |
| Mean±SD | 29±7 | | 30±7 ⁺ | 27±5 | |
| * BMI – weight (kg)/height (m ²). | | | | | |
| ⁺ No significant difference in mean BMI. | | | | | |

Table 2.4 Usual Median Daily Intakes (SE) of women* by food sufficiency status.

| | All Women (n=38) | Most Food Sufficient ^a (n=18) | Least Food Sufficient ^a (n=20) | NNS97 ⁺ n=848 |
|--------------------------|---------------------|--|---|-----------------------------|
| Energy (KJ) | 5.7 (0.5) | 5.9 (0.6) | 5.5 (0.6) | 8.1 (0.12) |
| Protein (g) | 50 (4.1) | 52 (5.8) | 49 (5.8) | 75 (1.3) |
| Total fat (g) | 59 (5.8) | 61 (8.3) | 57 (8.0) | 76 (1.4) |
| Saturated Fat (g) | 25 (2.8) | 25 (4.1) | 25 (3.8) | 33 (0.7) |
| Mono-unsaturated fat (g) | 20 (2.0) | 20 (2.7) | 19 (2.8) | 25 (0.5) |
| Poly-unsaturated fat (g) | 8.0 (0.9) | 9.5 (1.6) | 6.8 (1.2) | 10 (0.3) |
| Cholesterol (mg) | 184 (21.4) | 182 (30.7) | 187 (30.7) | 255 (7.4) |
| CHO (g) | 154 (13.2) | 163 (18.7) | 146 (18.6) | 221 (3.6) |
| Fibre (g) | 11.0 (1.1) | 12.2 (1.7) | 10.1 (1.5) | 18 (0.4) |
| Sucrose (g) | 38 (5.6) | 39 (7.8) | 36 (8.1) | 46 (1.4) |
| Calcium (mg) | 520 (58) | 487 (82) | 542 (81) | 745 (21.1) |
| Iron (mg) | 6.9 (0.6) | 7.2 (0.9) | 6.6 (0.8) | 10.1 (0.2) |
| Zinc (mg) | 6.8 (0.6) | 6.8 (0.9) | 6.4 (6.7) | 10.1 (0.2) |
| Selenium | 25 (3.2) | 26 (4.4) | 24 (4.9) | 39 (3.4) |
| Vitamin A (µgRE) | 719 (98) | 833 (152) | 626 (127) | 835 (40.3) |
| Retinol (µg) | 362 (64) | 370 (66) | 322 (65) | 342 (52.3) |
| β-Carotene (µg) | 2091 (400) | 2699 (715) | 1740 (441) | 2659 (174) |
| Folate (µg) | 140 (12) | 151 (17) | 129 (16) | 215 (4.6) |
| Thiamin (mg) | 0.85 (0.09) | 0.93 (0.14) | 0.78 (0.13) | 1.2 (0.02) |
| Riboflavin (mg) | 1.14 (0.11) | 1.14 (0.14) | 1.15 (0.17) | 1.6 (0.03) |
| Vitamin C (mg) | 43 (7.6) | 50 (9.6) | 37 (11.2) | 92 (6.1) |

* Six 24-hour diet recalls – adjusted for intra-individual variability, using PC-Side.

+ Data for women, NZ European and Others, 25-44 yrs, from the NZ National Nutrition Survey, 1997.

^a Intakes of energy and nutrients between most and least food sufficient group were non-significant.

**Table 2.5 Prevalence of inadequate intake by food sufficiency status:
Percent of women with usual intake of selected nutrients below requirement.**

| Nutrient | All Women (n=38) | Most food sufficient (n=18) | Least food sufficient (n=20) | NNS97 ⁺ n=848 |
|-------------|---------------------|--------------------------------|---------------------------------|-----------------------------|
| Vitamin A | 8.6 | 3.1 | 17 | 0.7 |
| Riboflavin | 31 | 30 | 32 | 3.1 |
| Folate | 59 | 49 | 66 | 11.5 |
| Vitamin B12 | 1.2 | 1.8 | 0.4 | 0.3 |
| Vitamin C | 25 | 12 | 35 | 1.1 |
| Iron | 76 | 72 | 81 | 41 |
| Zinc | 25 | 28 | 21 | 0.6 |
| Calcium | 51 | 55 | 47 | 16 |

⁺ NZ European and Others women, 25-44 yrs.

2.3.6 Nutrition of the children.

The mean daily nutrient intakes of the children (males and females over one year of age) are presented in Table 2.6, but given the small numbers in each age group, no reliable assessment of the adequacy of their intakes can be made from these data.

The weight for age and height for age centiles of the males (Figures 2.1 and 2.2) and females (Figures 2.3 and 2.4) have been plotted, on the US population centiles.

Table 2.6 Mean (SD) daily intake of energy and selected nutrients for children*.

| | 1 – 3 yrs M (9); F (11) | | 4 – 7 yrs M (16); F (7) | | 8 – 11 yrs M (11); F (14) | | 12 – 15 yrs M (9); F (8) | |
|----------------------------|----------------------------|----------------|----------------------------|----------------|------------------------------|----------------|-----------------------------|----------------|
| Energy (Kj) | 6374 (2786) | 5074 (1956) | 8285 (3605) | 8344 (2920) | 8618 (2972) | 8820 (2302) | 8928 (3384) | 7934 (2988) |
| Protein (g) | 47 (17) | 38 (11) | 55 (21) | 60 (23) | 54 (16) | 64 (26) | 55 (14) | 60 (22) |
| CHO (g) | 203 (88) | 161 (65) | 271 (122) | 260 (86) | 275 (93) | 263 (76) | 295 (125) | 223 (84) |
| Total fat (g) | 63 (31) | (50) (21) | 82 (38) | 86 (36) | 90 (37) | 96 (27) | 89 (37) | 90 (42) |
| % En Total fat | 38.5 | 38.5 | 38.6 | 40.0 | 41.0 | 42.0 | 39.0 | 44.0 |
| Calcium (mg) | 643 (303) | 550 (168) | 660 (296) | 787 (400) | 717 (400) | 810 (603) | 571 (179) | 523 (221) |
| Iron (mg) | 6.7 (2.6) | 6.4 (4.0) | 8.6 (4.9) | 9.2 (3.2) | 9.8 (2.5) | 9.4 (2.7) | 9.8 (3.2) | 9.9 (3.0) |
| Vitamin A (RE) | 636 (399) | 599 (594) | 924 (675) | 951 (509) | 1052 (619) | 940 (415) | 1440 (825) | 644 (330) |
| Thiamin (mg) | 2.9 (3.7) | 6.7 (11.8) | 3.2 (7.4) | 2.5 (2.4) | 5.1 (9.2) | 8.2 (13.3) | 1.1 (0.2) | 1.7 (1.3) |
| Riboflavin (mg) | 1.2 (0.6) | 1.1 (0.3) | 1.2 (0.6) | 1.5 (0.6) | 1.3 (0.7) | 1.3 (0.7) | 1.2 (0.3) | 1.1 (0.3) |
| Vitamin C (mg) | 166 (72) | 79 (50) | 124 (152) | 148 (81) | 115 (76) | 95 (52) | 152 (98) | 96 (49) |
| * 2, 24-hour diet recalls. | | | | | | | | |

Figure 2.1: Weight for age of all males.

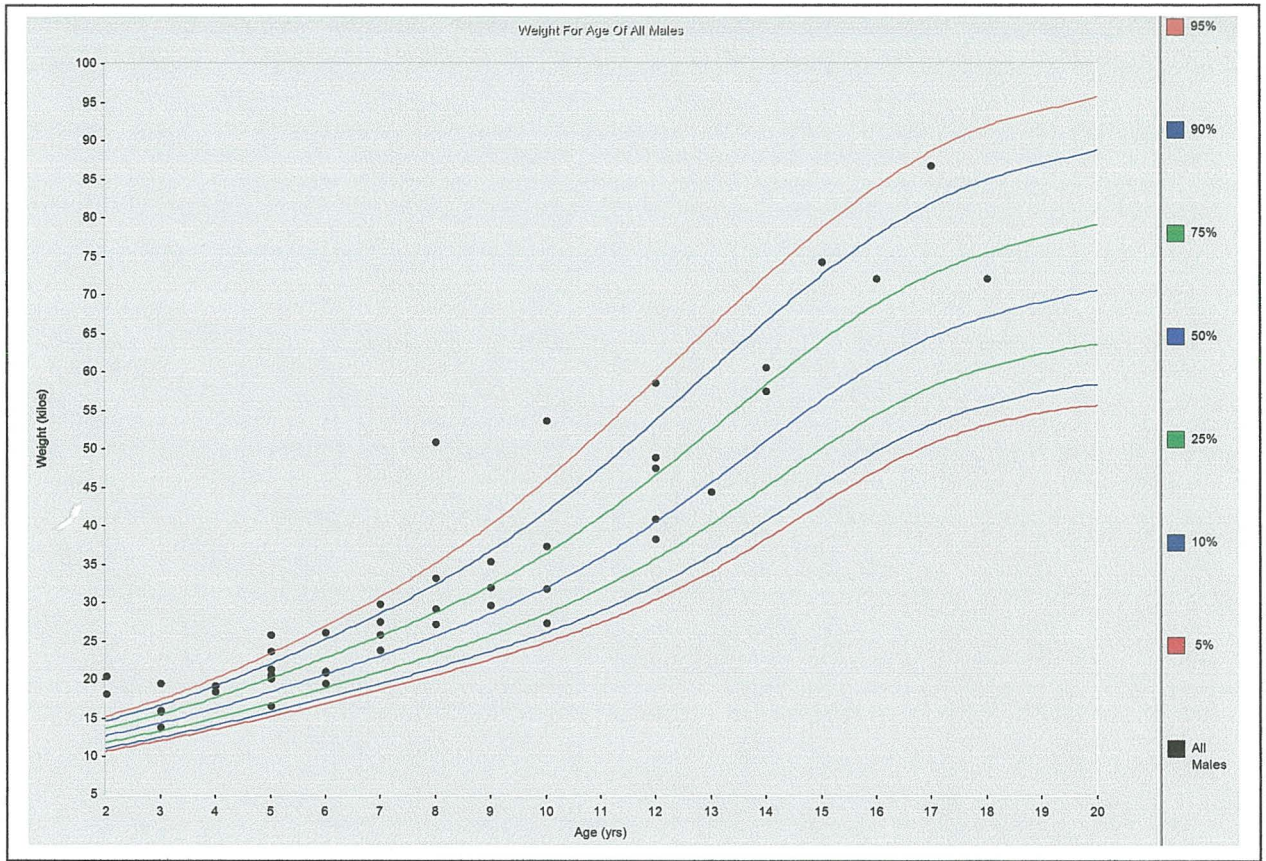


Figure 2.2: Stature for age of all males.

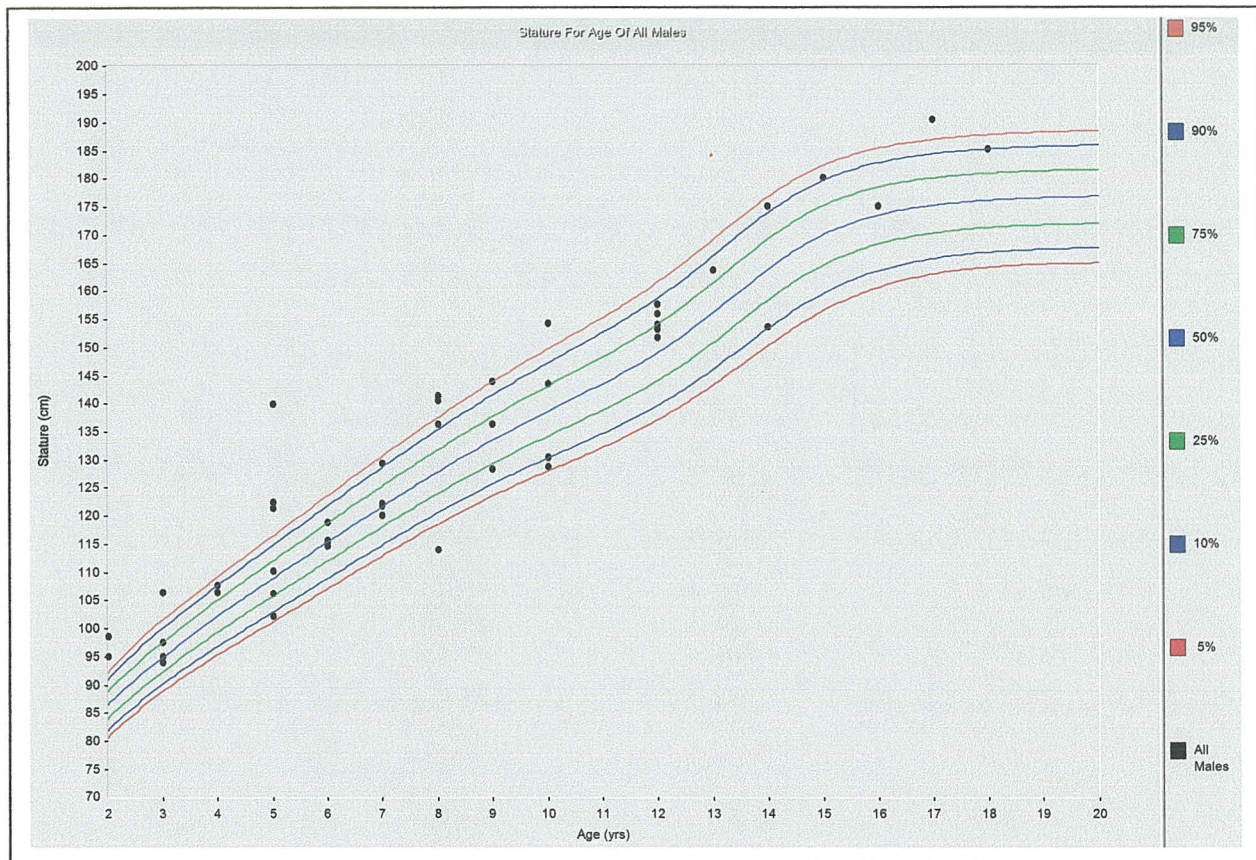


Figure 2.3: Weight for age of all females.

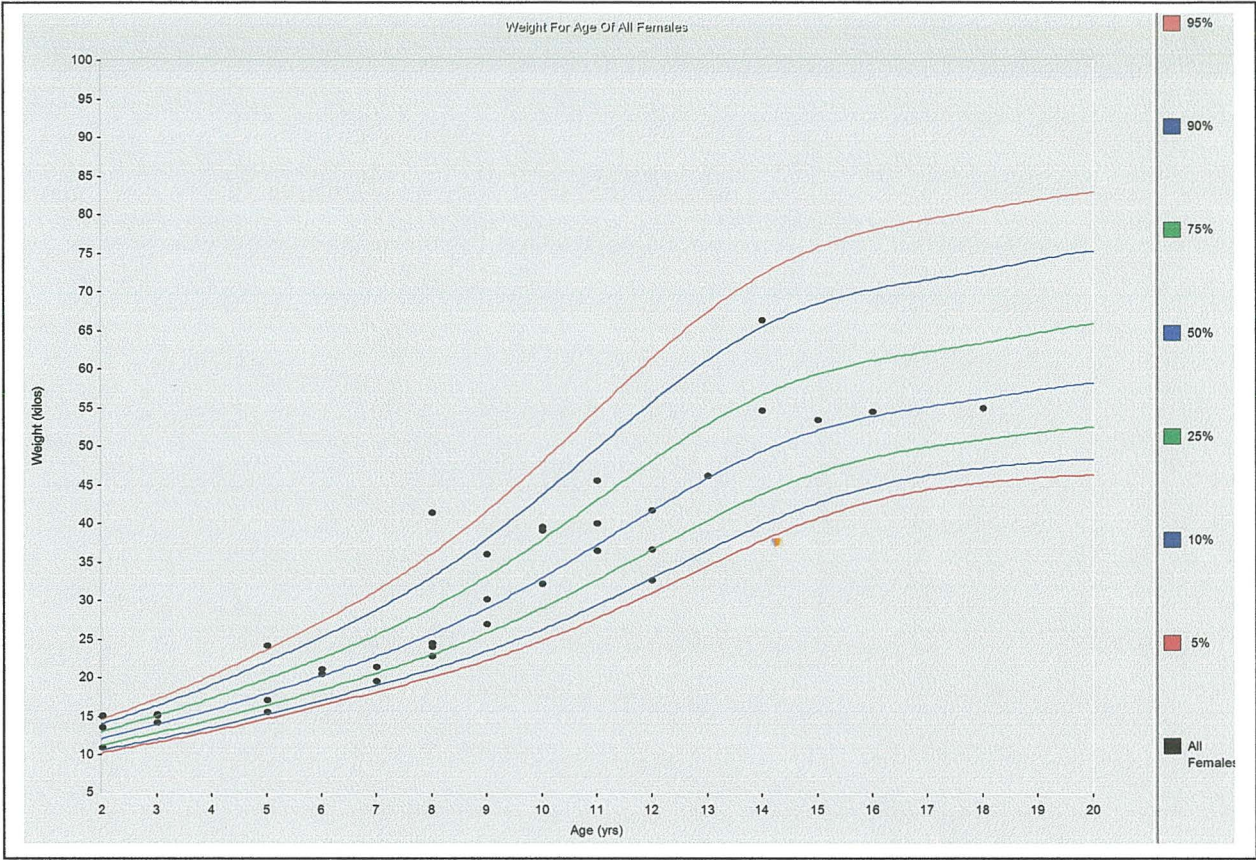
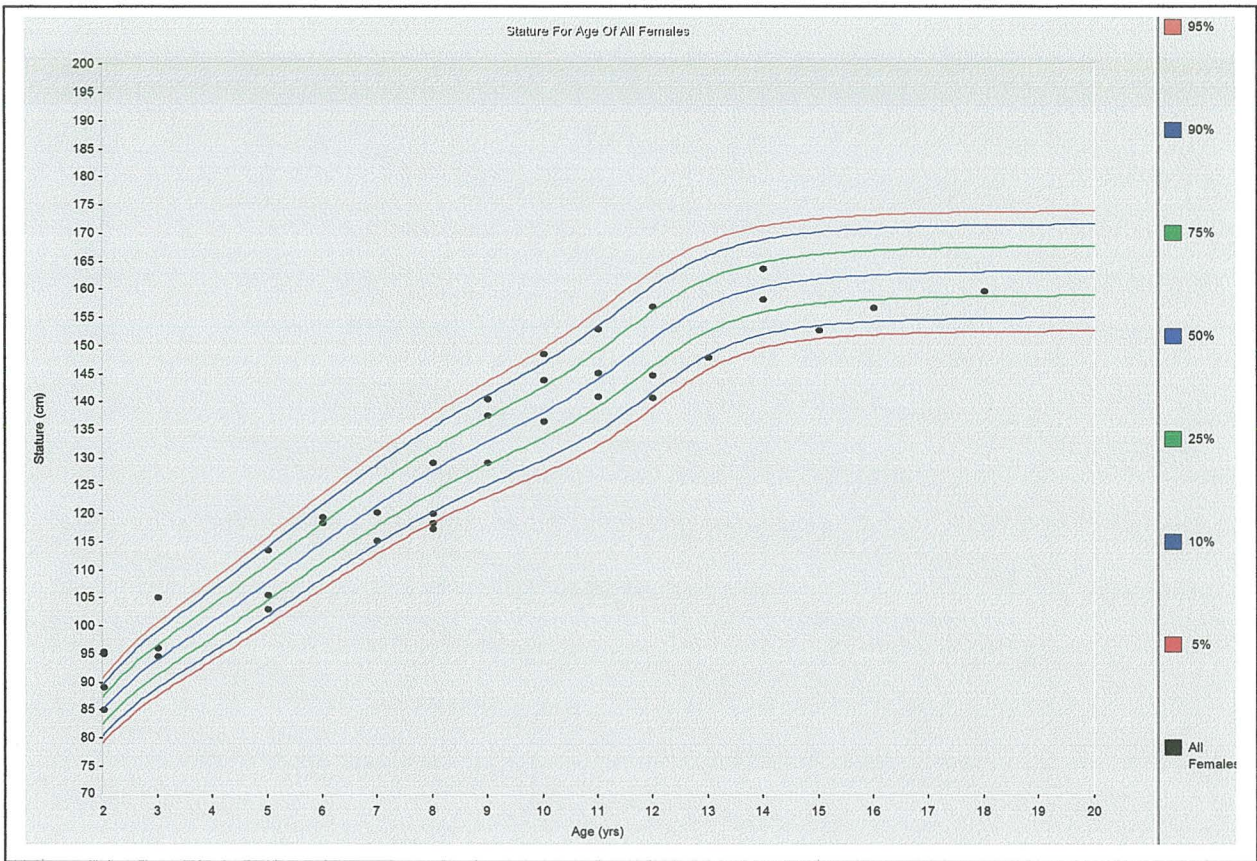


Figure 2.4: Stature for age of all females.



2.4 Discussion

This sample of New Zealand households was selected on the basis of the existing evidence of disadvantage for families with dependent children whose income was a government benefit or benefits. The Economic Living Standard Index (ELSI) is manifestly lower for this sub group of the population (Krishnan, Jensen *et al.*, 2002), and a lower ELSI is found especially among sole parent families. This study had almost two-thirds sole parent households, compared with just under one-third in the NZ population.

These households were well below the NZ population average for car ownership (about half, compared to over three-quarters of NZ sole parent and 99 percent of two parent families). In addition, the proportion in rented accommodation was higher, at two-thirds, compared to the one-third of the population on benefits, who rent homes (Jensen, Spittal *et al.*, 2002).

Although the average amount of money spent weekly for food fell below what disadvantaged groups estimated to be adequate, the proportion of income 27% was close to the 26% which single parent families concluded was a minimum proportion to be spent for adequate survival (Cody & Robinson, 1993).

It is acknowledged that the participating households are not representative of socio-economically disadvantaged households in New Zealand. The participants in this study were poor, but literate and volunteered to take part. They wanted their voice to be heard. The fact that these households agreed to participate in this study showed that they were 'coping' to some extent and unlikely to be the poorest of the

poor. The experiences (including food insecurity and nutritional status) of more severely disadvantaged households could be expected to be greater than those described here.

The sum of the experiences of food insufficiency within the household, expressed by the women who were responsible for food provisioning, clearly demonstrates that every household had some degree of 'food insecurity'. No woman was free of 'worry' about food provision.

"I get very angry and very bitter."

Murphy, in reviewing dietary assessment methodologies for low-income groups (Murphy & Bayer, 1997), noted that none were ideal, and that in particular 'replicate 24-hour recalls' were burdensome. However, it can be concluded that obtaining replicate (six) 24-hour diet recalls was an achievable technique to assess these women's nutrient intake. It was probably achievable because the participants were strongly motivated to share their deeply felt situation with the researchers.

The usual daily energy intake of the women was just over two-thirds (70%) of that reported by women of similar age and ethnicity in New Zealand (NNS97) (Russell, Parnell *et al.*, 1999). Unsurprisingly the intake of all nutrients is lower, with the exception of retinol. The percent energy from fat for these women (38%), is higher than the national average for NZ women (35%). Inexpensive or cheap food containing dairy fat and hence retinol may have contributed to an equivalent level of retinol intake, despite a lower energy intake.

“I have to go without food so the kids can eat.”

The trend for energy and nutrient intakes to be lower for the women in the least food sufficient households was consistent but not statistically significant (Table 2.4). It is indicative of the poorer level of intake of these women, although the overarching picture is that the intake of all of the women is inadequate. For eight nutrients (five vitamins and three minerals) (Table 2.5) the probability of inadequate intake is unacceptably high: in the case of vitamin A, riboflavin, vitamin C and zinc, at least ten-fold higher than for a comparable group representative of the NZ population of women (Russell, Parnell *et al.*, 1999). The exception is the low probability of inadequate intake of vitamin B12—indicative of the inclusion of animal products in these diets despite restricted resources. Cheaper and often high fat meats were purchased rather than choosing meat-less diets.

The usual mean daily energy intakes of the women were lower than those reported by a similarly disadvantaged group in Toronto, Canada (5.7 ± 0.5 cf 6.5 ± 2.8 1,KJ/day) and by a comparatively food insecure group in the Atlantic Provinces of Canada (7.3 ± 1.4 kJ/day) (McIntyre, Glanville *et al.*, 2003; Tarasuk & Beaton, 1999). However, they are almost identical to the most food insecure sub-group within the Toronto Canada sample; where the energy intake was significantly lower than the moderately and least food insecure sup-groups.

The issue of whether under-reporting of food intake can explain such low energy intakes has been discussed in detail by Tarasuk and Beaton (Tarasuk & Beaton, 1999). While not denying that some underreporting might have occurred among their group of women, their conclusion was that underreporting is an unlikely

explanation for the reported intakes of energy in an economically deprived and also relatively obese group of women. Calculated basal metabolic rates for obese individuals would be overestimates—which disallows reliable estimates of the ratio EI:BMRest. Also, cut-off values of this ratio believed to be indicative of underreporting have been set using population norms for physical activity levels which would not apply to the group they studied or to the current study.

In this study respondent burden may have exacerbated the tendency to under-report, and contribute to the very low energy intakes which were recorded. The use of six repeat diet recalls may have been excessive, but it did enable the possibility of adjustment of the data for intra-individual variability and the calculation of probability of inadequate intakes of some nutrients. However, these adjustments on a comparatively small sample, could be criticised. These analyses are sensitive to sample size. Therefore, particularly for the nutrients where intake was highly variable, such as vitamin A, and the intake distribution skewed, the application of a cut-off value within the tail of the distribution, might lead to over- or under-estimation of the probability of inadequate intake.

It is therefore a reasonable conclusion that this group of women—30% of whom said they ate less than two ‘meals’ per day, 70% that they cut down on the size of their meal, and 16% who said that they skipped meals daily—were energy deprived at the time of this study. It is also noteworthy that although not reaching statistical significance, the least food sufficient group within the sample reported a lower usual median energy intake than the most food sufficient group (5.5 cf 5.9 KJ/day).

Despite the low energy intakes reported by these women, their mean BMI at 29 is well above the mean level for New Zealand women (NZ European and Others) which was 24.5 in 1989. In 1989, the percent of NZ European and Others women classified as obese was 11.8%. In 1997 this had risen to 16.7% and in the lowest socio-economic group, NZDep96 quartile IV, 25.4% were obese (Russell, Parnell *et al.*, 1999). The group of women reported here is very different with 42% classified as obese. There also appears to be a trend, although not statistically significant, for the least food sufficient group to be less overweight—(mean BMI of 27) compared to the most food sufficient group (mean BMI of 30). This finding is consistent with the findings reported by Olson (Olson, 1999), of upstate New York women. Moderate food insufficiency was associated with overweight more so than severe food insufficiency, where food access is more likely to limit absolute energy intake. The small study size here precludes multivariate analysis, controlling for the influence of other variables known to correlate with BMI: level of education, income, marital status, age and ethnicity.

The women in these households over-represented in the obese category, and yet apparently poorly nourished, mirror the relationship noted among US women (Continuing Survey of Food Intakes by Individuals, 1994-1996), where the prevalence of overweight increases as food insecurity increases (Townsend, Pearson *et al.*, 2001). Drewnowski and Specter (Drewnowski & Specter, 2004), propose that there are explanations for the relationship between obesity and food insecurity or insufficiency. Dietary choice when restricted by economic constraints, is driven toward increasing intake of energy dense foods; foods which offer the most energy at the least cost. The comparatively high fat diets observed in this study support this argument. The women in food insecure households such as those described here

state they are never confident that there will be enough food. It is conceivable that when food is plentiful it would be consumed to excess, and is more likely to be inexpensive and energy dense food.

Although few studies of low-income households have included an examination of the nutrient intakes of children, some have reported that dietary adequacy and socio-economic status have not been clearly linked (McIntyre, Glanville *et al.*, 2003; Shatenstein & Ghadirian, 1996). McIntyre's study supports the hypothesis that mothers will compromise their intake to provide for their children (McIntyre, Glanville *et al.*, 2003). The 38 households in this New Zealand Study, included 85 children between one and 15 years, but there are insufficient in each age group to validly assess their usual daily nutrient intake. While the mean daily energy intakes reported are close to the RDI for each group (Truswell, 1990), the percent energy from fat ranging from 38.5-44% exceeds recommended levels (Department-of-Health, 1991). Mothers in this study reported compromising their own meal size or skipping meals but seldom reported taking these measures for their children. Further evidence that this group of children were relatively well nourished is seen in the comparison of their heights and weights, with the US population percentiles.

“It’s depressing. Son doesn’t care if it’s cheese on toast but I don’t think I’m feeding him well.”

2.5 Conclusions

This comparatively small study of women with children in food insecure New Zealand households firstly demonstrates that it is possible to assess the nutritional

status of women in such circumstances, and secondly provides a salutary picture of both their stated and observed inability to achieve optimal nutritional status.

It cannot be concluded that the dietary assessment used here is suitable for studies of all disadvantaged women. Nevertheless, the combination of qualitative methodology and quantitative repeated (6) diet recalls for women has encapsulated the experiences and nutritional status of women in marginalized and poor households.

The pattern of BMI status observed in this group of women provides impetus to further explore the relationship between 'food insecurity' status and body weight status in the New Zealand population. The New Zealand Index of Deprivation has been shown to be associated with the level of obesity among women (Russell, Parnell *et al.*, 1999). Those most 'deprived' are the most obese. It would appear from this study that they are deprived of the quality and quantity of food they require.

This study of households where the sole income was a government benefit, where the women in these households were experiencing a state of nutrition well below the population average, points to the need to further explore the needs of beneficiaries with respect to nutrition.

Expenditure 'saved' by reduction or under-spending in the welfare benefit sector may be required in the health sector to restore some of the effects of under-nutrition. Have we 'robbed Peter to pay Paul'?

“I won’t go into prostitution or anything.”

“When I was not getting help I nearly had a breakdown.”

“It’s hard to ask people for help. I don’t want to be a burden.”

This study also highlights the need to develop a validated food security index for the wider New Zealand population.

3 Development of an Instrument to Assess Aspects of Food Insecurity Among the New Zealand Population and Prevalence Rates of Aspects of Food Insecurity

These data are published in: Parnell WR, Reid J, Wilson NC, McKenzie J & Russell DG (2001). Food security: Is New Zealand a land of plenty? *NZ Med J* **114**(1128): 141-5.

3.1 Introduction

An emerging issue in developed countries over the 1990's was that of ensuring that all sectors of the population were appropriately nourished (FAO, 1992). In developing countries, explicit indicators of poor nutrition eg low body mass index (BMI) or poor weight gain in infancy can be used to define the extent of the problem. However, sub-groups of the population in developed countries may exhibit more subtle 'symptoms' of poor nutrition, which are nevertheless, associated with unsatisfactory health outcomes (Rose, Basiotis *et al.*, 1995). For example, the immune system may be impaired by compromised intake of some vitamins and minerals, and this will in turn contribute to increased susceptibility to infection (Kubena & McMurray, 1996). However, since rates of only some infections will be influenced by nutrition, it is difficult to quantify the outcome effect.

In seeking to describe the nature and extent of inadequate nutrition, nutritionists have debated the validity of prevailing and new terms. Efforts to define 'hunger' have largely been abandoned because of the difficulty of obtaining precise measures and disagreement as to whether hunger is purely a physiological phenomenon with long term consequences or

whether it includes the social and emotional consequences of shorter term deprivations (Rose, Basiotis *et al.*, 1995). If for reasons predominantly economic it is not possible to assuage hunger it might continue for an unacceptable length of time, or be dealt with by inappropriate acquisition of food or by the consumption of poor quality food.

'Food Insufficiency' has been assessed using questions developed for the Continuing Survey of Food Intake (CSFII) in 1989 and 1991 and later adapted for the third National Health and Nutrition Examination Survey (NHANES III) (Rose, Basiotis *et al.*, 1995). This term reflects 'not having enough food to eat'; an issue shown to be clearly related to income level, to home ownership, size of household, level of education and ethnicity (Alaimo, Briefel *et al.*, 1998). Self reported food insufficiency has been correlated with lower intake of nutrients (Rose, Basiotis *et al.*, 1995).

An extension of the concept of food insufficiency is that of food security. This term goes beyond the issue of resource for 'enough' food and includes the related issues of accessibility to food, the quality of that food (nutritional and biological), whether or not the food available for consumption is culturally acceptable to the recipient and can be accessed in a socially acceptable way (Leidenfrost, 1993). Conversely food insecurity exists 'whenever the availability of nutritionally adequate, safe foods or the ability to acquire personally acceptable foods in socially acceptable ways is limited or uncertain' (Anderson, 1990).

Food insecurity eventually puts physical health at risk through malnutrition and can jeopardise emotional and social wellbeing. Even periodic episodes of food insecurity are undesirable and could contribute to weight cycling and obesity (Kendall, Olson *et al.*, 1996).

Cohen et al. (1990) consider that a community measure of food insecurity is the use of 'non conventional food sources' (Cohen, 1990). Thus the increasing use of 'Food Banks' (charitable organisations) throughout New Zealand (NZ) in the last decade indicates that food insecurity is an important issue (Uttley, 1997).

The National Nutrition Survey (NNS97) provided a unique opportunity to explore the prevalence of food insecurity within the adult NZ population, and to explore predictors of food insecurity (Russell, Parnell *et al.*, 1999). As no fully validated means of measuring food security or (insecurity) existed in the NZ context at the individual or household level, it was first necessary to develop appropriate indicators to use in NNS97. These indicators were initially developed by Reid (Reid, 1997), piloted, modified and then used for the first time in the NNS97.

This chapter describes the development and modification of the indicators and then describes the prevalence rates of aspects of food security and how they relate to sex, age, ethnicity and socio-economic status in the NZ population.

3.2 Methods

A full description of the methods of the NNS97 including sampling, dietary methodology (24-hr diet recall) and anthropometry, is given in the paper 'Methodology of the 1997 New Zealand National Nutrition Survey (Parnell, Wilson *et al.*, 2001).

The development of Indicators of Food Security for NNS97 was a stepwise process commencing with an examination of the literature and followed by focus groups conducted with low income women and men from the ethnic groups described by Reid (Reid, 1997) as

‘Pakeha’, NZ Māori and Pacific people. From these, the key issues surrounding the procurement and provision of food were determined. Finally ‘indicator statements’ which addressed these key issues were prepared for inclusion in NNS97.

3.2.1 Examination of the literature.

The literature from other developed countries confirmed the appropriateness and efficacy of the model of food security as being one which included access to appropriate and acceptable food at all times. It was clear that several aspects would need to be addressed to describe the different facets of food security (Reid, 1997).

3.2.2 Focus groups.

Qualitative methodology chosen by Reid was ‘a tool to obtain information on the views and experiences of people in relation to coping with feeding a family on a limited income’ (Reid, 1997). The strength of the use of focus groups, compared to individual interviews, is that they enable the raising of issues which are embedded in the reality of the lives of the participants rather than reflecting any pre-conceived views of researchers. They are also an environment which will allow the discussion of sensitive issues such as food security, provided the facilitation of the focus groups is carried out appropriately by an experienced facilitator (Reid, 1997). It was assumed by purposefully sampling focus groups, including those (i) on low incomes (ii) responsible for food procurement and preparation in their household and (iii) of ‘Pakeha’, NZ Māori and Pacific Island ethnicity, that all or most of the issues pertinent to food security in NZ would be raised and discussed. However, the sampling for the focus groups did not adequately represent the elderly. Five focus groups (each of 8-16 people) were conducted, including one Māori, one ‘Pakeha’, two of Pacific people and one of mixed ethnicity. While the majority of the participants (principal food procurers for their household) were female, some fulfilling this role were male. All participants were either on a

low income or (the majority) were government beneficiaries. With the exception of the Māori group (for whom a Māori-facilitator was used) the focus groups were facilitated by one researcher experienced in focus group facilitation, and discussion was audio-taped and transcribed.

From the transcribed tapes of the focus group discussions, responses were analysed independently by three researchers (including Reid) familiar with the areas of nutrition and food security, according to the methods of Patton (Patton, 1990). Five key themes (or categories) were identified, and were inclusive of the cultural issues unique to NZ. As recorded by Reid (Reid, 1997) there was unanimous agreement that having enough money for food for the family was a real issue for all the groups. Coping strategies and attitudes/beliefs meant that dealing with the lack of food varied between and among groups.

3.2.3 Refinement of indicator questions/statements.

The five key themes emerging from the focus groups (food insecurity, food inadequacy, coping strategies, alternative sources, cultural issues), led to draft Indicator Questions. These were reviewed by the National Nutrition Survey Technical Advisory Committee (NNSTAC) and accepted. Nine questions were provided by J Reid to the National Nutrition Survey Research Team for pre-testing, on a sample of 300 participants.

The NNS97 field staff worked with the principal investigators and with J Reid throughout this pre-testing phase and eight statements describing household food insecurity, as experienced over the last year, emerged from the original questions as acceptable to both interviewers and respondents (Reid, 1997).

Trials of the questions with the first half of the pre-test sample led to the replacement of the word income with 'lack of money' and the omission of the word 'worry'; instead using the terms stress or stressful. It was found to be 'less intrusive' to present respondents with a statement rather than to directly ask a question. The intent of the questions was entirely retained and they were re-phrased into statements.

After presenting these statements to the second half of the pre-test sample an introductory paragraph was drafted which the interviewers read to the participants before they responded to the eight statements, and one introductory sentence was read to the participant before they responded to each statement (Reid, 1997). This ensured that participants understood that they were being asked about their resources (not their budgeting skills) and clarified for example that 'eat properly' was what they themselves understood this to mean.

Statements 1-8, as presented to respondents.

1. I/we can afford to eat properly.
2. Food runs out in my/our household due to lack of money.
3. I/we eat less because of lack of money.
4. The variety of food I am/we are able to eat is limited by a lack of money.
5. I/we rely on others to provide food and/or money for food for my/our household when I/we don't have enough money.
6. I/we make use of special food grants or food banks when I/we do not have enough money for food.
7. I feel stressed because of not having enough money for food.
8. I feel stressed because I can't provide the food I want for social occasions.

All survey respondents were presented with these statements: respondents in single person and multi-person households; males and females. Respondents were not necessarily the primary food procurers for multi-person households. Although the food security issues embedded in these 'statements' had been derived from a detailed exploration of the experiences of food procurers, it was assumed that they applied to and would be recognized by any adult household member.

First, an introductory 'explanation' was developed to be read to each respondent. This assured them that the emphasis was on how they or their household procured sufficient food, and not on how they budgeted or spent money. Then, for each of the eight statements an explanation or expansion of the issue was prepared to precede the statement and be read aloud to the respondent. Survey respondents were then shown each of the eight statements (Table 3.1), on a showcard. The response options to statement one were *always, sometimes, never*. The response options to statements two to eight were *often, sometimes, never*.

The focus on the household rather than the individual appeared to be more acceptable to respondents. All direct references to the sensitive issue of income were removed subsequent to the pre-testing, and the focus put on 'lack of money for food'.

3.2.4 Interviewer training.

During the initial training and ongoing regional training sessions field staff were encouraged to note any discomfort they experienced in presenting the Indicator Statements to participants. These matters were discussed and explanations of the meaning and importance of each aspect of food security were provided to the interviewers.

3.2.5 Statistical methods.

For statement 1, the group responding 'never or sometimes' was compared to the group who could 'always afford to eat properly'.

For statements 2-8, the group responding 'sometimes or often' was compared to the group who 'never' experienced that aspect of food insecurity.

Multiple logistic regressions were then used to investigate relationships between prevalence estimates of aspects of food security, and ethnic groups, gender, age, and socioeconomic status. Tests comparing prevalence estimates within gender between ethnic groups, and within ethnic groups between gender, were carried out using linear contrasts after modelling.

Analyses were carried out in STATA 6.0 accounting for the complex survey design.

Table 3.1: Percent of households exhibiting different aspects of food insecurity across ethnic groups¹.

| Statements (described below) | NZ Whole Population | | NZ European and Others ⁺ | | NZ Māori ⁺ | | Pacific People ⁺ | |
|------------------------------------|------------------------|------------------|--|------------------|-----------------------|-----------------|-----------------------------|-----------------|
| | Male n=1918 | Female n=2691 | Male n=1539 | Female n=2068 | Male n=265 | Female n=432 | Male n=114 | Female N=191 |
| 1 | 12 | 15 | 9 | 11 | 25 | 34* | 40 | 40 |
| 2 | 11 | 16 | 7 | 11* | 27 | 37* | 51 | 49 |
| 3 | 11 | 14 | 8 | 11* | 25 | 29 | 37 | 40 |
| 4 | 24 | 29 | 20 | 26* | 47 | 47 | 50 | 48 |
| 5 | 6 | 8 | 3 | 5* | 19 | 22 | 29 | 30 |
| 6 | 2 | 6 | 1 | 3* | 8 | 17* | 13 | 16 |
| 7 | 10 | 16 | 7 | 13* | 19 | 32* | 33 | 32 |
| 8 | 10 | 15 | 7 | 12* | 20 | 29* | 34 | 28 |

¹ Percent responding to Statement 1: never or sometimes.

Percent responding to Statements 2-8: sometimes or often.

⁺ Comparisons in proportions on all statements, within gender between ethnic groups (adjusted for age) were significant ($p < 0.05$).

* Significant ($p < 0.05$) comparisons in proportion within ethnic group between gender (adjusted for age).

Statements 1-8, as presented to respondents.

1. I/we can afford to eat properly.
2. Food runs out in my/our household due to lack of money.
3. I/we eat less because of lack of money.
4. The variety of food I am/we are able to eat is limited by a lack of money.
5. I/we rely on others to provide food and/or money for food for my/our household when I/we don't have enough money.
6. I/we make use of special food grants or food banks when I/we do not have enough money for food.
7. I feel stressed because of not having enough money for food.
8. I feel stressed because I can't provide the food I want for social occasions.

3.3 Results

Table 1 summarises responses to each of the eight indicator statements, which reflect that this was sometimes or at all times, an issue for the respondent or their household. Among the indicator statements of food security, *the variety of food I/we are able to eat is limited by a lack of money* (statement 4) was more frequently cited than any other; at least a quarter of the whole population responded *sometimes* or *often*. For statement 6 (*I/we make use of special food grants or food banks when I/we do not have enough money for food*), six percent of females and two percent of males in the NZ population responded sometimes or often. Both the statements *I feel stressed because of not having enough money for food*, and *I feel stressed because I can't provide the food I want for social occasions*, were responded to as *sometimes* or *often* by fifteen percent of females and nine percent of males in the NZ population.

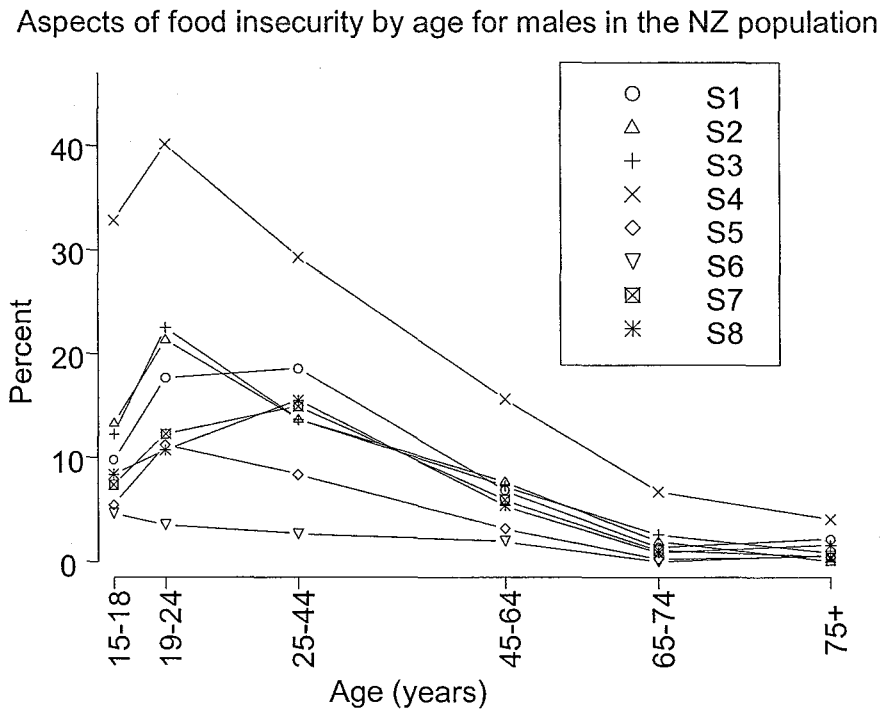
Female NZEO and female NZ Māori were more likely to experience food insecurity than males. Among Pacific people this gender difference was not evident. Prevalence was significantly higher ($p < 0.05$) for females compared to males for seven of the eight indicator statements among NZEO and for five of the eight, among NZ Māori (Table 3.1).

Between ethnic groups and within gender there was a significantly different response to all eight indicator statements for females and males after adjusting for age ($p < 0.05$). For both females and males, NZEO reported the least food insecurity; Pacific people reported the most and NZ Māori fell between the two (Table 3.1).

Figures 3.1 and 3.2 show the trends related to age groups. For both females and males, there was a significant decreasing linear trend with age for all statements after adjusting for gender ($p < 0.001$). Prevalence peaked most often in the 19-24 year group; statements 2 to 5 for males

and statements 1 to 6 for females. The stress related indicators (statements 7 and 8) peaked in the 25-44 year group for males, and for females statement 7 also peaked in this age group, but statement 8 for the 19-24 year group.

Figure 3.1: Aspects of food insecurity by age for males in the NZ population.

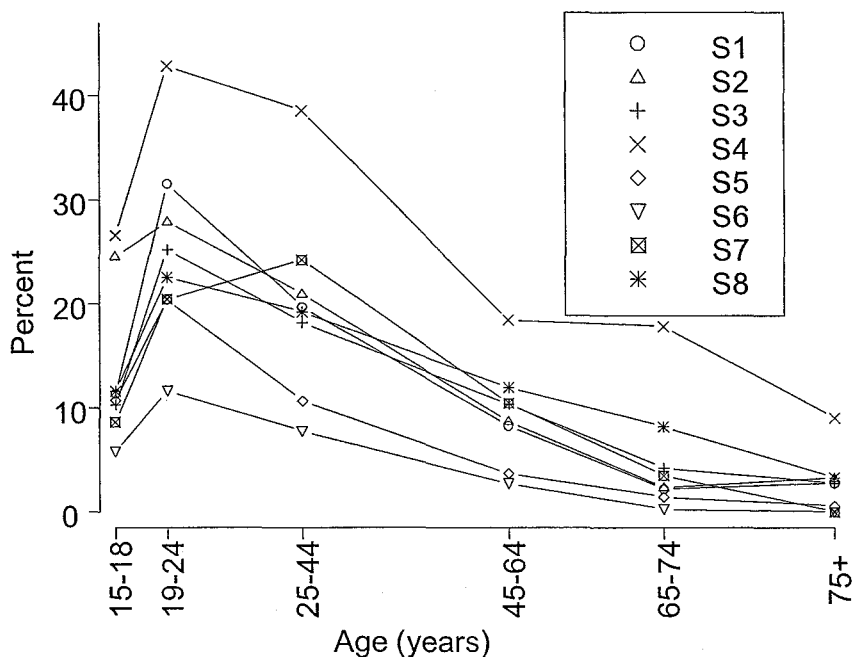


Statement 1 responses: sometimes or never

Statement 2-8 responses: sometimes or often

Figure 3.2: Aspects of food insecurity by age for females in the NZ population.

Aspects of food insecurity by age for females in the NZ population



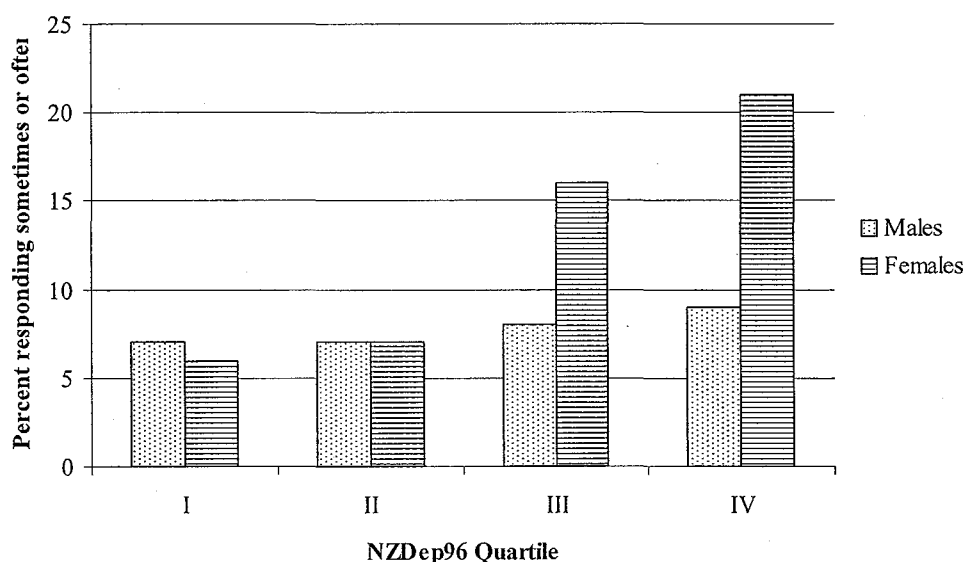
Statement 1 responses: sometimes or never

Statement 2-8 responses: sometimes or often

In order to consider the effect of socio-economic status the influence of NZDep96 quartile (Salmond, Crampton *et al.*, 1998), (a socio-economic index assigned to the place of residence of the respondent) was examined in relation to statement 2 (*food runs out in my/our household due to lack of money*).

Figure 3.3 illustrates the higher prevalence of this issue among NZ European and Others females compared to males in quartiles III and IV, which are the areas of residence with more restricted resources such as telephone or transport.

Figure 3.3: 'Food runs out in my/our household due to lack of money' by Quartile of NZDep96 for NZ European and Others, females and males⁺



⁺Difference between genders in the proportions who respond 'often or sometimes' to this statement is dependent on the level of deprivation after adjusting for age (adjusted Wald test $F_{3,1477} = 3.52, p = 0.01$).

Table 3.2 summarises the nutrients for which a difference in intake (as indicated by Usual Daily Median Intake) was observed by quartile of NZDep96 index. Quartile IV households had lower adequate intakes of seven nutrients (riboflavin, folate, calcium, manganese, dietary fibre, glucose and fructose).

Table 3.2: Intakes of nutrients which differ by NZDep96 quartile within the New Zealand population.

| <i>Nutrient</i> | <i>Sex</i> | <i>Quartile differences</i> |
|-----------------|------------|-----------------------------|
| Riboflavin | M | IV < II |
| | F | IV < I, II |
| Folate | M & F | IV < I |
| Calcium | M | IV < I, II |
| | F | IV < I |
| Manganese | M & F | IV < I, II |
| Dietary Fibre | M & F | IV < I, II |
| Glucose | M | IV < I, II, III |
| | F | IV < I, II |
| Fructose | M | IV < I, II, III |

3.4 Discussion

Food security by definition incorporates the aspects of affordability and accessibility to appropriate food. The relative importance of these various aspects of food security varies between countries, because economic stability, social structures, and food patterns are unique to each. Therefore, it is necessary to develop a tool which will capture the patterns of food security unique to a particular country, and identify vulnerable or at-risk sub-groups. It may also provide some insight into the reasons why food security has not been achieved among particular groups.

The eight indicator statements developed for, and used in the NNS97, provide data useful for a consideration of the issue of food security within NZ but of limited comparability to similar data in other developed nations. In the US for example, NHANES III collected data between

1988 and 1994 and found that 4.1% of households reported sometimes or often not having enough to eat (Alaimo, Briefel *et al.*, 1998; Kendall & Kennedy, 1998). The US Census Bureau Current Population Survey (CPS) concluded from their 1995 data that 7.8% of households were food insecure (Kendall & Kennedy, 1998). Food insufficiency in Queensland, Australia was estimated by Radimer *et al.* in 1993 (Radimer, Allsopp *et al.*, 1997) to affect 9.7 percent of households (8.2 percent males, 11.1 percent females). The 1995 Australian National Nutrition Survey found that 5 percent of adults (19 yrs and over) ran out of food and had no money to buy more (Australian-Bureau-of-Statistics, 1997b). This compares to *food runs out in my/our household due to lack of money* (indicator statement 2) being experienced *often* or *sometimes* by 14 percent of New Zealanders (11 percent males, 16 percent females). Given that similar but not identical tools or indicators were used to assess this aspect of food security direct comparisons of prevalence rates cannot be made, but insufficient food does appear to be a more prevalent problem among adults in NZ than in Australia.

Older people in NZ appear to be in households which are the most food secure. However, older people were under-represented in the focus groups and the indicator statements may be inadequate for this population subgroup. None of the indicator statements used embodied the issue of access to food, for example, proximity to supermarkets, or transport to food stores. This is a potential problem in areas of NZ, and one, which may disproportionately affect the elderly. Nevertheless, household food insecurity is most prevalent in early- to mid-adulthood when expenses for shelter (accommodation and clothes) and children's needs for health and education compete for resources for food.

Within younger age cohorts, there is a significant proportion who do not consider themselves to be food secure; who are unable to provision their households in the same way as their peers. Relying on others or on food grants or food banks for food should not be regarded as a normal practice, but as one, which marginalises. Riches (Riches, 1997) in his treatise on *First World Hunger: Food Security and Welfare Politics* states “that food banks stigmatise the poor, legitimise public begging, and mark the erosion of the social rights of citizenship”.

Differences in experiences of household food insecurity appear remarkably similar as reported by females and males, and they are particularly consistent for Pacific females and males—the ethnic group reporting the most food insecurity. While Pacific females and males ‘agree’ over aspects of food security, among NZ European and Others and NZ Māori, the degree of food insecurity is between two and 12 percent more likely to be reported as an issue by females. More females than males in these ethnic groups are likely to be solo parents (Mowbray & Dyal, 1994) and this situation is known to be related to poorer economic circumstances. However, food provisioning for a household is more often undertaken by women. Therefore, it is not surprising that 32 percent of Māori females are stressed about lack of money for food compared to 19 percent of Māori males. Similarly, 17 percent of Māori females, compared to 8 percent of Māori males, make use of special food grants or food banks when they do not have enough money for food. It may be that more women than men in NZ bear the burden of food insecurity. Prevalence rates of household food security between males and females must however be interpreted with particular caution. The instrument used to assess food security status may perform differently among household food-provisioners and non-provisioners, and this fact may influence ‘male’ responses, more so than ‘female’ responses.

Among ethnic groups, NZ European and Others consistently reported the least household food insecurity and Pacific people the most food insecurity. However, since both Pacific people and Māori are over-represented in the lower socio-economic groups it may be that ethnicity itself is not the determinant of food insecurity, but rather aspects of socio-economic status. Every effort was made to derive indicator statements equally relevant for all sectors of the population, but it could be argued that for some of the indicator statements, Māori and Pacific people have a different understanding to others. For example, they may place greater importance than NZ European and Others on provision of food for their household including the sharing of food (Ashcraft, 1985; Moata'ane & Guthrie, 2000), and therefore find it more stressful. It is possible that if household size were larger among Māori and Pacific people, they would be more likely to experience food insecurity due to the added possibility of inequitable food distribution within a larger household.

Not only does 'money' or income enable the purchase of adequate and appropriate food, but also it frequently determines area of residence. For NZ European and Others the very different response observed for males (no change with area of residence) and females (higher food insufficiency in areas with least resources) indicates that either male participants were unaware of this issue of food security as presented to them or they may to some extent be protected from it by their female partners. Studies in the UK (Dowler & Calvert, 1995) and in NZ (Parnell, 1997) exploring the effects of socio-economic disadvantage on nutritional status have noted that low energy and low nutrient intakes are most marked among women, compared to men or children which would support this view.

Among NZ Māori across NZDep96 quartiles there is also an increasing level of 'insufficient food' and a difference between genders. No interaction was found between gender and

NZDep96 quartile, as was observed among NZ European and Others ($p=0.015$). However there were insufficient NZ Māori in the sample to adequately explore this issue.

Results of the NNS97 showed that fruit and vegetable consumption were the most compromised in NZDep96 quartile IV, the quartile with the highest reported incidence of insufficient food (Russell, Parnell *et al.*, 1999). The NZ Nutrition Task force Guidelines (Department-of-Health, 1991) of three plus servings of vegetables per day and two plus servings of fruits were met by fewer of NZDep96 quartile IV residents compared to quartile I. The nutrients noted to be most compromised in NZDep96 quartile IV, were those provided by perishable foods; fruits, vegetables and dairy products.

In conclusion the indices of household food security developed as part of the NNS97 have differentiated between population subgroups: males vs females; selected ethnic groups; and across the age spectrum, of the adult population of NZ. It appears that the prevalence of household food insecurity among adult New Zealanders is greater than in Australia. In particular, improved household food security status of young adults, of women, and of NZ Māori and Pacific people is needed. The trend for aspects of food insecurity to be reported more by young adults compared to older is particularly serious. These are the years when healthy eating is important in order to prevent future problems for example, osteoporosis, raised blood cholesterol levels, high blood pressure. The data presented here suggest that many New Zealanders feel that they are not able to achieve this. As this cohort become older it will be vital to monitor their food security and nutritional health. If prevention is better than cure, action is required now.

4 The potential of Indices of Food Security Developed to Predict Nutrition Outcomes in the Adult Population

4.1 Introduction

The indices of food insecurity developed, modified and trialled in New Zealand to capture the prevalence among the population and sub-groups, have been described in Chapter 3 and elsewhere (Parnell, Reid *et al.*, 2001). The approach used followed that recommended in the US (Carlson, Andrews *et al.*, 1999), namely that the indicators (or indices) arose from an in-depth understanding of the experience of food insecurity in New Zealand households. As Wolfe and Frongillo note (Wolfe & Frongillo, 2001); ‘some aspects of the experience of food insecurity are probably reasonably universal across locations and cultures (but) the experience is likely to be locally specific in many aspects’. Commencing with Radimer’s concept, that ‘hunger is a managed process’ (Radimer, Olson *et al.*, 1990), the US research teams proceeded by recognizing ‘stages’ or ‘levels of severity’ in the experience of food insecurity. They concluded that although food insecurity is intrinsically multidimensional and is manifest in varying ways, it could also be measured unidimensionally, on a scale of increasing severity. The Rasch model was successfully used to scale the indices, each representing a dimension of food insecurity. It was capable of ordering the US food security indices by level of severity, including estimating the intervals between them (Carlson, Andrews *et al.*, 1999).

Eighteen indicator items were included in the US scale and ranked for households with children (ten, for households without children) (Olson, 1999). In addition, this scale of indices was divided into sub-sections or categories each with a defined

score-range. The sub-sections were conceptually distinct—within the range ‘food secure’ to ‘food insecure with severe hunger’ (Hamilton, Cook *et al.*, 1997). The consequence of preparing such categorical measures to classify households by food security status, was that it made it possible to examine nutrition and health outcomes across the spectrum of food insecurity within a population. In other words, levels of severity of food insecurity could be used to predict food and nutrient outcomes, and other health parameters such as body weight status (Olson, 1999).

The literature defining the relationships between poverty or socio-economic status (SES) (using objective measures) and nutrition outcomes is considerable (Davey-Smith & Brunner, 1997; Dowler & Dobson, 1997), but there remained a need to further explore the direct relationship between food security status (self-reported, and hence a subjective measure) and nutrition outcomes.

Bhattacharya and co-workers (Bhattacharya, Currie *et al.*, 2004) used the NHANES III data set which contained some questions on food security similar to those in the Core Food Security Model (CFSM). No ‘summary measure’ of food security status was able to be made, but food security questions were related to a Health Eating Index (HEI), and to inadequate serum levels of some nutrients. They concluded that food insecurity was a predictor of nutritional outcomes among adults; non-elderly adults who were food insecure had a less healthy diet and were more likely to be low in serum levels of some nutrients. Food insecure elderly not only had less healthy diets but a lower BMI than other elderly.

Should rigorously assessed food security status prove to be a reliable predictor of specific nutrition outcomes, then it will be a further level of evidence of the negative effects of food insecurity and particularly important to those setting food and nutrition policy for the regions where it is prevalent.

Development of a rigorous measure of food security may also be important given its potential as a further tool among those currently used for assessing and monitoring nutritional status. The assessment of nutrient intake for a population is a complex and expensive process (Gibson, 1990). Identifying households (the functional groups for food provision and distribution) as food secure or insecure, could be an effective technique for predicting that individuals within such households are or are not likely to be obtaining the nutrients they need for optimal health. Within a particular country, food security status could be an additional tool to predict risk of inadequate nutrient intake; valuable in circumstances when assessment of full nutritional status is not possible.

Categorical variables derived from the US Food Security Model (CFSM) (where indices were first ranked for level of severity by Rasch analysis) have been used to successfully predict nutrient intake among disadvantaged Canadian women, by Tarasuk and Beaton (Tarasuk & Beaton, 1999). Two studies—one in Trinidad-Tobago and the other in the UK—have used the shortened version of the US Food Security Module, to successfully predict food choice (Gulliford, Mahabir *et al.*, 2003; Tingay, Tan *et al.*, 2003). In both of these studies those categorized as most food insecure were less likely to choose fruits, salads and some vegetables.

No published studies using nationally representative samples report the predictive ability of accepted benchmark measures such as the US Core Food Security Module on nutrient intake. Similarly no reports of national surveys have been published exploring the paradoxical relationship between food security status and body weight status—where a fully validated measure of food security status has been used as the predictor variable.

The NNS97 carried out in New Zealand in 1997 (NNS97) (Russell, Parnell *et al.*, 1999) provided a data set which included responses to eight indices of household food security (Chapter 3). This chapter will first explore the possibility of ranking these Food Security Indices by level of severity (using Rasch analysis); develop categories of food security status from least to most food secure, and then determine whether household food security status is related to food choices, nutrient intake and to BMI.

4.2 Methods

The development of eight indices of food insecurity for New Zealand households and the prevalence of each aspect have been described in detail (Chapter 3). Each index was designed to capture one aspect of the experience of food insecurity:-

1. We can afford to eat properly: always/sometimes/never.
2. Food runs out in our household due to lack of money: often/sometimes/never.
3. We eat less because of lack of money: often/sometimes/never.
4. The variety of foods we are able to eat is limited by lack of money: often/sometimes/never.

5. We rely on others to provide food and/or money for food for our household when we don't have enough money: often/sometimes/never.
6. We make use of special food grants or food banks when we don't have enough money for food: often/sometimes/never.
7. We feel stressed because of not having enough money for food: often/sometimes/never.
8. It is stressful because we can't provide the food we want for social occasions: often/sometimes/never.

4.2.1 Development of a New Zealand Food Security Model.

Of the 4635 participants in the NNS97, 4608 provided data on their household food security status, 4576 a full range of food and nutrient data (from both 24-hour recall and FFQ) and 4552 both food security status and food and nutrient data.

Rasch analysis was performed on households reporting some food insecurity. The Rasch modeling approach used in the discipline of developmental psychology is believed to be relevant to other human sciences. It is a tool which takes a set of attributes (indices) of an underlying construct (food security) and:-

- Examines whether each of the attributes are discrete and contribute meaningfully to the construct and can then be ordered on a uni-dimensional scale (item difficulty).
- Explores or describes the responses of a group of individuals to the attributes, the patterns into which they fall, and places them on the same scale (Bond & Fox, 2001).

Its suitability for use with a set of food security indices, has been demonstrated on a US sample and is fully described by Derrickson et al. (Derrickson, Fisher *et al.*, 2000) and has been also described by Hamilton et al. (Hamilton, Cook *et al.*, 1997) and Carlson et al. (Carlson, Andrews *et al.*, 1999). It aims to produce in the first instance a uni-dimensional, continuous variable measure of the severity of food insecurity, which is reliable and internally valid.

In summary, this analysis can be used to first rank each household by the number of indices to which the participating household member responded positively. The scale value achieved depends both on the number of affirmative responses to the set of indices and on the severity or rank order (item calibration) of the indices to which they responded affirmatively. In other words, the more food secure a household the more likely there will be affirmative responses to the less severe indices. The expectation is that less severe indices will be responded to more often than more severe indices. The analysis also maps the food security indices, assigning them a calibration score, based on the probability of the participants in the households responding positively to that indicator. The resulting item calibration score orders the indices and denotes their spacing relative to one another, on a linear scale.

Both the household response measures and the severity of the indices are calibrated on the same linear scale. The analysis assigns a measure of reliability (standard errors of the item calibrations and household food security measures), to each estimate. Further, the goodness-of-fit (to the model) of each index is determined, by Mean Square Residuals (MNSQ), which are ratios of the observed versus the expected scores (Derrickson, Fisher *et al.*, 2000).

Rasch analyses on the NNS97 dataset were performed using BIGSTEPS 2.82 (Linacre & Wright, 1998). Polytomous rather than dichotomous Rasch models were used in all cases to utilize the full range of the possible responses. The statement 'I/we can afford to eat properly' was anchored at 0. This 'general' indicator of food security status assisted with comparing item difficulties for the remaining indices, particularly when making comparisons between populations or population sub-groups such as males vs females.

4.2.2 Assigning categories of household food security.

In order to obtain useful sub-ranges or categories of food security, scale cut points for three categories of household were assigned, following the ranking of the indices.

Cut points were assigned so that:-

1. The categories made sense conceptually (the cut points for the most food insecure category were set so that they included the indices 'rely on others for food and/or money for food' and 'use of special food grants/banks').
2. The distributions of households across the categories provided adequate cell sizes to enable statistical comparisons of outcome variables for each category.

The following dependent (outcome) variables were chosen on which to examine the effects of food security status.

A. Food choice outcomes.

Eight dependent food related variables were identified from the Qualitative Food Frequency Questionnaire (QFFQ) of the NNS97 (Russell, Parnell *et al.*, 1999).

1. Fruit serves 2+ per day.
2. Vegetable serves 3+ per day.
3. Fruit & vegetable serves 5+ per day.
4. Bread & cereal serves 6+ per day.
5. Bread serves 5+ per day.
6. Cereal serves 10+ per week.
7. Beef/veal serves 1+ per day.
8. Sausages/saveloys 1+ per day.

Variables 1-4 were taken directly from the New Zealand Dietary Guidelines for Adults (Department-of-Health, 1991). Variables 5 and 6 were arbitrarily chosen in order to examine separately the possible effect of food insecurity on choice of breads and cereals. Although this stated dietary guideline combines breads and cereals (choose at least six serves of breads and cereals each day), in New Zealand bread was relatively more frequently chosen among cereals in general (Russell, Parnell *et al.*, 1999). Variables 7 and 8 arose from the Dietary Guideline, which recommends one serve per day from the group 'meat and alternates' and further that the meat choice be lean. This was on the basis that few New Zealanders avoid red meat (Russell, Parnell *et al.*, 1999), and lean meats tend to be more expensive. Therefore, one relatively lean but expensive meat group (beef/veal) and one relatively fatty but cheap meat group (sausages/saveloys) were selected. Sausages

and saveloys are comminuted or finely ground meat, mixed with cereals and distinctive spices and flavourings, encased in a skin.

B Nutrient intake outcomes and body weight status.

Daily intake of energy and nutrients was calculated from the primary 24-hour diet recall of each participant (Parnell, Wilson *et al.*, 2001; Russell, Parnell *et al.*, 1999). Each participant was weighed and their standing height measured and then BMI was calculated as weight in kg/height in meters². The procedures used have been described elsewhere (Parnell, Wilson *et al.*, 2001; Russell, Parnell *et al.*, 1999).

4.2.3 Prediction of nutrition outcomes by household food security category.

Associations between the resultant three categories of food security and BMI, mean daily energy intake and intake of selected nutrients derived from 24-hour diet recall data, were investigated by Analysis of Variance (ANOVA) controlling for: sex (M, F); ethnicity (NZ European and Others, NZ Māori, Pacific); NZDep96 quartile; place of residence (urban, rural); level of education (no qualification, school only, post-school only, school and post-school); annual household income (\leq \$20,000, >\$20,000-\$30,000, >\$30,000-\$50,000, >\$50,000); household number (1-4, 5-6, 7+). The statistical package SAS, Version 8.02 was used for these analyses.

Both body weight status and nutrient intakes had been shown to vary by sex, ethnicity, NZDep96 quartile, place of residence, level of education, income and household number, in bivariate analyses.

4.3 Results

4.3.1 Food security indices: ranking and categorization.

Rasch Analysis

This was performed on participants of 1868 households reporting some food insecurity. (One extreme household responded positively to the full extent to all indices, so that it could not be assigned a food security score and was removed from the analysis.) Tables 4.1, 4.2 and 4.3 summarise the statistics for the 'households' and for the eight indices of food security to which they responded.

Table 4.1 shows that for the household responses to the eight indices the mean measure (or score) achieved ranked on a scale of 4 to -4, is 2.19, the minimum -2.92 and the maximum 3.84. Thus the indices used successfully separate out and 'scale' the household's experiences of food security. This is demonstrated visually on the left-hand side of Figure 4.1.

Subject (household) reliability (the proportion of variance in respondent scores that is not due to measurement error), a measure of whether households respond to the indices in a similar order, lies between 0.60 and 0.66. This is close to a level conventionally regarded as acceptable: >0.7 (Linacre & Wright, 1998).

The fit for each index (infits and outfits) are shown and they lie between 0.80 and 1.25, which is an acceptable range (Wright & Linacre, 1994).

Table 4.1: Summary of Rasch analysis statistics for 1868 households.

| | Raw Score | Count | Measure | Model Error | INFIT | | OUTFIT | |
|------------------------|-----------|--------|---------|-------------|-------|--------------------------|--------|------|
| | | | | | MNSQ | ZSTD | MNSQ | ZSTD |
| Mean | 20.3 | 8.0 | 2.19 | 0.85 | 0.99 | -0.2 | 0.99 | -0.2 |
| S.D. | 2.9 | 0.2 | 1.50 | 0.19 | 0.53 | 1.0 | 0.85 | 1.0 |
| Max. | 23.0 | 8.0 | 3.84 | 1.29 | 3.88 | 3.8 | 9.90 | 4.6 |
| Min. | 4.0 | 2.0 | -2.92 | 0.65 | 0.01 | -2.7 | 0.01 | -2.7 |
| Real RMSE | .95 | ADJ.SD | 1.17 | SEPARATION | 1.23 | SUBJECT* RELIABILITY .60 | | |
| Model RMSE | .87 | ADJ.SD | 1.23 | SEPARATION | 1.41 | SUBJECT* RELIABILITY .67 | | |
| SE OF SUBJECT MEAN .03 | | | | | | | | |
| * Subject = household. | | | | | | | | |

Similarly, Table 4.2 shows the spread of the scores for the indices on the same scale as that used for the household response: 4 to -4. The minimum score -1.66 was achieved by the index ‘use of special food grants/banks’. In other words, this was the index least reported and at the same time most severe. The maximum score of 1.86 was that achieved by the index ‘variety of foods eaten limited’ ie the index most often reported to be experienced and at the same time the least severe index of food insecurity. This is shown visually on the right hand side of Figure 4.2.

Item (index) separation is in the range 17.20 to 17.77, indicating that each index is capturing a distinct aspect of food insecurity.

Table 4.2: Summary of Rasch analysis statistics for eight measured indices.

| | Raw Score | Count | Measure | Model Error | INFIT | | OUTFIT | |
|-------------------------|-----------|--------|---------|-------------|-------|-----------------------|--------|------|
| | | | | | MNSQ | ZSTD | MNSQ | ZSTD |
| Mean | 4739.8 | 1861.1 | -0.01 | 0.05 | 1.02 | 0.2 | 0.99 | -0.6 |
| S.D. | 370.7 | 1.5 | 0.96 | 0.01 | 0.14 | 3.7 | 0.15 | 3.3 |
| Max. | 5265.0 | 1864.0 | 1.86 | 0.07 | 1.25 | 6.8 | 1.24 | 5.2 |
| Min. | 3920.0 | 1859.0 | -1.66 | 0.04 | 0.85 | -4.5 | 0.80 | -4.8 |
| Real RMSE | .06 | ADJ.SD | .96 | SEPARATION | 17.20 | QUESTION* RELIABILITY | 1.00 | |
| Model RMSE | .05 | ADJ.SD | .96 | SEPARATION | 17.77 | QUESTION* RELIABILITY | 1.00 | |
| SE OF QUESTION MEAN .36 | | | | | | | | |
| * Question = index. | | | | | | | | |

Table 4.3 presents the ‘ordering’ by measure (score) of the eight indices from the least to the most food secure.

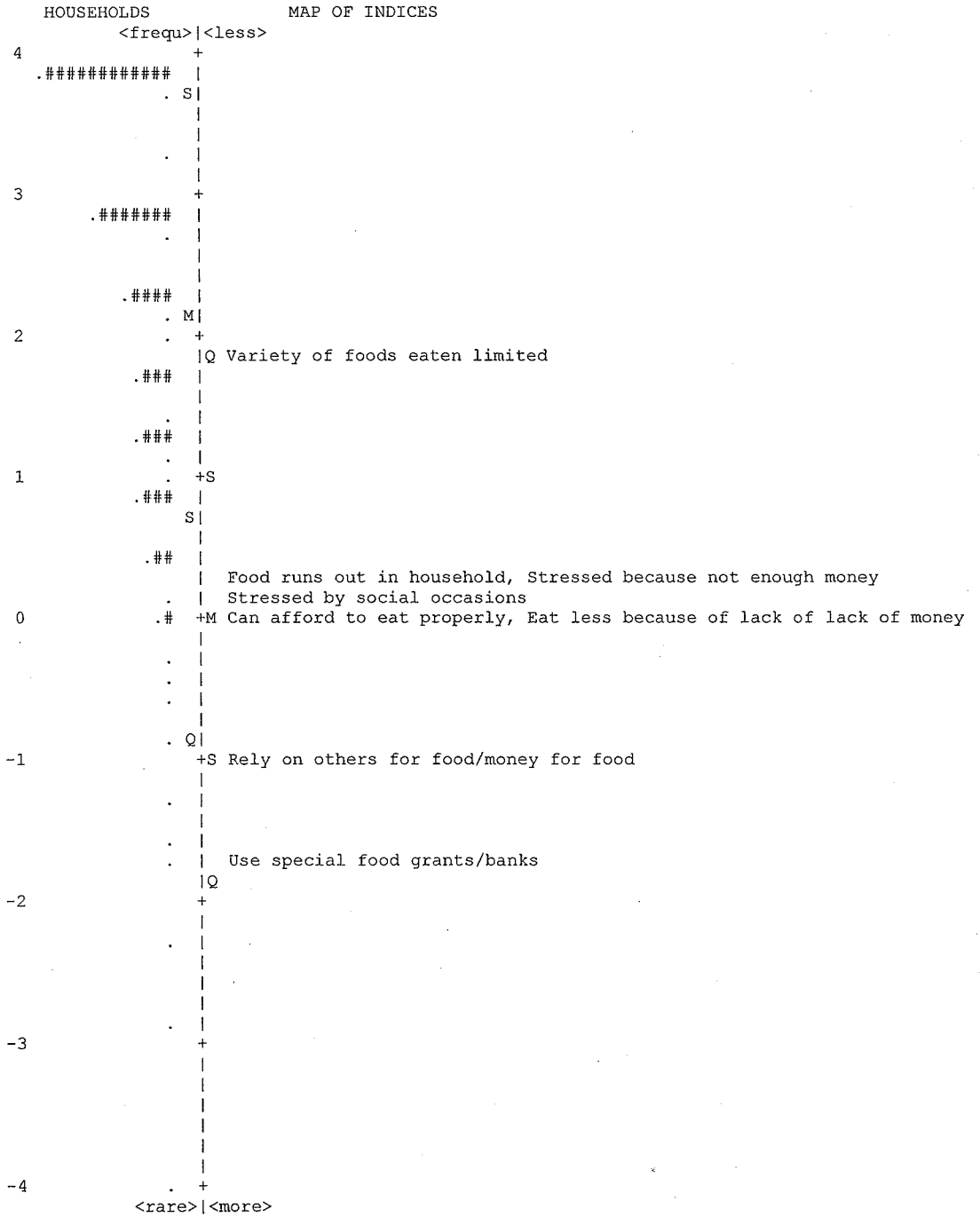
Table 4.3: Indices of food security presented in measure order ie from least to most severe food insecurity.

| Entry No. | Raw Score | Count | Measure | Error | INFIT | | OUTFIT | | PTBIS CORR. | Indicator Statement |
|-----------|-----------|-------|---------|-------|-------|------|--------|------|-------------|-----------------------------------|
| | | | | | MNSQ | ZSTD | MNSQ | ZSTD | | |
| 4 | 3920 | 1861 | 1.86 | .04 | 1.03 | .9 | 1.03 | 1.1 | C .35 | Variety of foods eaten limited |
| 7 | 4659 | 1859 | .30 | .05 | .91 | -2.8 | .82 | -4.8 | b .60 | Stressed because not enough money |
| 2 | 4663 | 1861 | .30 | .05 | .92 | -2.6 | .88 | -3.1 | c .54 | Food runs out in household due |
| 8 | 4750 | 1862 | .09 | .05 | 1.25 | 6.8 | 1.24 | 5.2 | A .37 | Stressed by social occasions |
| 3 | 4771 | 1859 | .02 | .05 | .85 | -4.5 | .80 | -4.8 | a .58 | Eat less because of lack of money |
| 1 | 4781 | 1861 | .00A | .05 | .96 | -1.3 | 1.00 | -1 | d .42 | Can afford to eat properly |
| 5 | 5109 | 1864 | -.98 | .06 | 1.22 | 5.0 | 1.17 | 2.2 | B .40 | Rely on others for food/money |
| 6 | 5265 | 1862 | -1.66 | .07 | 1.01 | .2 | .98 | -.2 | D .45 | Use special food grants/banks |
| Mean | 4740. | 1861. | -.01 | .05 | 1.02 | .2 | .99 | -.6 | | |
| S.D. | 371. | 1. | .96 | .01 | .14 | 3.7 | .15 | 3.3 | | |

Figure 4.1 maps on the left hand side the household 'measure'/score of food insecurity, on a scale from -4 to +4; around the anchor point (arbitrarily assigned 0) indicator 'can afford to eat properly'.

It also maps on the right hand side the eight indices of food insecurity in measure (score) order: with the indicator 'the variety of foods eaten in limited' being the most frequently reported and least severe index, and the index 'use of special food grants/food banks' being the least frequently reported but most severe index on the scale.

Figure 4.1: Ranking of households and indices on food security scale, by level of severity.



= Approximately 50 households.

As demonstrated in Figure 4.1, the moderately food secure group have the highest probability of experiencing 'limited variety of foods eaten', 'running out of food', 'stress because of not enough food', 'stress because of not enough food for social occasions', or 'eating less because of lack of money'. This group are unlikely to report having undertaken any resource augmentation actions.

The low food security group, has the highest probability of respondents reporting that they have also experienced resource augmentation actions in addition to the likelihood of having experienced other aspects of food insecurity.

Rasch Analysis was also performed separately for households where the respondent was female and for households where the respondent was male. Results are presented figuratively in Appendix B-1, 2. Table 4.4 compares the summary statistics from Rasch analysis for males and females separately, demonstrating the superior reliability of the model when data are reported by females. The subject reliability for females is in the range 0.64-0.69 compared to males 0.50-0.59.

Table 4.4: Rasch Model performance statistics comparing the assessment of household food security reported by males and females.

| | Males | Females | Males & Females |
|---|-----------|-----------|-----------------|
| N | 647 | 1221 | 1868 |
| Subject Reliability | | | |
| Real RMSE | 0.50 | 0.64 | 0.60 |
| Model RMSE | 0.59 | 0.69 | 0.66 |
| Item Separation | | | |
| Real RMSE | 10.11 | 13.99 | 17.20 |
| Model RMSE | 10.48 | 14.47 | 17.77 |
| Item Fit (Range of Infits {MNSQ} and Outfits) | 0.79-1.32 | 0.80-1.26 | 0.80-1.25 |

4.4 Categories of Food Security

Three categories across the range of severity of food insecurity were assigned:-

1. Fully/almost food secure: Households providing no affirmative response to any of the eight indices of food insecurity (n=2720) and households responding to any one of the indices (n=557).
2. Moderate food security: Scale reading 0 – 2.00 (n=1079).
3. Low food security: Scale reading < 0 (n=196).

4.4.1 Predictive ability of food security on food choice.

Table 4.5 describes the odds of meeting the specified food guideline, by category of food insecurity, compared to the reference class of fully/almost fully secure.

Table 4.5: OR's* (CI) for likelihood of meeting a food guideline by category of food security status, for the household.

| Food Guideline | Household Food Security Category | | |
|--|----------------------------------|----------------------------|-----------------------|
| | Fully/almost fully secure | Moderate security (95% CI) | Low security (95% CI) |
| N | 3277 | 1079 | 196 |
| Fruit 2+ per day | 1.0 | 0.63(0.54-0.73)* | 0.50(0.37-0.70)* |
| Vegetables 3+ per day | 1.0 | 0.61(0.53-0.70)* | 0.53(0.40-0.71)* |
| Fruit & Veg 5+ per day | 1.0 | 0.58(0.50-0.67)* | 0.43(0.31-0.59)* |
| Bread & Cereals 6+ per day | 1.0 | 1.28(1.07-1.53)* | 1.39(1.00-2.0) |
| Bread 5+ per day | 1.0 | 1.26(1.10-1.48)* | 1.35(0.97-1.89) |
| Cereals 10+ per week | 1.0 | 0.97(0.80-1.20) | 0.81(0.51-1.29) |
| Beef/Veal 1+ per week | 1.0 | 0.81(0.71-0.93)* | 0.62(0.47-0.83)* |
| Saus ⁺ /Sav ⁺⁺ 1+ per week | 1.0 | 1.57(1.36-1.82)* | 1.65(1.23-2.23)* |

* OR's are significant at the 5% level.

ANOVA, controlling for sex, ethnicity, NZDep96 quartile, place of residence, level of education, annual household income, household number.

⁺ Sausages.

⁺⁺ Saveloys.

Compared to the fully/almost fully secure households, those moderately or of low security, are less likely to consume recommended daily servings of fruit, vegetables (separately and combined), less likely to consume leaner meats such as beef and veal, and more likely to consume fatty meats such as sausages and saveloys. The moderately secure group consumed more daily serves of bread (and breads and cereals combined) than those in fully/almost secure households.

4.4.2 Predictive ability of food security on nutrient intake.

For the three assigned categories of household food security the intakes of energy and selected nutrients (mean daily intakes) are presented, controlling for sex, ethnicity, Index of Deprivation, urban/rural location, age, level of education, income, and household size (Table 4.6). Category of household food security was associated with the level of intake of total fat, saturated, monounsaturated and polyunsaturated fat, cholesterol, glucose, fructose, lactose, vitamin B6, vitamin B12, and vitamin C.

Table 4.6: Adults energy and nutrient* intakes by category of household food security.

| Mean daily intakes (adjusted) | Fully secure/almost fully secure | Moderate food security | Low food security | p-value for difference in adjusted means |
|-------------------------------|----------------------------------|------------------------|-------------------|--|
| n % | 3277 (72.0%) | 1079 (23.7%) | 196 (4.3%) | |
| Energy (Kj) | 9,905 | 10,068 | 10,519 | 0.104 |
| Protein (g) | 92.0 | 92.7 | 94.5 | 0.743 |
| CHO (g) | 271 | 271 | 280 | 0.498 |
| Fat (g) | 90.7 | 95.9 | 98.8 | 0.008 ⁺ |
| Sat. Fat (g) | 38.4 | 40.5 | 42.2 | 0.017 ⁺ |
| MUS Fat (g) | 30.8 | 32.3 | 33.4 | 0.026 ⁺ |
| PUS Fat (g) | 12.4 | 13.3 | 13.4 | 0.015 ⁺ |
| Chol (mg) | 314 | 323 | 367 | 0.007 ⁺ |
| Tot. Sugars (g) | 117 | 114 | 120 | 0.350 |
| Sucrose (g) | 58.6 | 58.7 | 62.5 | 0.484 |
| Glucose (g) | 20.3 | 18.4 | 18.7 | 0.005 ⁺ |
| Fructose (g) | 21.9 | 20.1 | 19.8 | 0.013 ⁺ |
| Lactose (g) | 11.7 | 11.9 | 14.3 | 0.028 ⁺ |
| Vit A µgRE | 979 | 1074 | 1059 | 0.500 |
| Thiamin (mg) | 1.41 | 1.41 | 1.35 | 0.582 |
| Riboflavin (mg) | 1.65 | 1.65 | 1.77 | 0.193 |
| Vit B ₆ (mg) | 1.48 | 1.39 | 1.44 | 0.010 ⁺ |
| Vit B ₁₂ µg | 4.78 | 5.49 | 6.12 | 0.025 ⁺ |
| Vit C (mg) | 113 | 104 | 101 | 0.040 ⁺ |
| Folate (µg) | 239 | 231 | 230 | 0.171 |
| Calcium (mg) | 541 | 532 | 512 | 0.275 |
| Iron (mg) | 12.8 | 12.7 | 12.7 | 0.919 |
| Zinc (mg) | 13.4 | 13.6 | 14.2 | 0.377 |

* Mean values adjusted for: sex, ethnicity, NZDep96, urban/rural status, education, income, age and household size.

⁺ Significant difference in intake by Food Security Category, when at least one of the group mean values differs from an other (p<0.05) ANOVA.

4.4.3 Food security category in relation to Body Mass Index (BMI).

Adjusted mean BMI is lowest for participants within the fully/almost fully food secure category of households (28.7) compared to those in households of moderate food security (29.2) and is highest for those in the households which have low food security (29.5). These BMI levels are significantly different across food security categories $p=0.015$ (ANOVA).

4.5 Discussion

The need to measure household food security has been accepted and promoted in third world situations, where relief and development organizations are required to be accountable for their programs (Wolfe & Frongillo, 2001). Among developed countries, only the US has developed a population based tool 'The US Core Food Security Measure'. It has been adapted for use in Brazil (Perez-Escamilla, Segall-Correa *et al.*, 2004) and the translated and adapted version tested for validity, qualitatively and quantitatively. No published data indicate that other developed countries have given priority to the development of a specific rigorous and objective measure of food security. Food security is nevertheless, widely recognized as a phenomenon of importance, its potential causes are commented on and a multitude of solutions planned to mitigate its effects (NSW-Department-of-Health, 2003).

In this New Zealand model, the indices differ from those included in the US Core Food Security Measure in the following ways. They:-

1. Were presented to the participants as statements (to which they could respond: never/always, sometimes, often), and not as questions.
2. Are fewer in number (eight compared to 18 for US families with children) which minimized respondent burden, and were suitable for all participants in the NNS97, regardless of income level (data were obtained on a full national sample with no prior income level screening).
3. Included resource augmentation actions, eg obtaining food from friends, relatives or charitable sources. These intermittent actions in the NZ context were considered to have only a temporary effect on food security status, and to be socially unacceptable in all circumstances (Reid, 1997; Riches, 1997).

The Rasch analyses of the New Zealand indices described in this chapter have provided evidence that a relatively small number of multi-dimensional food security indices (eight), can be translated to a uni-dimensional scale. Further, the categories developed from this scale have the ability to predict aspects of nutritional status—namely, food and nutrient intakes and body weight status, independently of other potential socio-economic indicators, such as level of education, and annual household income.

The New Zealand model has marginal 'household' reliability (between 0.60 and 0.66), as it is considered that reliability is marginally satisfactory at >0.7 (analogous to Cronbach's alpha) (Derrickson, Fisher *et al.*, 2000). When data for household food security have been provided by women, reliability lies between 0.64 and 0.69,

demonstrating that better or more reliable data are provided by women compared to men (Table 4.4). This is likely to be because women more often than men would be expected to be the major food provisioner for a household and thus have a greater awareness of food security issues.

Item separation for the eight indices lay between 17.20 and 17.77 above the item separation levels reported by Derrickson for the US Core Food Security Model (Derrickson, Fisher *et al.*, 2000), of 9.29. Such a high item separation index is an indication that the indices chosen for this model, are adequate to define a line of increasing intensity.

The Infit and Outfit values for the indices range from 0.8-1.25 (within the range 0.5-1.5 considered acceptable (Wright & Linacre, 1994)). These statistics from the Rasch model, compare the observed proportions of positive responses to each index, with the proportions expected by the model assumptions (Connell, Nord *et al.*, 2004). Values exceeding 1 show that a disproportionate number of responses have not followed the expected order, which is that respondents would give positive responses to less severe indices prior to a positive response to the index in question. Values less than 1 indicate that an item is not contributing useful information to the overall measure of food insecurity. Thus item fit which is the extent to which the chosen indices fit the Rasch model, is satisfactory. In other words, each of the eight indices selected from the original focus group analyses, to represent the experience of food insecurity in the New Zealand population could be considered to be appropriate. This is pleasing given other studies have proposed more items only to

find inadequate fit for some of them, leading to a reduced set of items. The 8 items originally proposed here have all displayed adequate evidence of fit.

While the Rasch model assumes a basic pattern of response (to household food security indices) clearly some households would not fit the expected pattern, such as always responding to easier indices before more difficult indices. Derrickson quotes an acceptable misfit rate of $\leq 5\%$ and in these data the misfit rate for infits and outfits is lower at 4.1 (Derrickson, Fisher *et al.*, 2000). This misfit rate has been calculated as the percent of respondents who ‘misfit’ on at least one of the infits and outfits—where misfitting is defined as having the mean square value >1.2 and the absolute value of the standardized Z score >2 . The reasons for misfit are not clear, but may be because some respondents did not fully comprehend the statements (indices) presented to them. In further studies using these indices, more rigorous introductory explanations of the issues at stake could be necessary.

It appears that this 8-index model (The NZ Food Security Model) is sufficient to assess the phenomenon of food security in the New Zealand population. The indices ‘Relying on others for food or money for food’ and the ‘Use of special food grants or food banks’ have been demonstrated to fit in the NZ model. Such resource augmentation questions did not do so in the US (Hamilton, Cook *et al.*, 1997). The difference is likely to be that such actions in New Zealand, while they are last resort responses to food insecurity, can only temporarily alleviate the situation. They cannot eliminate it as they depend upon voluntary charitable responses which are often a food parcel intended to supplement a household’s food for less than one week and do not result in any more permanent government funded institutional

response—such as might occur in the US (Hamilton, Cook *et al.*, 1997; McKay, 1995). New Zealand has no programmes analogous to the ‘Women’s, Infant’s and Children’s-WIC’ programme where enrollment is for a longer term or duration.

The scale divisions of the NZ Food Security Model set to assign categories of food security status, can be considered satisfactory for several reasons. Intuitively the resource augmentation actions (two indices) would be expected to be taken only by households experiencing the most severe form of food insecurity. On the other hand the food security index ‘Variety of foods is limited...’ was the most frequently experienced aspect of food insecurity across all age, sex, and ethnic sub-groups of the population (Parnell, Reid *et al.*, 2001); it is the aspect of food insecurity at the least severe end of the scale. The demonstrated ability of the categories as assigned, to predict nutritional outcomes is further evidence of their external validity.

The cumulative evidence from a variety of studies (Dowler & Calvert, 1995; Gulliford, Mahabir *et al.*, 2003; Kendall, Olson *et al.*, 1996; Tarasuk & Beaton, 1999; Tingay, Tan *et al.*, 2003) has demonstrated that when economic circumstances engender food insecurity, fruits and vegetables are the first groups of foods to be reduced or omitted in the diet. Also, food insecurity in Brazil (Perez-Escamilla, Segall-Correa *et al.*, 2004) has been shown to reduce the intake of fruits and vegetables. This is to be expected, given their relatively low energy density and perishability (Drewnowski & Specter, 2004). These results from the NNS97 illustrate that in the NZ population, the level of food insecurity increased the probability of eating less than the recommended number of servings of fruits and vegetables. The declining levels of intake of fructose and glucose with increasing

level of household food insecurity are fully congruent with these food choice data, since fruits are the largest contributors of fructose and glucose to the diet in New Zealand (LINZ., 1999). Any education efforts to promote the intakes of fruits and vegetables are likely to be ineffective for the food insecure where a lack of money is the underlying condition.

Since fruit is the most abundant source of vitamin B6 in the NNS97 (Russell, Parnell *et al.*, 1999), the observation that vitamin B6 intake is significantly related to food security status (intake is lower for the food insecure) might be expected. The food insecure are least likely to meet the guideline for recommended number of servings of fruit, and this is reflected in the lower fructose, glucose, vitamin B6 and vitamin C intakes; all nutrients primarily supplied by fruit.

In the NZ population where it is clear that meat is a dietary preference (Russell, Parnell *et al.*, 1999), rather than omitting meat from the diet, food insecurity moves the meat choice toward cheaper, higher fat options. It is possible that in New Zealand food insecurity could result in some reduction in meat portion size or frequency of consumption overall, similar to what was noted in Brazil, namely that the food insecure were less likely to consume meat on a daily basis (Perez-Escamilla, Segall-Correa *et al.*, 2004). While this question cannot be entirely resolved from the data presented, the fact that vitamin B12 intake (25% of which is sourced from animal products such as meat), was significantly higher among the most food insecure, points to the conclusion that meat portion size is not reduced. However, the deduction can be made from these analyses that for the food insecure

there is an economic barrier to achieving recommended dietary practices i.e. choosing lean meats.

There is further evidence for the relationship between food security status and both food and nutrient intake. The least food secure have higher intakes of total, saturated, monounsaturated and polyunsaturated fats and also cholesterol. Such a relationship between food security status and level of fat intake in the diet has not been demonstrated before either in studies where a surrogate food security measure has been used (Kendall, Olson *et al.*, 1996; McIntyre, Connor *et al.*, 2000; Rose & Oliveira, 1997) or in the one study where the predictive variable was the validated US measure of food security status (Tarasuk, 2001). The particularly striking variation in fat intake (10% higher for the least food secure category compared to the most food secure category) has not before been demonstrated. Again, for New Zealanders, it illustrates that achieving dietary goals (in this case to reduce the proportion of energy from fat, in particular saturated fat) is impeded by food insecurity (Department-of-Health, 1991). The fact that 5% of the population are in severely food insecure households and many more in moderately food insecure households, highlights the fact that a reduction in food insecurity might impact on the fat intake of the population.

Lactose intake is a marker of dairy product consumption. Dairy products are frequently consumed in the NZ diet particularly the high fat options such as full cream milk and cheddar cheese (Russell, Parnell *et al.*, 1999). Given the higher lactose intake by the food insecure it appears that dairy products in New Zealand, may contribute to the fat burden of the food insecure.

Studies where food security status or its proxy (e.g. food insufficiency) have been used to predict nutrient intakes as follows: vitamin C (Dowler & Calvert, 1995; Kendall, Olson *et al.*, 1996; McIntyre, Glanville *et al.*, 2003; Tarasuk & Beaton, 1999), iron (Dowler & Calvert, 1997; Kendall, Olson *et al.*, 1996; McIntyre, Glanville *et al.*, 2003; Tarasuk & Beaton, 1999), calcium (Kendall, Olson *et al.*, 1996; Tarasuk & Beaton, 1999), folate (Dowler & Calvert, 1997; McIntyre, Glanville *et al.*, 2003; Tarasuk & Beaton, 1999), dietary fibre (Dowler & Calvert, 1997; Kendall, Olson *et al.*, 1996), or vitamin A (McIntyre, Glanville *et al.*, 2003; Tarasuk & Beaton, 1999). However more extensive measures of nutrient intake were used in these studies on smaller and relatively homogeneous population, compared to this study. Also, within any given country or culture, the relative costs of particular foods or beverages and the foods which are 'preferred' are likely to differ (Drewnowski & Specter, 2004). Food insecurity might therefore be expected to be associated with food and nutrient intake levels uniquely in different countries or cultures. However, it must be emphasized that while in New Zealand household food security appears to be unrelated to the current intakes of iron, calcium and folate for example, intakes of these nutrients in the population are not necessarily ideal (Russell, Parnell *et al.*, 1999); factors other than food security status may influence the food choices determining their level of intake and utilization.

The finding that members of the most food insecure households in the New Zealand population were the group with a significantly higher body weight status adds evidence to that of earlier studies of the existence of this (paradoxical) relationship. Olson (Olson, 1999) recorded that moderately food insecure women had BMI levels

two points above the food secure, but the relationship between food security status and BMI was not seen for the severely food insecure where overall level of intake rather than quality of intake only might have been compromised. Townsend (Townsend, Peerson *et al.*, 2001) also noted that for US women percent overweight of the moderately insecure was 52% compared to 34% for the food secure. Vozoris and Tarasuk (Vozoris & Tarasuk, 2003) however found that Canadian men in food insufficient households were less likely to be overweight than those in food sufficient households. The evidence presented here of a relationship between food security status and BMI for the whole adult population, males and females, is significant given that a validated, country-specific model of food security has been used, on a nationally representative sample.

The most food insecure household members were not only most likely to have a higher BMI, but to be eating the highest fat diets and to be the lowest consumers of fruits and vegetables. This adds weight to the evidence of a relationship between poorer food choice and body weight status. The food insecure self-reported that they were unable to afford the food they would have liked for their household. These data demonstrate that those reporting food insecurity in their household, currently had poorer levels of intake of some nutrients.

The evidence for the conclusion that the instrument has validity (fitness for purpose) as outlined by Frongillo (1999) is as follows. The construction of the items was 'well grounded' in the verbalized experiences of food insecure New Zealanders, albeit women rather than men. In accord with item response-theory (Rasch analysis) a logical sequence of response from less to more severe 'experience' was

demonstrated in not one but two national samples of households. Internal consistency has been reasonably upheld with good separation of the items (each capturing a distinct aspect of the phenomenon), and performing reasonably reliably in the model. Household food security status was associated with nutrition outcomes in an 'expected manner'; the members of the most food insecure households had the poorest nutrition.

4.6 Conclusions

A population specific model of food security has been successfully developed for use in New Zealand. It illustrates that the relatively short eight-index food security model was effective and the underpinning aspects of food insecurity were successfully captured in the focus group method used in the development phase. The NZ Food Security Model had an acceptable respondent burden for use in national surveys (Chapter 3) and is an instrument with internal and external validity.

The evidence for the conclusion that the instrument has validity (fitness for purpose) as outlined by Frongillo (1999) is as follows. The construction of the items was 'well grounded' in the verbalized experiences of food insecure New Zealanders, albeit women rather than men. In accord with item response theory (Rasch analysis) a logical sequence of response from less to more severe 'experience' was demonstrated in not one but two national samples of households. Internal consistency has been reasonably upheld with good separation of the items (each capturing a distinct aspect of the phenomenon), and performing reasonably reliably in the model. Household food security status was associated with nutrition

outcomes in an 'expected manner'; the members of most food insecure households had the poorest nutrition.

Given the demonstrated ability of food security status to predict ability to meet recommended food guidelines and also nutrient intakes, particularly those well known to influence health, its use could now be considered as one of the markers of nutritional status in the New Zealand population.

For the first time a validated, population-specific food security measurement has been associated with ability to meet food guidelines, nutrient intakes and BMI. Food insecure household members in New Zealand are less likely to choose fruits and vegetables and more expensive leaner meats, to have higher fat intakes and Vitamin B12 intakes, lower fructose and glucose intakes and higher BMI's. This provides further evidence of the need to address the issue of food insecurity if nutritional health of the nation is to be improved.

5 Food Insecurity Among New Zealand's Children: Prevalence and Association with Nutrition

5.1 Introduction

Prior to the development of robust indicators of food security, studies in several developed countries, raised the questions of whether the children in 'disadvantaged' households experienced insufficient food, and further whether it affected their nutrient intakes, physical development or health status (Dowler & Calvert, 1995; Murphy & Bayer, 1997).

In 1992, Cristofar and Basiotis (Cristofar & Basiotis, 1992) reported on their analysis of 1985-86 data from a low income sample in the USDA Continuing Survey of Food Intakes by Individuals (CSFII) and concluded that there was a much less convincing relationship between household food sufficiency status and food and nutrient intake among the children compared to that noted for women. Wehler et al (Wehler, Scott *et al.*, 1992) constructed a 'measure of hunger' for use in the US (The Community Childhood Hunger Identification Project-CCHIP). Their definition of hunger was 'the mental and physical condition that comes from not eating enough food, due to insufficient economic, family or community resources'. Acknowledging that reliable measures of mental or physical changes were not achievable, they focused on food insufficiency and developed a scale, encapsulating eight concepts of 'hunger' with a time-scale over which each aspect was experienced. In a sample of 377 low income families, they noted that a higher hunger score correlated with more health problems and school absences among children.

Further studies on large data sets explore these issues. The CSFII data sets of 1989-1991 and 1994 allowed Kennedy and Powell (Kennedy & Powell, 1997) to examine and report on the nutrient intake of children by Food Sufficiency Status (a three-question level of severity indicator). They reported that the children from households 'less food secure' had lower energy intakes and higher intakes of total and saturated fat. Alaimo et al. (Alaimo, Olson *et al.*, 2001) explored the paradox of food insufficiency in relation to overweight in US children (National Health and Nutrition Examination Survey—NHANES III). Such an association was only found among older (8-16 years), low-income, white (non-Hispanic) girls. This was not noted among younger children, Black or Mexican children, or males.

With the advent of the US Core Household Food Security Module (CFSM) more robust assessments of the health and nutrition outcomes among the food insecure have been possible. Casey and co-workers on a sample of 399 children used this module and examined the relationship between categories of household food insecurity and health-related quality of life (HRQOL) by telephone survey and in an economically depressed region of the US. The HRQOL included physical, social and school functioning. They concluded that the children in food insecure households had poorer HRQOL than those in food secure households (Casey, Szeto *et al.*, 2005).

The more recent Children's Sentinel Nutrition Assessment Project (C-SNAP) provided data on over 11,000 urban US children. Their caregivers responded to the CFSM, enabling categorization of the children by severity of food insecurity. Food insecurity exposure for infants and toddlers ≤ 3 years was clearly associated with

poorer health status and health problems requiring hospitalization (Cook, Frank *et al.*, 2004).

Battacharya et al. (Bhattacharya, Currie *et al.*, 2004) used the NHANES III data set to explore whether food insecurity was related to nutrition outcomes across all age groups. For school children they concluded that food insecurity was not related to nutritional outcomes. However, for these analyses the assessment of food security status and of nutritional outcomes can be questioned. The food security 'questions' were close to but not those of the US CFSM. The nutritional outcomes did include BMI, a composite measure of low serum values of selected nutrients, and rather than nutrient intake per se, the USDA's Healthy Eating Index (HEI).

A number of researchers raise the question of whether within food insecure households, children are protected by caregivers, in particular their mothers. Indeed, the development of the CFSM, espouses this perspective, as among households with children those considered most severely food insecure, are those where the children within them report experiencing hunger. The assumption is that among more food secure households, children will be less likely to be nutritionally affected. Kaiser et al. (Kaiser, Melgar-Quinonez *et al.*, 2002) used the 12-item Radimer-Cornell index of food security to predict nutrition outcomes on a convenience sample of 239 Mexican-American parents with children 3-6 years. Children in the most food-insecure households were least likely to meet Food Guide Pyramid recommendations. Meats and vegetables were the groups of foods most affected by food insecurity. However, food insecurity level was not associated with body weight and height status. The

authors concluded that ‘children may be somewhat spared from the effects of food insecurity until levels in the household become severe’.

McIntyre and co-workers also examined this issue in a sample of low-income lone parent households with children, in Atlantic Canada. On the basis that at four time periods over a month, the women’s dietary intakes and adequacy of intake were poorer than their children’s, they concluded that ‘low-income lone mothers compromise their own nutritional intake in order to preserve the adequacy of their children’s diets’ (McIntyre, Glanville *et al.*, 2003). In the UK, Dowler and Calvert (Dowler & Calvert, 1995) describing the effects of poverty on the nutrition of lone parent households in London, reached the same conclusions, namely that ‘children’s parents do protect their children from the worst nutritional consequences of poverty’.

The question of whether children in New Zealand were all well nourished was fiercely debated in the 1990’s. Among the subjective data supporting the view that a significant number of children were not well fed, was the Public Health Commission funded survey (Food-and-Nutrition-Consultancy-Service, 1995) where the principals of all NZ schools, were asked (by mail questionnaire) to estimate the proportion of children arriving at school without breakfast and/or provision for lunch. In addition, schools were asked to describe remedial actions taken such as providing free or subsidized food or beverages or any other actions taken (Food-and-Nutrition-Consultancy-Service, 1995). The responses from the schools (response rate 85%) are summarized in Appendix C-1. Nine percent of principals of schools reported that they believed at least ten percent of their children were regularly hungry during the school day; more children arrived without breakfast than without provision for lunch.

One third of schools provided free food/beverages on an ad hoc basis and five percent did this daily. A conclusion which can be reached from this study is that the schools which provided either subsidised or free foods or beverages, did this because they believed that some of their pupils were not well feed. They were concerned enough to address this issue, assuming that their remedial action would benefit the food insecure pupils. Whether or not there was any resultant nutrition benefit is not known since this study was cross sectional and did not objectively measure children's dietary intake or any indices of nutritional status.

The 2002 National Children's Nutrition Survey (CNS02) provides the first national data set documenting the nutritional status of New Zealand's school children (Parnell, Scragg *et al.*, 2003). It includes data on the children's nutrient intake (quantitative 24-hr diet recall), anthropometric measures including height and weight, and selected biochemical indices. Household food security status was assessed by an adult caregiver of the participating child. This study therefore enables the documentation of the prevalence of food security among NZ households with children and further, the opportunity to ascertain whether food security status is related to children's nutrition, in particular to nutrient intake and to body weight status.

5.2 Methods

The methodology for the CNS02 is fully described in the report NZ Food, NZ Children: Key results of the 2002 National Children's Nutrition Survey (Parnell, Scragg *et al.*, 2003).

5.2.1 Participant recruitment.

With the aim to ensure a nationally representative sample and also sufficient children to enable ethnic-specific analyses, a two-stage sampling frame was used, recruiting children 5-14 years from schools throughout New Zealand. One-hundred and sixty schools were sampled and students were randomly selected from the school roll. The sampling proportions for Māori, Pacific and New Zealand European and Others (NZEO) children were set to obtain about equal numbers of children from the groups Māori, Pacific and NZEO. Since 16 of the 160 schools sampled declined to participate a further sample of 30 was selected, of which two declined.

5.2.2 Dietary intake.

Data on the food and beverage intake of children 5-14 years were obtained by computer assisted multiple pass 24-hour diet recall. The interview was structured in three steps (quick list, detailed description, review of recall) to maximize recall. All children under ten years were interviewed in the presence of an adult caregiver and the majority over ten years also with a caregiver present. Interviews mostly took place in the home to maximize both identification of brand/product names of foods and beverages and portion size assessment.

To enable calculation of nutrient intake, foods and beverages consumed were matched to food composition data, obtained from the New Zealand Food Composition Database (NZFCD) (Crop-and-Food-Research, 1993).

5.2.3 Anthropometry.

Anthropometric measurements taken at school during the second interview included: height and weight. For all anthropometric measurements the children wore light clothing and no shoes.

Weight. This was measured to the nearest 0.1 kg and scales were calibrated with a standard weight each day. Two measurements were taken and if these differed by more than 0.5 kg a third measurement was taken. The weight measurement assigned to each child was the mean of the two closest measurements.

Height. Measurements were made with a portable stadiometer. Two measurements were made to the nearest 0.1 cm. If these differed by more than 0.5 cm a third measurement was taken. The height measurement assigned to each child was the mean of the two closest measurements.

Body Mass Index (BMI) was calculated as weight in kg/height in meters².

5.2.4 Demographic variables.

For every participant age in years and months was recorded at the time of recruitment. Based on the participant's residential address a 'New Zealand Index of Deprivation' NZDep01 score was assigned (Parnell, Scragg *et al.*, 2003; Salmond & Crampton, 2002). This index is based on eight dimensions of deprivation: income, access to a car, living space, home ownership, employment, qualifications, support and access to a telephone. The NZDep01 consists of a principal components score, scaled to a mean of 1000 with a standard deviation of 100, out of which is broken 10 equal categories (Salmond & Crampton, 2002). These categories were further collapsed into quintiles. Quintile I children were those living in the least deprived areas and

quintile V children those living in the most deprived areas. The school type of the child was classified as being 'urban' if the school was located in either a main urban or secondary urban area. Remaining schools located in either rural or minor urban areas were classified as 'rural' (Parnell, Scragg *et al.*, 2003).

5.2.5 Food security.

The indices used to ascertain household food security were the same eight indices used in the NNS97 and their development has been fully described in Chapter 3. Data were not collected from households where the child was interviewed without an adult present. The relationship of the adult to the child was noted (eg parent, sibling), but not whether they were male or female. Thus an adult caregiver (either male or female) made a response for the household of the respondent (a male or female child), with respect to each food security index.

5.2.6 Rasch analysis of food security indices.

In an identical manner to that described in Chapter 4, Rasch analysis was conducted on responses from 1561 households exhibiting food insecurity. Data were included even when the adult reporting on food security status of the household did not respond (or responded 'don't know') to some of the eight indices.

5.2.7 Assigning categories of household food security.

These were first assigned in an identical manner to that described in Chapter 4: fully/almost fully food secure, moderate food security and low food security, to enable comparisons to be made between the NNS97 and CNS02 data sets. In a second analysis categories were assigned with a different cut point between the moderate food security group and the low food security group. It was set at -0.19 on the scale, so that only the two indices experienced at the extreme end of the scale (by

those most food insecure) were ranked within this scale area; the low food security area.

5.2.8 Nutrient intake outcomes.

Daily intake of energy and nutrients was calculated for each child from the primary 24-hour diet recall of each participant. The number of participating children exceeded the number of households. To account for the clustering effect (similarity of children's nutrient intake when they lived in the same household) a linear mixed model was used.

5.2.9 Prediction of nutrition outcomes by household food security status.

Associations between three categories of food security and BMI, and mean daily energy intake and intake of selected nutrients have been made using a linear mixed model controlling for: sex (M, F); ethnicity (NZ European and Others, Māori, Pacific); NZDep01 Quintile; school type (urban, rural); number of household members (2-4, 5-6, 7+) and accounting for household similarity through a household random effect.

5.3 Results

The overall response rate for schools was 91%. From the 172 participating schools, 4728 children were recruited, and 3275 participated and the response rate was close to 70% (Parnell, Scragg *et al.*, 2003).

5.3.1 Prevalence of food security.

The prevalence of each of the eight indices of food security (over the last year) is provided in Appendix C-2. Data are tabulated for: all NZ households with children,

and broken down by: number of members and number of children in the household; NZDep01 quintile; urban or rural school; and ethnicity (Appendix C-2).

The responses to the eight individual food security indices showed consistent trends. Food insecurity was experienced in all its aspects (ie by each index), significantly more often by children in the largest households, those in the most deprived areas of residence (NZDep01 Quintile V), and those of Pacific and Māori ethnicity compared to NZEO children.

5.3.2 Food security of households with children: Rasch analysis.

Of the 3275 survey participants, data on household food security were obtained from the adult caregiver in 2771 households. Since some households (221) had more than one child, 2950 children were able to be assigned a household food security category. Figure 5.1 demonstrates the results of the Rasch analysis of the results from the 1561 households which exhibited some degree of food insecurity. The remainder were food secure (ie made no positive response to any of the eight indices of food insecurity).

Tables 5.1, 5.2 and 5.3, summarise the Rasch analysis statistics for these 'food insecure' participants and for the eight indices of food security to which their adult caregiver responded. While for most participants responses were made to all eight indices, there were up to ten who responded to some but not all.

Subject reliability lay between 0.71 and 0.76 (Table 5.1). Item separation was in the range 16.14 to 16.56 (Table 5.2). The fit for all indices is shown: All infits and outfits

(MNSQ) were between 0.74 and 1.23 (Table 5.3). The misfit rate for either infit or outfit statistics was 5.5%.

Table 5.1: Summary of Rasch analyses statistics from 1561 participants.

| | Raw Score | Count | Measure | Model Error | INFIT | | OUTFIT | |
|------------------------|-----------|--------|---------|-------------|-------|-------------------------|--------|------|
| | | | | | MNSQ | ZSTD | MNSQ | ZSTD |
| Mean | 19.2 | 8.0 | 1.55 | 0.80 | 1.01 | -0.2 | 1.00 | -0.2 |
| S.D. | 3.2 | 0.3 | 1.67 | 0.16 | 0.57 | 1.1 | 0.74 | 1.1 |
| Max. | 23.0 | 8.0 | 3.84 | 1.96 | 3.71 | 3.8 | 6.09 | 4.2 |
| Min. | 2.0 | 1.0 | -4.16 | 0.68 | 0.00 | -2.3 | 0.00 | -2.3 |
| Real RMSE | .89 | ADJ.SD | 1.41 | SEPARATION | 1.58 | SUBJECT RELIABILITY .71 | | |
| Model RMSE | .81 | ADJ.SD | 1.45 | SEPARATION | 1.79 | SUBJECT RELIABILITY .76 | | |
| SE OF SUBJECT MEAN .04 | | | | | | | | |

Table 5.2: Summary of Rasch analyses statistics for eight food security indices.

| | Raw Score | Count | Measure | Model Error | INFIT | | OUTFIT | |
|---------------------------|-----------|--------|---------|-------------|-------|---------------------------|--------|------|
| | | | | | MNSQ | ZSTD | MNSQ | ZSTD |
| Mean | 3749.9 | 1555.0 | -0.15 | 0.06 | 1.00 | 0.00 | 1.00 | -0.3 |
| S.D. | 305.9 | 3.5 | 0.92 | 0.01 | 0.11 | 3.2 | 0.14 | 3.6 |
| Max. | 4247.0 | 1559.0 | 1.36 | 0.07 | 1.10 | 3.0 | 1.23 | 5.2 |
| Min. | 3202.0 | 1548.0 | -1.77 | 0.05 | 0.81 | -5.7 | 0.74 | -6.7 |
| Real RMSE | .06 | ADJ.SD | .92 | SEPARATION | 16.14 | QUESTION RELIABILITY 1.00 | | |
| Model RMSE | .06 | ADJ.SD | .92 | SEPARATION | 16.56 | QUESTION RELIABILITY 1.00 | | |
| S.E. OF QUESTION MEAN .35 | | | | | | | | |

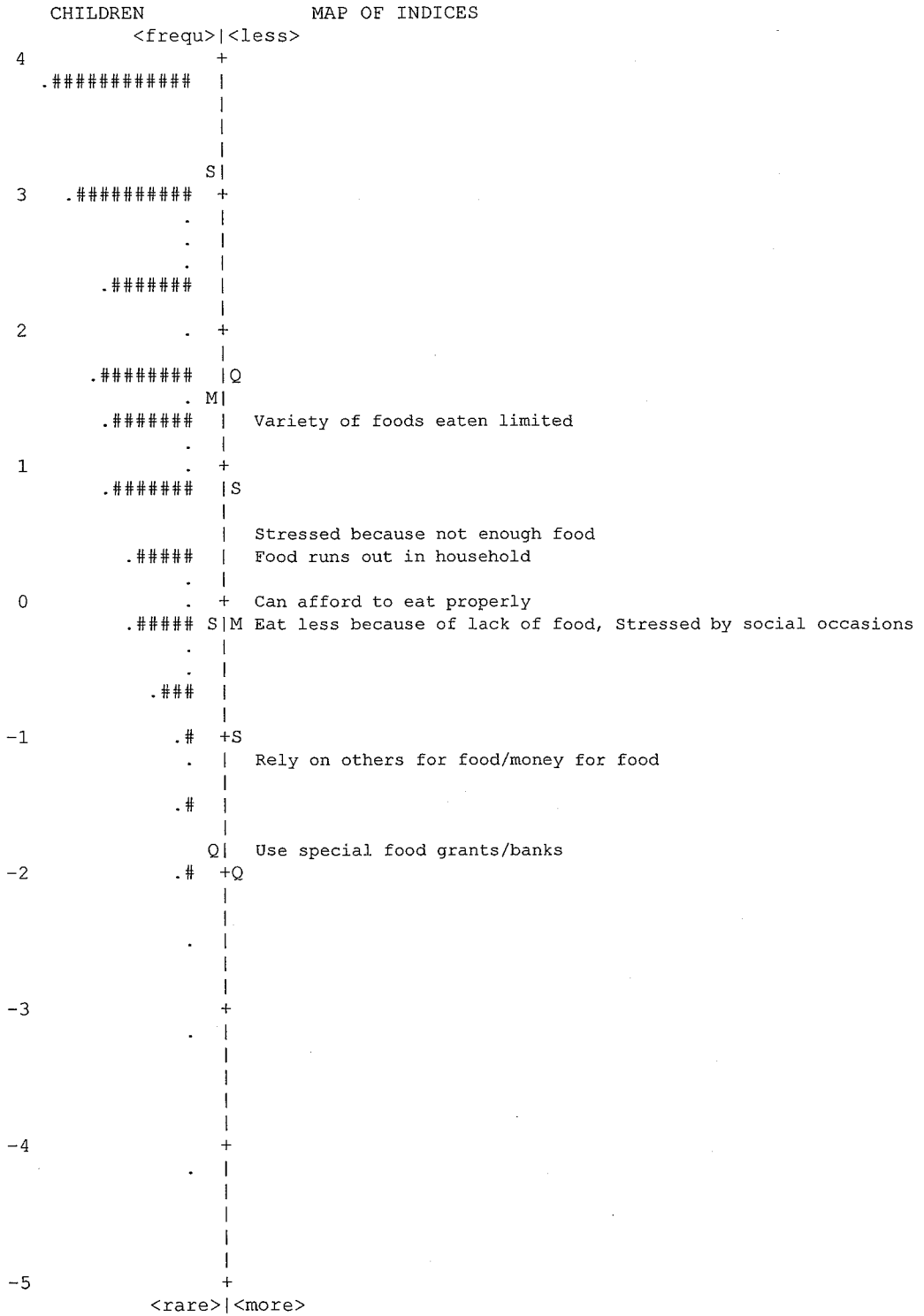
Table 5.3: Indices of food security presented in measure order i.e. from least to most severe food insecurity.

| Entry No. | Raw Score | Count | Measure | Error | INFIT | | OUTFIT | | PTBIS CORR. | Indicator Statement |
|-----------|-----------|--------|---------|-------|-------|------|--------|------|-------------|-----------------------------------|
| | | | | | MNSQ | ZSTD | MNSQ | ZSTD | | |
| 1 | 3729 | 1558 | 0.00A | 0.05 | 1.10 | 2.7 | 1.23 | 5.2 | A 0.36 | Can afford to eat properly |
| 4 | 3202 | 1555 | 1.36 | 0.05 | 1.10 | 3.0 | 1.09 | 2.5 | B 0.42 | Variety of foods eaten limited |
| 8 | 3772 | 1548 | -0.19 | 0.05 | 1.09 | 2.6 | 1.07 | 1.6 | C 0.50 | Stressed by social occasions |
| 5 | 4116 | 1557 | -1.24 | 0.05 | 1.07 | 1.9 | 1.07 | 1.0 | D 0.47 | Rely on others for food/money |
| 6 | 4247 | 1557 | -1.77 | 0.05 | 1.05 | 1.1 | 1.04 | 0.5 | d 0.47 | Use special food grants/banks |
| 7 | 3522 | 1555 | 0.54 | 0.05 | 0.94 | -1.8 | 0.90 | -2.9 | c 0.60 | Stressed because not enough money |
| 2 | 3634 | 1559 | 0.27 | 0.05 | 0.87 | -4.0 | 0.87 | -3.6 | b 0.56 | Food runs out in household due |
| 3 | 3777 | 1551 | -0.19 | 0.05 | 0.81 | -5.7 | 0.74 | -6.7 | a 0.62 | Eat less because of lack of money |
| Mean | 3750.0 | 1555.0 | -0.15 | 0.06 | 1.00 | 0.00 | 1.00 | -0.3 | | |
| S.D. | 306.0 | 4.0 | 0.92 | 0.01 | 0.11 | 3.21 | 0.14 | 3.6 | | |

Figure 5.1 maps on the left hand side the child/household score of food insecurity, on a scale from -4 to +4; around the anchor point index (arbitrarily assigned 0) index 'can afford to eat properly'.

It also maps on the right hand side the eight indices of food insecurity in measure order, with the indicator 'the variety of foods eaten in limited' being the most frequently reported and least severe index, and the index 'use of special food grants/food banks' being the least frequently reported but most severe indicator on the scale.

Figure 5.1: Rasch analysis for Children's Nutrition Survey (CNS02).



= Approximately 50 households.

5.3.3 Categories of food security.

Primary categorisation.

Three categories across the range of severity of food insecurity were assigned using the cut points described in Chapter 4 as:-

1. Fully/almost food secure: Participants for whom no affirmative response to any of the eight indices of food insecurity were given (n=1201) and households responding to only one of the indices (n=292).
2. Moderate food security (n=1106)—falling above a zero cut point on the scale.
3. Low food security (n=351)—falling below zero cut point on the scale.

Secondary categorisation.

In the second categorisation three categories across the range of severity of food insecurity were assigned using a different cut point as:-

1. Fully/almost food secure: Participants for whom no affirmative response to any of the eight indices of food insecurity were given (n=1201) and households responding to only one of the indices (n=292).
2. Moderate food security (n=1248)—falling above -0.19 cut point on the scale.
3. Low food security (n=209)—falling below -0.19 cut point on the scale.

5.3.4 Prediction of nutrient intake by level of food security.

Using the same method of assigning categories as that used in NNS97 food security category predicts the following nutrient intakes among children: total sugars, lactose, vitamin A, β -carotene, vitamin B12, calcium (Table 5.4).

Using the second method of assigning categories of food security described above, food security additionally predicts glucose, fructose and folic acid intakes (Table 5.5).

Table 5.4: Children's Energy and nutrient* intakes by primary category of household food security.**

| Mean daily intakes (adjusted) | Fully secure/Almost fully secure | Moderate food security | Low food security | p-value for difference in adjusted means |
|-------------------------------|----------------------------------|------------------------|-------------------|--|
| N % | 1493 (50.1%) | 1106 (37.5%) | 351 (11.9%) | |
| Energy (Kj) | 8493 | 8480 | 8553 | 0.900 |
| Protein (g) | 70.2 | 67.9 | 66.6 | 0.129 |
| CHO (g) | 269 | 268 | 272 | 0.819 |
| Fat (g) | 77.7 | 77.3 | 76.5 | 0.884 |
| Sat. Fat (g) | 34.1 | 33.2 | 32.5 | 0.310 |
| MUS Fat (g) | 25.7 | 26.1 | 25.5 | 0.725 |
| PUS Fat (g) | 8.74 | 8.92 | 9.25 | 0.339 |
| Chol (mg) | 224 | 217 | 196 | 0.069 |
| Tot. Sugars (g) | 123 | 115 | 118 | 0.023 ⁺ |
| Sucrose (g) | 66.0 | 62.3 | 65.9 | 0.103 |
| Glucose (g) | 18.0 | 17.1 | 16.5 | 0.100 |
| Fructose (g) | 20.4 | 19.0 | 19.0 | 0.072 |
| Lactose (g) | 14.6 | 13.0 | 13.1 | 0.003 ⁺ |
| Vit A µgRE | 631 | 547 | 567 | 0.001 ⁺ |
| Retinol (µg) | 338 | 309 | 303 | 0.053 |
| B-Carotene (µg) | 1758 | 1434 | 1587 | 0.006 ⁺ |
| Thiamin (mg) | 1.48 | 1.41 | 1.43 | 0.775 |
| Riboflavin (mg) | 1.77 | 1.57 | 1.51 | 0.071 |
| Vit B ₆ (mg) | 1.32 | 1.19 | 1.09 | 0.206 |
| Vit B ₁₂ (µg) | 3.61 | 3.25 | 2.90 | 0.038 ⁺ |
| Vit C (mg) | 113 | 106 | 103 | 0.286 |
| Folate (µg) | 236 | 223 | 235 | 0.084 |
| Calcium (mg) | 727 | 676 | 652 | 0.003 ⁺ |
| Iron (mg) | 11.11 | 10.66 | 10.61 | 0.157 |
| Zinc (mg) | 9.89 | 9.50 | 9.22 | 0.106 |

* Mean values adjusted for: age, sex, ethnicity, NZDep01, urban/rural status and family size.
** Cut points for food security categories identical to those for adults (NNS97).
⁺ Significant difference in intake by Food Security Category, (p<0.05).

Table 5.5: Children's Energy and nutrient* intakes by secondary category of household food security.**

| Mean daily intakes (adjusted) | Fully secure/Almost fully secure | Moderate food security | Low food security | p-value for difference in adjusted means |
|-------------------------------|----------------------------------|------------------------|-------------------|--|
| n % | 1493 (50.6%) | 1248 (42.3%) | 209 (7.1%) | |
| Energy (Kj) | 8563 | 8477 | 8519 | 0.854 |
| Protein (g) | 70.2 | 67.8 | 66.5 | 0.139 |
| CHO (g) | 269 | 268 | 275 | 0.666 |
| Fat (g) | 77.7 | 77.3 | 76.0 | 0.839 |
| Sat. Fat (g) | 34.1 | 33.2 | 32.2 | 0.280 |
| MUS Fat (g) | 25.7 | 26.1 | 25.1 | 0.629 |
| PUS Fat (g) | 8.74 | 8.95 | 9.32 | 0.358 |
| Chol (mg) | 224 | 216 | 190 | 0.063 |
| Tot. Sugars (g) | 123 | 116 | 116 | 0.031 ⁺ |
| Sucrose (g) | 66.0 | 62.3 | 65.9 | 0.103 |
| Glucose (g) | 18.0 | 17.2 | 15.4 | 0.026 ⁺ |
| Fructose (g) | 20.3 | 19.1 | 17.8 | 0.035 ⁺ |
| Lactose (g) | 14.6 | 13.0 | 13.4 | 0.003 ⁺ |
| Vit A µgRE | 631 | 548 | 576 | 0.001 ⁺ |
| Retinol (µg) | 338 | 308 | 307 | 0.056 |
| B-Carotene (µg) | 1758 | 1444 | 1619 | 0.006 ⁺ |
| Thiamin (mg) | 1.48 | 1.40 | 1.52 | 0.612 |
| Riboflavin (mg) | 1.77 | 1.55 | 1.57 | 0.077 |
| Vit B ₆ (mg) | 1.31 | 1.18 | 1.09 | 0.242 |
| Vit B ₁₂ (µg) | 3.61 | 3.23 | 2.83 | 0.042 ⁺ |
| Vit C (mg) | 113 | 104 | 107 | 0.294 |
| Folate (µg) | 236 | 222 | 246 | 0.018 ⁺ |
| Calcium (mg) | 727 | 671 | 672 | 0.004 ⁺ |
| Iron (mg) | 11.11 | 10.61 | 10.97 | 0.113 |
| Zinc (mg) | 9.89 | 9.51 | 9.23 | 0.123 |

* Mean values adjusted for: age, sex, ethnicity, NZDep01, urban/rural status and family size.
** Cut points for food security categories different to those for adults.
⁺ Significant difference in intake by Food Security Category, (p<0.05).

5.3.5 Relationship of primary food security category with Body Mass Index (BMI).

The adjusted mean BMI for the most food secure category was 19.0, for those moderately food secure 18.7 and for the least food secure, 19.1. These group differences were not statistically significant ($p=0.44$).

5.4 Discussion

The data from New Zealand's National Children's Nutrition Survey (CNS02) has provided a unique opportunity to examine the effects of household food insecurity on children's nutrition.

The Rasch analysis of the CNS02 data set has demonstrated that the eight indices used to capture the aspects of food insecurity experienced by households with children performs satisfactorily. The rank ordering (for severity) of the indices is very similar to that observed in the sample of NZ households studied in NNS97 (see Chapter 4) and it is almost identical to the sub-set of these households—the 987 households which included children—from this data set (Appendix C-3). Although the CNS02 data collection took place five years after the NNS97, and some secular changes in the experiences of household food insecurity in the population might have been expected it appears that this is not so.

Using the same eight indices of household food insecurity in these two national surveys it has been demonstrated that the indices rank in the same order of severity, and exhibit a good item separation index, and item fit in the acceptable range. The misfit rate (calculated as the percent of respondents who misfit on at least one of the

infit and outfits) was 5.5%—slightly above the guideline of 5% considered acceptable (Derrickson, Fisher *et al.*, 2000). The levels of reliability for the CNS02 subjects are higher than those reported for the NNS97: 0.71 – 0.76 compared to 0.60 – 0.67, and closer to those for the subset of adults in households with children from NNS97: 0.66 – 0.72. This indicates that household food security status might be more satisfactorily reported for households with, rather than without, children. The presence of children in a household could heighten awareness of the need to provide adequate and appropriate food.

Another explanation may be that in the CNS02, the adult household respondents (who provided the food security data) were their child's care-giver. The CNS02 respondents could therefore have included a greater proportion of food-provisioners than the NNS97 respondents which would probably reduce miss-classification error.

The same indices were used to assess household food security prevalence in a national sample of households (NNS97) both with and without children (Chapter 4) and in a sample of households all of which contained children (CNS02). Using identically derived categories of food security, the prevalence of 'low food security' reported was 4.3% in 1997 rising to 11.9% in 2002. However, the level reported in 1997 was from a mix of households, some with and some without children. Although the same set of indices were used in both instances, as Wilde (Wilde, 2004) has already noted in the US that 'households with and without children responded differently to (the) adult-referenced food-security items'. He believes that this is because of the distinct nature of food-related hardship for different types of households, in particular those with and without children. When the categorization into levels of food insecurity in this study

was made in the same way as that undertaken on the NNS97 (Chapter 4), (given the similar ranking and item separations of the household food security indices) and the relationship between categories of food security and nutrition explored, some different nutrient outcomes were seen, consistent with the argument that food insecurity will be experienced uniquely because of the presence of children (Wilde, 2004).

Despite the level of concern about the 'nutrition' of the school children of New Zealand reported by their Principals (Food-and-Nutrition-Consultancy-Service, 1995), household food security status did not predict poorer intake of all nutrients. The nutrients which food security status influenced included those already noted to be of some concern among school children in general namely: calcium, total sugars and vitamin A (Parnell, Scragg *et al.*, 2003). The most food secure children were significantly more likely to consume more calcium and lactose. It appears that dietary sources of calcium, which in New Zealand are primarily dairy products (Russell, Parnell *et al.*, 1999), were consumed in greater quantities by those who were food secure. Concern about the vitamin A content of the diet of NZ children has recently been expressed (Wall, Grant *et al.*, 2000) although only in a preliminary report of a study among pre-school rather than school-age children. This is surprising given the apparent ready availability of rich dietary sources: retinol from dairy products and the pre-cursor carotenes from relatively inexpensive vegetables such as carrots, pumpkin, tomatoes (Parnell, Scragg *et al.*, 2003). Nevertheless, household food insecurity was related to a significantly poorer intake of pro-vitamin A (β -carotene) for children. The food insecure would have been less likely to consume the fruits and vegetables providing pro-vitamin A.

The intake of total sugars was highest among the food secure. No 'one' sugar accounted for this, but the trend occurred across all component sugars including lactose but not sucrose. Children in food secure households will have consumed more fruits and as has been already noted, more dairy products. (Parnell, Scragg *et al.*, 2003), influencing the intakes of glucose, fructose and lactose. When a second more stringent categorization of the category low food security was made (Table 5.5) there was also a significantly lower intake of glucose and fructose seen among the most food insecure children; lending further evidence to the credence to the conclusion that they would have been consuming less fruit than those in food secure households.

In contrast to the data for New Zealand adults NNS97 (Chapter 4), food security status did not predict energy, macro-nutrient intakes or BMI among school children. Among adults and particularly women the most common explanation provided for the association between BMI and food security status, is the fluctuation in energy intake believed to occur among the food insecure. If children are protected from a fluctuating intake and are given precedence in the family food distribution hierarchy by their mothers as has been suggested elsewhere (McIntyre, Glanville *et al.*, 2003) then the observations made in this study are not surprising. Further support for this view is provided by the data from the study of the nutrition of disadvantaged households (Chapter 2), where women described their efforts to provision their families—particularly their children—and consequently compromised their own intakes.

The diets of adults and school children in New Zealand are demonstrably different (Parnell, Scragg *et al.*, 2003; Russell, Parnell *et al.*, 1999). Adults have chosen foods and beverages leading to higher fat diets than children; children have chosen foods and beverages leading to higher sugar intakes than adults. Thus, it is not unexpected that food security status has influenced nutrition in a different way among adults and children.

5.5 Conclusion

Living in a food insecure household in New Zealand has to some extent compromised the diets of school children in those households. Their intakes of the nutrients sourced from dairy products—calcium and lactose—were lower; their intakes sourced from fruits— β -carotene and vitamin B6—were also lower. No relationship between food security status and BMI was observed. As household food insecurity appears not to influence the macro-nutrient intake of children in food insecure households, whereas it does for adults, it may be that children are protected from some negative nutrition outcomes by their caregivers. This is consistent with the view of Wilde (Wilde, 2004), that households with children have an experience of food insecurity that is different to that in households without children. It appears that the nutrition outcomes of children in food insecure households are unique.

6 Overall Summary and Conclusions

The data presented in this thesis demonstrate that food insecurity is an issue in the New Zealand population. As has been reported in the UK and in North America, economically disadvantaged households experience many facets of food insecurity (Dowler, 2001; Rose, 1999; Tarasuk & Beaton, 1999). The study undertaken of poor New Zealand households, demonstrated that although respondent burden was relatively high it was possible to assess the nutrient intakes of women using six repeat 24-hour diet recalls. This was a more rigorous assessment of dietary intake for food insecure women than has been reported elsewhere in the literature. Congruent with the results from similar published studies (Laraia, Seiga-Riz *et al.*, 2004; McIntyre, Glanville *et al.*, 2003; Townsend, Peerson *et al.*, 2001), the women in poor and food insecure households were nutritionally compromised by food insecurity: they had poorer nutrient intakes and the proportion who were obese exceeded the population average.

Food insecurity has been successfully measured among the New Zealand population. It particularly affects younger household members, rather than older and is experienced most by Pacific and Māori ethnic groups. The trial on a national sample, of eight indices of household food insecurity each capturing an aspect of the phenomenon, demonstrated that (across all socio-economic sectors) both men and women were willing to respond to eight indices of food security, as they applied to them or to their households over the past year. There are no directly comparable data with which to compare these data as other national data sets have first screened out those above specified income levels (Hamilton, Cook *et al.*, 1997).

While the responses to the food security indices by women elicited greater subject reliability compared to men, it appears that men can assess food security for themselves or their household reasonably well.

The use of relatively few (eight) indices of food insecurity was of particular interest in order to establish whether the indices developed each capture a unique aspect of food insecurity relevant to New Zealand households, and to see if the indices could be ranked in order of severity. The only comparable published work in this area was from the US, where a greater number of indices were used (Carlson, Andrews *et al.*, 1999; Hamilton, Cook *et al.*, 1997). Rasch modelling analysis provided evidence that a successful model of food security status could be derived for New Zealand, using the eight indices. This was useful, as a smaller number of indices reduced respondent burden in a survey setting.

The influence of level of category of household food security: Fully/almost fully food secure; moderately food secure; least food secure; on food and nutrient intake and body weight status has been demonstrated. The categories of food security have been found to be associated with the levels of intake of fat (total fat, MUS fat, PUS fat, and cholesterol), glucose, fructose, lactose, vitamin B6, vitamin B12 and vitamin C. These data presented here are unique. The US food security module (Hamilton, Cook *et al.*, 1997) has been used to examine nutrition outcomes within food insecure groups, but to date its relationship with nutrient intake has only been tested on small samples of disadvantaged populations.

The same categories of household food insecurity were found to predict daily intake of nutrients among school children: Total sugars, lactose, calcium, vitamin A, β -carotene, and vitamin B12.

While the specific nutrients associated with level of household food security are different for adults and for children it does appear that in both instances food insecurity affects the intake of fruits and vegetables. The evidence for adults is provided by the fact that those in the most food insecure households are least likely to meet guidelines for recommended levels of intake of fruits and vegetables (both together and separately) and to have lower levels of intake of the nutrients sourced from these food groups: fructose, glucose, vitamin B6 and vitamin C. The evidence for children is provided by the reduced level of intake of β -carotene among the least food secure, and the trend for lower fructose and glucose intakes. These latter two nutrients were related to level of food insecurity when a more rigorous cut-off was used for the category 'least food secure'.

The association of food security status with fat intake (of all levels of saturation) and cholesterol for adults but not for school children is interesting and may be because adult diets have a higher proportion of fat than school children. Higher fat food choices by the poor and food insecure have been observed in a number of studies and many explanations given for this in relation to relative costs of food (Drewnowski & Specter, 2004). This finding was confirmed by the New Zealand study of disadvantaged households (Chapter 2), where the intakes of higher fat food options and consequently of fat of the women were in excess of the general population.

This contrasts with the finding that for school children household food security status is associated with total sugar intake and the most food secure have the highest intake. However, the individual sugars contributing to this do not include sucrose; but result from the additive increments from glucose, fructose and lactose. Therefore the most food secure have consumed more foods supplying these nutrients, eg fruit and dairy products. It can be concluded that the diet choices of the food secure are healthier than the less food secure.

Thus, although household food security status is not associated with identical nutrient outcomes among a sample of adult New Zealanders and a sample of children, the diet of the most food secure, in both instances, is closer to that recommended for good health. As has been noted the experience of food insecurity is different for the children of food insecure households compared to adults and the most convincing explanation for this may be the 'protective' actions of women; a view that was expressed by New Zealand women in poor households (Chapter 2).

The data presented in this thesis support the view that 'lack of money' to obtain enough appropriate, acceptable and affordable food is experienced by a significant number of New Zealand households. The descriptive data from the relatively small study of food insecure households demonstrated the express desire of participants to access healthy food although they were unable to do this; the quantitative data from two national samples of households describes the extent of the problem. Only 72.8% of households in 1997 (some of which included children) and 50.5% of households with children in 2002 were described as being almost or fully food secure. The members of food insecure households, both adults and school children, consumed

current diets with poorer nutrient intakes and adults had less desirable body weight status than their counterparts, in more food secure households.

6.1 Recommendations for the future

Further developmental work on the assessment of the phenomenon of food insecurity in New Zealand is required. The eight indices trialled on the New Zealand population have proved to be reasonably effective. However, they may not capture particular aspects of food insecurity experienced by the older segments of the population (eg access to food) and so the prevalence of food insecurity could be underestimated in this group.

The performance of the eight indices using Rasch modelling has indicated that they have satisfactory internal validity and reliability but they could be improved. This would require re-developing the indices by exposing them to cognitive testing and ensuring that respondents of all ages and ethnicities interpret them consistently (Connell, Nord *et al.*, 2004). Such a process could expand the application of the indices to include older children (12+ years) who would then respond directly rather than by means of their caregiver responding to the indices, such as has been successfully achieved with the US Food Security Model (Connell, Nord *et al.*, 2004).

The potential exists to examine the performance of the NZ Food Security Model on single person households compared to multi person households (with or without children). The experience of food security for 'single person households' has not been described.

The categories of household food security have been associated with different current nutrient intake levels among both adults and children, and body weight status among adults, at the population level. They could now be used to explore these and other outcomes in a wide variety of research studies. Food security status has not yet been used to predict health outcomes in New Zealand. In research studies where it is not possible to fully assess food and nutrient intakes, establishing food security status—using the indices developed—could in itself be a meaningful indicator of nutritional health.

The data presented in this thesis lend urgency to the need to address food insecurity in New Zealand at all levels. If access to healthy food is a basic human right and lack of food security impairs nutritional health, then this matter should be addressed by policy makers in government and local government; by non-governmental organisations, and all who influence the pricing and distribution of foods to the households of New Zealand. We may measure the phenomenon of food insecurity more precisely in the future, but its presence in our population has been described here in a robust way.

Further, the approach to food security status taken in this thesis has been that the ability to access appropriate food is primarily ‘determined’ by ‘resource’ (money) rather than ‘skills’. Therefore, responses to food insecurity and its attendant outcome ‘poor nutrition’ should focus on ensuring that all NZ households have sufficient economic resource to provision their members. Food insecurity in New Zealand has been demonstrated to be associated with poorer nutritional health and this calls for an immediate response.

Appendices

Appendix A: Chapter 2.

1. Questionnaire

The first section of this questionnaire contains some questions about your food practices.

1. Where do you buy most of your food? And how often do you shop there? (tick one answer)

| | |
|-------------------------------------|------------------------------|
| <input type="radio"/> Supermarket | _____ times a week/fortnight |
| <input type="radio"/> Grocery store | _____ times a week/fortnight |
| <input type="radio"/> Dairy | _____ times a week/fortnight |
| <input type="radio"/> Other _____ | _____ times a week/fortnight |

2. Are there other places you shop for food? How often do you shop there? (tick all answers that apply)

| | |
|-------------------------------------|--|
| <input type="radio"/> Supermarket | _____ times a week/fortnight/sometimes |
| <input type="radio"/> Grocery store | _____ times a week/fortnight/sometimes |
| <input type="radio"/> Dairy | _____ times a week/fortnight/sometimes |
| <input type="radio"/> Other _____ | _____ times a week/fortnight/sometimes |

3. How long has it been since you bought food for the last time?
 - Less than a week
 - 1 to 2 weeks
 - More than two weeks
 - Don't know

4. For how long will the foods you have in store last?
 - _____ days
 - Don't know

5. How do you normally go to the shop?

| | |
|----------------------------------|--|
| <input type="radio"/> Walking | <input type="radio"/> By taxi |
| <input type="radio"/> By bicycle | <input type="radio"/> With own car |
| <input type="radio"/> By bus | <input type="radio"/> Other (please specify) _____ |

6. In what other ways do you get food?
 - Growing your own
 - Gifts from friends/relatives
 - Meals out of the house (take-aways, in restaurants or meals at a relatives house)
 - Other (please specify) _____

7. Do you use a food bank? (A food bank is a place that gives out food parcels for free in times of emergency)
 - No
 - Yes
 - Don't know

8. If you use a food bank, how often do you go there?
 - I don't use a food bank
 - Once a week
 - Once a fortnight
 - Once a month or more
 - Once every 2 to 3 months
 - Don't know

9. Would you use a food bank if you ran out of money to buy food? (ask only if relevant)
 - No
 - Yes
 - Don't know

10. Do you belong to a food co-op? (A food co-op is where a group of people put their money together so they can buy food more cheaply in bulk, which is then divided amongst participants)
- No
 - Yes
 - Don't know
11. If you belong to a food co-op, how useful do you find the food co-op for meeting your household's food needs?
- I don't belong to a food co-op
 - Very useful
 - Not very useful
 - Not useful at all
 - Don't know
12. If you don't belong to a food co-op, would you like to?
- No
 - Yes
 - Don't know
13. Do you always have enough food to feed your household?
- Always (just) enough to eat
 - Sometimes not enough to eat
 - Often not enough to eat
 - Don't know
14. What is the main reason why your household has (had) problems to feed itself? (open ended)
15. Do you have to rely on a limited variety of foods because you are running out of money to buy food?
- No, never
 - Sometimes
 - Often
 - Don't know
16. How often do you worry about finding time to cook?
- Never
 - Sometimes
 - Often
 - Don't know
17. How much time do you spend on cooking each day?
- Less than an hour
 - One hour to two hours
 - More than two hours
 - Don't know
18. How important is it to your household that their food is homemade?
- Very important
 - Not very important
 - Not important at all
 - Don't know

19. How often do you buy prepared or precooked meals? (for example frozen pizzas, pies or instant risotto, that still need preparation at home)
- More then once a week
 - Once a week
 - Once a month
 - Hardly ever or never
 - Don't know
20. Who normally decide(s) what is to be eaten in your household?
- You
 - Other adult(s) in your household
 - You and the other adult(s) in your household together
 - Children in your household
 - Don't know
21. How often do the children in your household eat differently from the adults?
- Never
 - Sometimes
 - Often
 - Don't know
22. If so, who decide(s) what the children will eat?
- Children never eat different
 - You
 - Other adult(s) in your household
 - Children in your household
 - Don't know
23. Do you think the food you eat is usually healthy? (as you understand it)
- No
 - Yes
 - Don't know
24. How many meals do you usually have each day?
- Less then two
 - Two to three
 - More then three
25. Do you ever cut down on the size of your own meals to make food last?
- No
 - Yes If yes, how often did this happen in the last month? _____ times
26. Do you ever cut down on the size of your children's meals to make food last?
- No
 - Yes If yes, how often did this happen in the last month? _____ times
27. Do you and/or other adults in your household ever skip meals because there is not enough money to buy food?
- No
 - Yes If yes, how often did this happen in the last month? _____ times
28. Do the children ever skip meals because there is not enough money to buy food?
- No
 - Yes If yes, how often did this happen in the last month? _____ times

29. Do your children ever have less food than you feel they should?
 No
 Yes If yes, how often did this happen in the last month? _____ times
30. Do you and/or other adults in your household ever have less food than you feel they should?
 No
 Yes If yes, how often did this happen in the last month? _____ times
31. Do your children ever say they're hungry and you're not able to meet their need?
 No
 Yes If yes, how often did this happen in the last month? _____ times
32. Do your children ever have to go to bed hungry?
 No
 Yes If yes, how often did this happen in the last month? _____ times
33. How often have you taken your children to the general practitioner/doctor during the last 3 months? _____ times
34. How often have you visited a general practitioner/doctor on your own behalf during the last 3 months? _____ times
35. Would you visit your doctor more often if you had more money?
 No
 Yes If yes, how often would you like to visit your doctor? _____
36. How do you feel about your general health during the last 6 months?
- (37. If partner is present how does he feel about his general health during the last 6 months?)
38. Does anyone in your household require medication?
 No
 Yes
39. Does anyone in your household follow a particular diet?
 No
 Yes If yes, what diet is it? _____
40. How often do you worry about food or feeding your household and how bad is it?
41. How do you feel about your situation?

The next section of this questionnaire contains some questions about you and your household

1. What is your age in years? _____ years.
2. What sex are you?
 - Female
 - Male
3. If there are any other adults in your household, what sex and age are they?
 1. Sex: _____ Age: _____
 2. Sex: _____ Age: _____
4. If you have children in your household, what sex and age are they?

| | | | |
|---------------|------------|---------------|------------|
| 1. Sex: _____ | Age: _____ | 4. Sex: _____ | Age: _____ |
| 2. Sex: _____ | Age: _____ | 5. Sex: _____ | Age: _____ |
| 3. Sex: _____ | Age: _____ | 6. Sex: _____ | Age: _____ |
5. Do you have any pets?
 - No
 - Yes, what type?
 - cat(s): number: _____
 - dog(s): number: _____
 - size: Large / Medium / Small
 - other, please specify _____
6. About how much do you spend on your animals each week?
 - Food \$ _____
 - Other expenses \$ _____
7. What ethnic group do you belong to?
 - Maori
 - European or Pakeha
 - Pacific Islander
 - Other (please specify) _____
8. What 'form' did you complete before leaving high school? _____
9. Do you have any other qualification or training for some job?
 - No
 - Yes If yes, what is it? _____
10. During the last month were you?(tick all the answers that apply)

| | | |
|--|--------------------------------------|--|
| <input type="checkbox"/> Working full time | <input type="checkbox"/> Wage earner | <input type="checkbox"/> Unemployed |
| <input type="checkbox"/> Working part time | <input type="checkbox"/> Homemaker | <input type="checkbox"/> Self employed |
| <input type="checkbox"/> Working shifts | <input type="checkbox"/> Student | <input type="checkbox"/> Retired |
11. If you have other adults in your household what were they during the last month?
(tick all the answers that apply)

| | | |
|--|--|--|
| <input type="checkbox"/> Working full time (no___) | <input type="checkbox"/> Wage earner (no___) | <input type="checkbox"/> Unemployed (no___) |
| <input type="checkbox"/> Working part time (no___) | <input type="checkbox"/> Homemaker (no___) | <input type="checkbox"/> Self employed (no___) |
| <input type="checkbox"/> Working shifts (no___) | <input type="checkbox"/> Student (no___) | <input type="checkbox"/> Retired (no___) |

12. What is your usual occupation? (If you're not in paid employment, say what your job was. If you're a student say what it will be. If you've never had a job, say so)

13. Do you have any insurance?

No

Yes If yes, what is the insurance for? _____

14. Do you have any savings?

No

Yes

15. In what range is your household's weekly income? (including that of all adults and children)

\$ 150 to \$ 200 per week

\$ 200 to \$ 250 per week

\$ 250 to \$ 275 per week

\$ 275 to \$ 300 per week

> \$ 300 per week

If you can specify \$ _____ per week/fortnight

Don't know

16. Where does this income come from? (tick all answers that apply)

Wages (number of wages _____)

Benefit (number of benefits _____)

Sometimes wages and sometimes benefit

Gifts from relatives or friends

Don't know

17. Do you worry about having sufficient money, long term?

No

Yes If yes, why? _____

Don't know

18. What are your usual weekly expenses for the following things?

1. Rent \$ _____

4. Power \$ _____

2. Food \$ _____

5. Medical care \$ _____

3. Transport \$ _____

6. Other expenses \$ _____

19. Which expenses do you tend to pay first? (rank the categories from question 18)

1. _____

4. _____

2. _____

5. _____

3. _____

6. _____

20. How much do you spend on the following food items: (estimated)

- breads and cereals \$ _____

- vegetables and fruits \$ _____

- dairy products \$ _____

- meats, fish, eggs etc \$ _____

21. What sort of housing do you live in?

Own house, paying mortgage

Own house, free and clear

Rental house, state housing

Rental house, private

Other (please specify) _____

Don't know

22. Do you have a garden that you cultivate?

- No
- Yes

23. Do you own a freezer?

- No
- Yes

24. Do you have a car?

- No
- Yes

25. Do you smoke?

- No
- Yes If yes, how many cigarettes a day? _____

26. Do you drink any alcohol? (discretionary)

- No
- Yes

27. What clubs/groups do you belong to? (for example church or recreational groups)

1. _____
2. _____
3. _____
4. _____
5. _____

28. How often do you see some friend or relative?

- Every day
- 3 to 6 times a week
- Once or twice a week
- Less then once a week

29. How close do your best friends live?

- Walking distance (1 - 2 km)
- Bicycling distance (3 - 5 km)
- A car ride away (> 5 km)
- Don't know

30. Do you have friends that you can turn to for help?

- No
- Yes If yes, how many friends can you turn to? _____

31. Do you have relatives that you can turn to for help?

- No
- Yes If yes, how many relatives can you turn to? _____

RECALL OF ALL FOOD AND DRINK CONSUMED IN THE LAST 24 HOURS

Instructions:

- Record all information on the form (that is: a full description and the amount eaten of every food item and the time of consumption)
- Switch from today to yesterday at the appropriate time (question), maybe even cover a little more than 24 hours.

Before interview, state the following:

“We would like you to remember everything you ate and drank in the last 24 hours, including snacks and drinks of all kinds. To help you remember, we will be asking you questions about what you have been doing because most people find it easier to remember what they ate this way. We are **not** interested in what you did, but just when you did it as a check to see we have covered all your day and all that you ate.”

Let us first cover your food and drink for today and then back to yesterday, so we will have a full 24 hours.

1. What was the first thing you had to eat or drink, after you got up this morning?

- What time did you get up?
- What did you do when you got up this morning?

2. What else did you eat or drink? (for breakfast)

3. Did you have anything between breakfast and lunch?

- What did you do after breakfast? (e.g. shopping/school/(house)work)
- What did you have for morning-tea?
- Did you go somewhere for morning-tea?

4. What did you have for lunch today?

- At what time did you have lunch?
- Where did you have lunch?
- When did you prepare lunch?
- Did you eat any fresh foods, like orange-juice or salad?

5. Have you had anything to eat or drink after lunch and before your evening-meal?

- What did you do after lunch? (e.g. shopping/school/(house)work)
- Did you have afternoon-tea? Where and with whom?
- What time did you have afternoon tea?
- Did you go somewhere after lunch? (e.g. sports canteen, work etc)

6. Did you have anything else before your evening meal?

- Can you remember what you did before the evening meal?
- Did you (help) prepare the meal?
- Did you watch TV/listen to radio/play music?

7. Did you have your evening-meal at home with your household?

If yes then ask question 8 - If no go to question 9

8. What did you eat and drink?

9. Did you have a meal away from home last night?

- Did you eat at another person's home?
- Did you eat out at a takeaway, restaurant etc?

10. What did you have?

11. Have you had anything since your evening-meal?

- What did you do last night?
Did you - watch TV/listen to radio
 - go to town or to movies
 - do homework/housework

12. Did you have anything to eat or drink just before you went to bed?

13. Did you have anything to eat during the night?

As a check at the end of the recall ask:

What was the most recent thing you ate or drank this today?

Finally

'Here is a check list which I will read aloud to you. If you remember that you ate or drank any of these foods between yesterday and now which you haven't told me about, please stop me and tell me.

Read out checklist of foods eaten:

- | | |
|---|---------------------------------------|
| 1. Sugar e.g. in tea or coffee | 19. Cake or fruit loaf |
| 2. Milk or milk shake | 20. Pastry or pie |
| 3. Yoghurt | 21. Baked or steamed pudding |
| 4. Cream | 22. Jelly |
| 5. Cheese or cheesecake | 23. Sweet spread e.g. jam, honey |
| 6. Butter | 24. Marmite, vegemite or peanutbutter |
| 7. Margarine | 25. Sweets including chocolate |
| 8. Ice cream | 26. Chippies or other savoury snacks |
| 9. Custard or milk pudding | 27. Soft drink |
| 10. Egg | 28. Cordial or ice block |
| 11. Meat e.g. beef, mutton, pork, ham, bacon, poultry any other (sausage) | 29. Tea |
| 12. Fish or shellfish | 30. Coffee |
| 13. Sauce, gravy or dressing | 31. Milo or cocoa |
| 14. Breakfast cereal | 32. Drink with alcohol in it |
| 15. Rice spaghetti, macaroni, etc | 33. Raw fruit |
| 16. Bread, bread rolls/buns | 34. Cooked fruit (stewed or tinned) |
| 17. Sweet buns, scones, pikelets pancakes, doughnuts, muffins | 35. Fruit juice |
| 18. Biscuits - plain sweet - fancy sweet - crackers | 36. Potato, kumara or taro |
| | 37. Other root vegetables e.g. carrot |
| | 38. Pumpkin, marrow or similar |
| | 39. Cooked green vegetables |
| | 40. Tinned spaghetti or baked beans |
| | 41. Nuts or dried fruit |
| | 42. Soup |

WEEKLY ESTIMATE OF KEY-FOODS

1. Can you remember if you have bought or eaten meat during the last week?

If so - How often did you eat meat during the last week?

- What kind of meat was it? (e.g. sausages, steak, mince pies etc)

If not so, can you tell me why?

2. Have you eaten any cheese during the last week?

If so - How often have you eaten cheese?

- What kind of cheese did you eat?

- When did you eat it? (e.g. on toast or at the evening meal)

If not, can you remember why you did not eat cheese?

3. During the last week did you have any fruit?

If so - How often did you eat fruit?

- What kind(s) of fruit did you have?

- Who eat most of the fruit in your household?

If not, can you tell me the reason you did not have fruit?

4. Have you eaten any take-aways during the last week?

If so - How often did you eat them?

- What kind of take-away did you have?

- Who bought it or made the decision to buy it? (the reason to buy it)

If not so, can you give me the reason?

2. Survey Schedule and Consent Form

NUTRITION-SURVEY VISITS

Family name:.....

Interview 1. Date:..... Time:.....

- Explanation of the study
- Food practices
- Background information

Interview 2. Date:..... Time:.....

- 24-hour-recalls from all the members of the family
- Consumption of key food over the last week

Between interview 2 and interview 3 two 24-hour-recalls from by phone.

Interview 3. Date:..... Time:.....

- 24-hour-recalls from all the members of the household
- Heights and weights will be measured

After interview 3 two additional 24-hour-recalls will be taken from by phone.

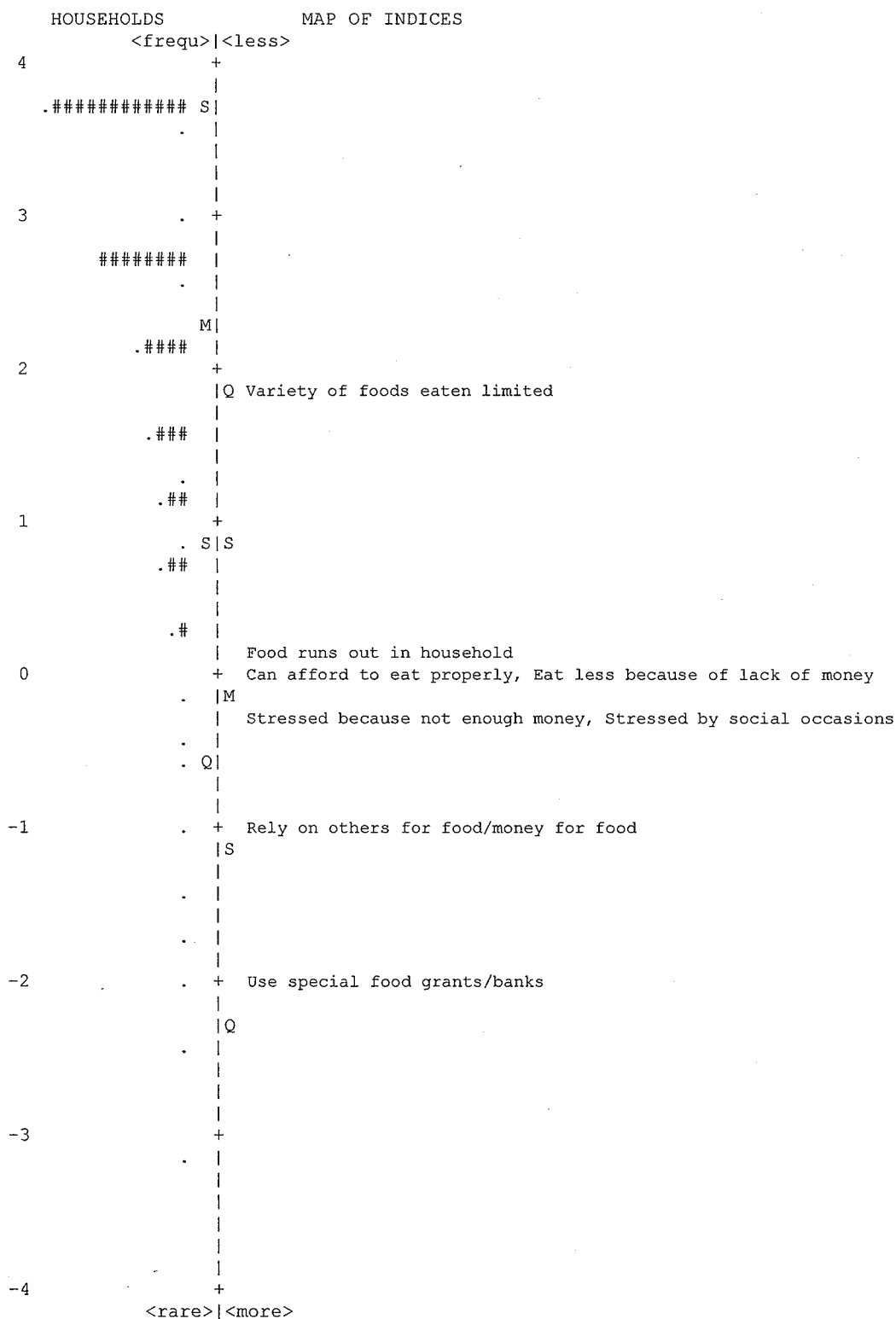
Informed consent

I have been informed about the study and I agree to participate. I agree that results from this study will be used by the Dept of Human Nutrition of Otago University. Results will be confidential and identified by number only. We will provide the subjects with dietary results. If you have any questions about the study or about nutrition, please feel free to ask.

date:
place:
signature:

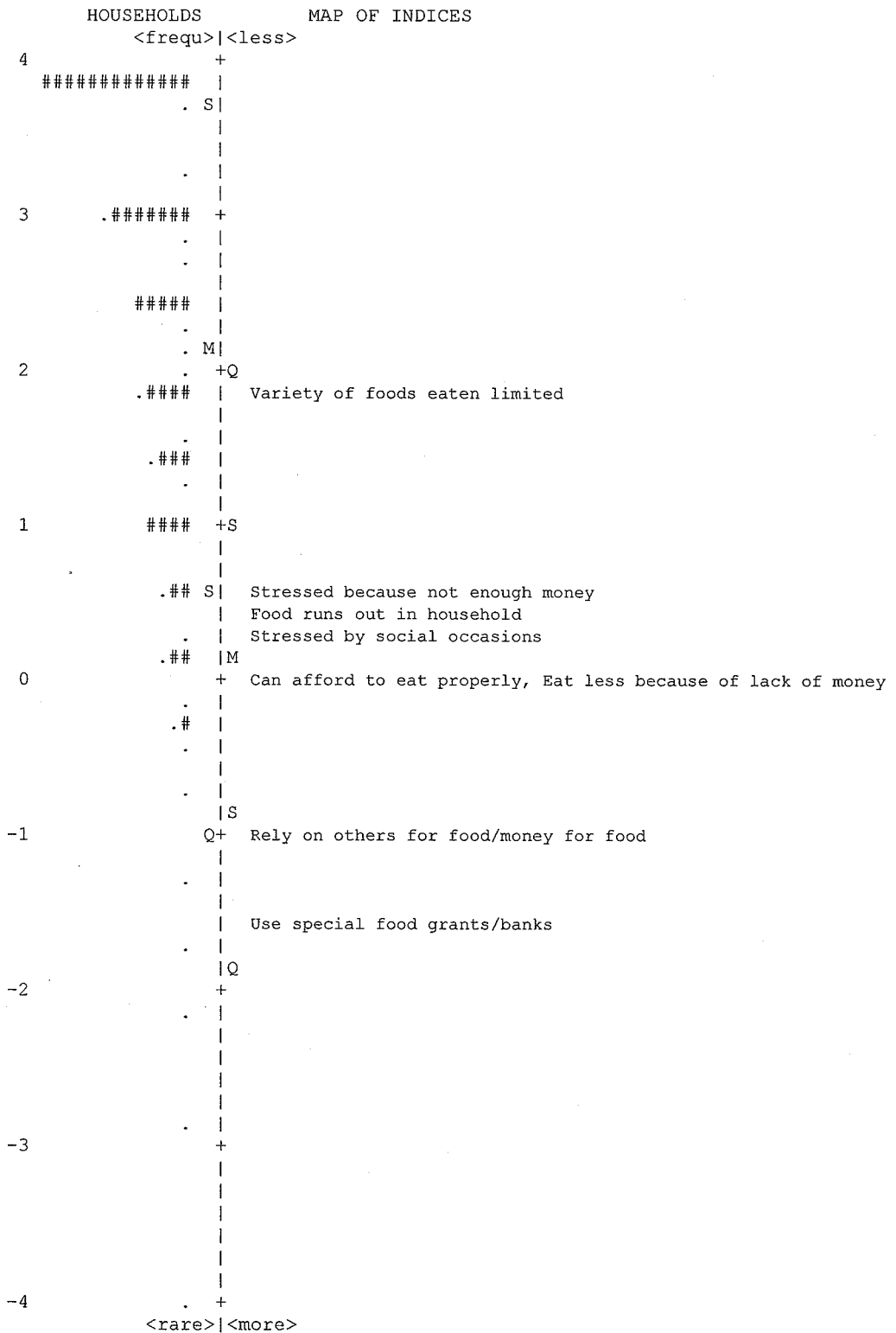
Appendix B: Chapter 4.

1. Rasch analysis for NNS—Males only



= Approximately 50 households.

2. Rasch analysis for NNS—Females only



= Approximately 50 households.

Appendix C: Chapter 5

- 1. Executive Summary of 'Final Report of the Public Health Commission on the Perceived Food Inadequacy among Children in Schools'.**

Final Report for the
Public Health Commission on the
Perceived Food Inadequacy
Among Children in Schools

Food and Nutrition Consultancy Service

February 1995

University of Otago, Dunedin
New Zealand

Executive Summary

There is considerable anecdotal evidence that schoolchildren in New Zealand are not adequately fed, but there are no national data concerning the extent of this problem. An initial study has been undertaken to document the extent of hunger in schoolchildren as perceived by school teachers, and the provisions currently being made within schools to address the problem. A questionnaire was mailed to the principals of all New Zealand schools. After a second mailing and then a follow up telephone call to non-respondents, a final response rate of 85.4 percent was achieved. This sample appears to be fairly representative of the schools of New Zealand but slightly under represents schools with higher percentages of Māori and Pacific Islands children on the roll. The North Auckland region response rate was 10 percent below the average.

Two thirds of school principals consulted with their staff in order to arrive at an estimate of hungry children. About fifteen percent of schools asked the pupils themselves about breakfast and lunch consumption. Overall, more than one half of the schools reported that no children were 'regularly hungry' during the school day, and with the exception of Christchurch City of 60 percent of South Island schools estimated 'no hungry children'. Nationally almost 39 percent estimated that up to 10 percent of the roll were 'regularly hungry'. Secondary schools, state and state integrated schools, schools with higher rolls and schools with a higher percentage of Māori or of Pacific Islands children on the roll estimated 'hungry children' most often. Schools estimating most often that they had 'hungry children' (and greater numbers of them) were in the regions of North and South Auckland, Auckland and Hamilton cities, and Kapiti-Porirua.

Schools estimated that considerable numbers of children arrive at school without breakfast on a regular basis. Just over five percent estimate that more than 30 percent of their school roll, fit this category. Secondary schools, state and state integrated schools, larger schools, those with a higher percentage of Māori or of Pacific islands children on the roll estimate most often, and greater numbers of children arriving without breakfast. Consequently the regions making the highest estimates of this problem are South Auckland, followed by Auckland City, Northland, North Auckland, Kapiti-Porirua, Bay of Plenty, Hutt, and Wellington City. A considerable number of schools noted regarding breakfast that (it was) 'students won choice not to eat' (this meal).

Fewer schools estimated that children had no provision for lunch, ie food from home or money to purchase it. Again it was most frequently cited by secondary schools, state and state integrated schools, larger schools and schools with higher percentages of Māori and Pacific Islands children on the roll. Schools in the South Auckland, Auckland and Hamilton Cities and Kapiti-Porirua regions were most likely to have children without provision for lunch; fewest schools in the Canterbury and Otago regions estimated this.

The provision of free food or beverages for 'hungry children' was made 'sometimes' by one third of schools and by 4.5 percent on a daily basis. Numbers of children provided for in this way were small with only four percent of schools offering the service, meeting the 'need' for more than five children per day. Provision was more

likely to be made by secondary, state and state integrated school, co-educational, and larger schools, and those with higher numbers of Māori and Pacific Islands children on the roll. Schools in the Kapiti-Porirua, Hutt, South Auckland and Auckland City regions were most likely to provide some free food and/or beverages, and South Auckland and Hamilton City appeared to provide it to the most children.

The provision of subsidized food and/or beverages was lower: fifteen percent of schools doing this sometimes and two percent daily. It was most often a service provided by schools with a significant number of Māori and Pacific Islands children. Help with providing food for children was given to fifteen percent of school, by their local community. It was more often provided to secondary than primary schools and to schools with higher percentages of Māori and Pacific Islands children. Hamilton, Hutt and Auckland cities were most likely to receive this type of assistance which included help from Church Groups, Foodbanks, and parent Teacher Associations.

Tuckshops were a feature of almost all secondary schools and around 40 percent of primary schools. They were reported least often in predominantly rural regions such as Taranaki, West Coast and South Canterbury. The amount of money spent by children to purchase food was most often between two and three dollars – higher for private schools and in some regions; Gisborne, Nelson-Marlborough, West Coast and South Canterbury.

Throughout the country, 3.4 percent (22,600 children) are perceived by 'schools' to be regularly hungry, almost as many without provision for lunch and around 9 percent (60,000) are said to arrive at school without breakfast. Schools with higher percentages of Māori and Pacific Islands children and in specific regions, make higher estimates of this problem, and often make provision for children's needs through the provision of free or subsidised food and receiving of other help from the community.

Interpretation of these data must be made with care, as this study provides no evidence that 'hungry children' are in fact inadequately fed, overall. This study focuses on observations made by teachers during the school day. Smaller but more detailed studies of nutritional status (Bell 1993 and Otago University, Department of Human Nutrition – Personal communication) indicate that Pacific Islands children (Tongan and Tokelauan) and Māori girls are adequately nourished. They have heights and weights which meet or in the case of Pacific Islands children exceed those of other New Zealand children, and energy and nutrient intakes which are very similar. Pacific Islands children appear (Bell 1993) to eat most of their food after school and in early evening. It should also be noted that the issue of the links between ethnicity and socio-economic status have not been explored in this study. The results as shown focus on ethnicity (Māori and Pacific Islands) simply because this information has been documented in the Ministry of Education database provided to the researchers. Socio-economic indices were not available from this source nor asked for in the survey.

Further research comparing nutritional status (anthropometric status, nutrient intake, biochemical and clinical indices) of children in areas reporting the highest levels of perceived hunger, with children in areas with the lowest reported levels are urgently needed. Work is also needed to explore the distribution of food intake throughout the day and ways to improve this. Schools are currently endeavouring to redress this problem. Discussion and consultation are needed at policy level to decide whose responsibility this is.

2. Food security among households with children: Data (tabulated and summarised) from the report ‘NZ Food: NZ Children: Key results of the 2002 National Children’s Nutrition Survey’.

This appendix is adapted from the section titled ‘Household food security’ in the report ‘NZ Food: NZ Children: Key results of the 2002 National Children’s Nutrition Survey’, Parnell et al., pp 109-115, 121. Data are presented in table form (Household food security over the last year) and then summarized. Differences in food security experience between groups (age, sex, ethnicity, NZDep01 etc) are only mentioned in the text when the differences are statistically significant.

Household food security over the last year.

| | | | Valid n | The household: ¹ | | Because of lack of money, the household: ¹ | | | | | | | | | | The household: ¹ | | | |
|------------------------|------------|-------|---------|-----------------------------|-------------|---|-------------|----------|-------------|--------------------------|-------------|----------------|-------------|-----------------------|-------------|---------------------------------------|-------------|--|-------------|
| | | | | Can afford to eat properly | | Food runs out | | Eat less | | Variety of foods limited | | Rely on others | | Use food banks/grants | | Stressed about lack of money for food | | Stressed when no food for social occasions | |
| | | | | Always % | Sometimes % | Often % | Sometimes % | Often % | Sometimes % | Often % | Sometimes % | Often % | Sometimes % | Often % | Sometimes % | Often % | Sometimes % | Often % | Sometimes % |
| New Zealand households | | | 2271 | 77.8 | 20.1 | 3.6 | 18.5 | 2.8 | 15.3 | 9.0 | 25.6 | 1.5 | 10.3 | 0.8 | 8.6 | 6.4 | 18.1 | 3.3 | 16.9 |
| | # members | ≤4 | 1040 | 82.8 | 15.6 | 2.5 | 14.9 | 2.1 | 11.7 | 7.9 | 22.0 | 1.5 | 7.8 | 0.5 | 7.1 | 5.3 | 14.4 | 2.8 | 14.3 |
| | | 5-6 | 1082 | 78.6 | 19.3 | 3.5 | 18.7 | 2.7 | 15.6 | 9.2 | 27.2 | 1.3 | 9.3 | 1.0 | 7.4 | 6.2 | 18.4 | 3.1 | 17.2 |
| | | ≥7 | 649 | 59.1 | 36.7 | 7.5 | 29.9 | 5.2 | 26.0 | 12.0 | 32.4 | 2.3 | 21.0 | 0.8 | 16.7 | 10.7 | 29.0 | 5.3 | 24.4 |
| | # children | ≤2 | 1196 | 83.4 | 15.1 | 2.4 | 14.4 | 2.0 | 10.7 | 6.7 | 21.9 | 1.2 | 6.9 | 0.4 | 6.4 | 4.9 | 13.4 | 2.7 | 13.4 |
| | | 3-4 | 737 | 81.5 | 16.7 | 1.8 | 16.2 | 1.5 | 13.8 | 7.4 | 26.1 | 1.1 | 8.0 | 0.3 | 5.6 | 4.4 | 17.0 | 2.7 | 16.0 |
| | | ≥5 | 838 | 58.7 | 37.3 | 9.1 | 31.9 | 6.5 | 28.5 | 16.7 | 33.6 | 3.0 | 21.6 | 2.3 | 18.4 | 13.0 | 31.0 | 5.7 | 26.7 |
| NZDep01 | | I | 273 | 94.0 | 5.5 | 0.6 | 5.6 | 0.5 | 5.3 | 3.3 | 14.9 | 0.0 | 1.7 | 0.4 | 1.1 | 0.5 | 7.2 | 0.4 | 8.4 |
| | | II | 319 | 88.2 | 9.8 | 2.5 | 7.3 | 1.8 | 6.7 | 8.4 | 16.9 | 0.6 | 1.8 | 0.2 | 3.6 | 3.5 | 6.8 | 1.6 | 8.9 |
| | | III | 344 | 82.2 | 14.9 | 5.4 | 15.4 | 2.4 | 13.1 | 8.9 | 27.1 | 2.4 | 9.6 | 0.3 | 7.1 | 7.1 | 20.3 | 2.3 | 17.7 |
| | | IV | 474 | 72.0 | 24.3 | 1.5 | 22.7 | 2.6 | 17.4 | 10.9 | 30.3 | 1.0 | 13.5 | 0.9 | 10.3 | 8.6 | 20.7 | 4.9 | 21.8 |
| | | V | 1108 | 59.5 | 37.5 | 8.9 | 36.3 | 5.6 | 29.1 | 14.4 | 38.8 | 2.4 | 21.8 | 2.1 | 17.6 | 11.6 | 32.2 | 8.2 | 25.3 |
| School type | | Urban | 2366 | 77.1 | 20.7 | 4.0 | 18.9 | 2.8 | 16.0 | 8.5 | 27.2 | 1.6 | 10.7 | 0.8 | 9.1 | 6.5 | 18.1 | 3.4 | 17.0 |
| | | Rural | 405 | 80.9 | 17.3 | 1.9 | 16.8 | 2.6 | 12.2 | 11.2 | 18.2 | 0.4 | 8.4 | 0.8 | 6.4 | 5.9 | 18.0 | 2.8 | 16.5 |
| Māori | # members | ≤4 | 398 | 68.2 | 30.5 | 5.5 | 27.6 | 5.7 | 22.1 | 13.3 | 30.6 | 4.5 | 15.1 | 2.4 | 16.1 | 11.4 | 24.7 | 5.5 | 17.7 |
| | | 5-6 | 418 | 63.1 | 34.0 | 6.5 | 31.6 | 5.5 | 26.3 | 14.8 | 31.1 | 3.0 | 20.3 | 3.4 | 14.9 | 12.3 | 27.6 | 7.3 | 22.0 |
| | | ≥7 | 241 | 60.0 | 37.9 | 9.8 | 33.5 | 8.0 | 25.3 | 14.2 | 32.1 | 3.2 | 26.4 | 1.6 | 23.6 | 12.8 | 33.5 | 6.8 | 26.7 |
| | # children | ≤2 | 450 | 71.2 | 27.5 | 5.1 | 23.0 | 5.0 | 18.4 | 10.6 | 27.0 | 2.9 | 13.0 | 1.9 | 12.9 | 9.4 | 22.0 | 5.2 | 15.5 |
| | | 3-4 | 266 | 65.7 | 32.1 | 4.1 | 32.7 | 4.4 | 24.1 | 12.0 | 33.4 | 3.2 | 18.8 | 0.9 | 13.1 | 9.9 | 29.7 | 7.3 | 20.7 |
| | | ≥5 | 341 | 54.5 | 42.4 | 11.2 | 38.4 | 9.0 | 32.4 | 20.2 | 34.7 | 4.9 | 29.0 | 4.7 | 26.2 | 17.1 | 34.0 | 7.5 | 29.7 |
| | Total | 1057 | 64.3 | 33.6 | 6.9 | 30.6 | 6.2 | 24.5 | 14.1 | 31.1 | 3.6 | 19.8 | 2.6 | 17.4 | 12.1 | 27.9 | 6.5 | 21.5 | |
| Pacific | # members | ≤4 | 172 | 59.0 | 37.1 | 3.5 | 33.7 | 4.6 | 29.1 | 11.9 | 33.6 | 0.9 | 21.1 | 2.1 | 13.1 | 5.5 | 23.4 | 4.9 | 21.5 |
| | | 5-6 | 293 | 46.7 | 48.4 | 5.8 | 50.7 | 4.1 | 47.5 | 11.1 | 51.3 | 1.7 | 26.7 | 1.3 | 20.9 | 6.8 | 41.2 | 7.9 | 38.2 |
| | | ≥7 | 341 | 41.2 | 52.1 | 7.6 | 51.3 | 2.5 | 48.1 | 6.4 | 58.9 | 1.1 | 31.5 | 0.8 | 18.2 | 7.2 | 45.9 | 2.9 | 43.7 |
| | # children | ≤2 | 243 | 56.6 | 37.7 | 5.1 | 36.2 | 4.5 | 30.2 | 9.2 | 37.6 | 1.0 | 22.4 | 1.1 | 13.2 | 5.3 | 25.9 | 4.4 | 26.7 |
| | | 3-4 | 179 | 51.2 | 45.8 | 4.4 | 43.3 | 2.1 | 44.3 | 11.0 | 47.2 | 1.0 | 19.9 | 2.0 | 15.3 | 5.2 | 41.0 | 4.6 | 37.1 |
| | | ≥5 | 384 | 39.6 | 54.1 | 7.5 | 55.4 | 3.5 | 51.5 | 8.4 | 60.0 | 1.5 | 33.7 | 1.0 | 21.8 | 8.1 | 46.8 | 5.6 | 43.2 |
| | Total | 806 | 46.6 | 47.9 | 6.2 | 47.7 | 3.5 | 44.2 | 9.1 | 51.3 | 1.3 | 27.8 | 1.2 | 18.1 | 6.7 | 39.9 | 5.0 | 37.4 | |
| NZEO | # members | ≤4 | 470 | 87.5 | 11.0 | 1.7 | 10.9 | 1.0 | 8.4 | 6.3 | 19.4 | 0.8 | 5.4 | 0.0 | 4.7 | 3.8 | 11.4 | 2.1 | 13.2 |
| | | 5-6 | 371 | 87.0 | 11.5 | 2.2 | 11.1 | 1.7 | 8.8 | 7.1 | 23.4 | 0.6 | 3.8 | 0.2 | 3.5 | 4.1 | 13.0 | 1.2 | 13.4 |
| | | ≥7 | 67 | 71.4 | 23.9 | 5.0 | 10.2 | 4.0 | 10.4 | 13.5 | 13.3 | 2.2 | 7.4 | 0.0 | 8.1 | 10.8 | 11.6 | 5.4 | 7.6 |
| | # children | ≤2 | 503 | 88.1 | 10.5 | 1.5 | 10.9 | 1.1 | 7.6 | 5.6 | 19.7 | 0.8 | 4.5 | 0.0 | 4.2 | 3.6 | 10.5 | 2.0 | 12.0 |
| | | 3-4 | 292 | 88.0 | 10.4 | 1.0 | 9.9 | 0.6 | 8.8 | 6.0 | 22.6 | 0.5 | 4.3 | 0.0 | 2.9 | 2.9 | 11.8 | 1.3 | 13.2 |
| | | ≥5 | 113 | 72.3 | 24.0 | 8.0 | 13.9 | 5.7 | 13.2 | 17.6 | 19.3 | 2.1 | 8.6 | 0.8 | 9.3 | 11.7 | 20.2 | 4.0 | 15.6 |
| | Total | 908 | 86.1 | 12.1 | 2.1 | 10.9 | 1.5 | 8.7 | 7.2 | 20.6 | 0.9 | 4.9 | 0.1 | 4.4 | 4.4 | 12.1 | 2.0 | 12.8 | |

Food security is an internationally recognized term that encompasses the ready availability of nutritionally adequate and safe foods and the assumed ability to acquire personally acceptable foods in a socially acceptable way. An adult member of the household participating in the survey was asked to respond to eight statements on behalf of the child or children in the household. Each of these statements about food related to the issue of affordability i.e. the response was made in light of whether or not the respondent felt their household had enough money.

We can afford to eat properly.

NZ Households. About 78 percent of households reported that they could always afford to eat properly, but close to 20 percent said that they could not afford to do so (either *Sometimes* or *Never*).

The largest households, those with 7 or more members, and those with at least 5 children were more likely than smaller households to report that they could not afford to eat properly *Always*.

NZDep01. Households in NZDep01-V were less likely to *Always* be able to afford to eat properly (59.5 percent) than those in NZDep01-I to IV (94.0 percent to 72.0 percent) (Figure 1).

Ethnic. Households with NZEO children were most likely to state that they *Always* 'can afford to eat properly' (86.1 percent), compared to households with Māori (64.3 percent), and Pacific children (46.6 percent) (Figure 2).

Māori, Pacific and NZEO households with one or two children more frequently said they could *Always* and *Sometimes* afford to eat properly, compared to households with five or more children. Across all ethnic groups, households with seven or more members compared to those with 4 or less members, were less likely to say they could *Always* afford to eat properly.

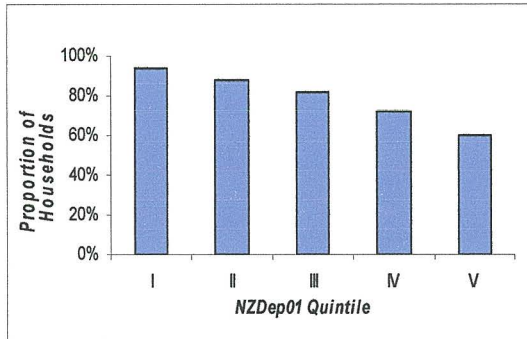


Figure 1: Can *Always* afford to eat Properly

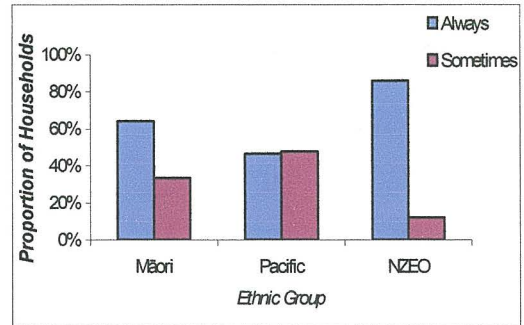


Figure 2: Can *Always* and *Sometimes* afford to eat properly

Food runs out in our household due to lack of money.

NZ Households. Over 22 percent of households reported that ‘food runs out because of lack of money’, *Sometimes* (18.5 percent) and *Often* (3.6 percent). Around 40 percent of households with at least seven members or at least five children reported that ‘food runs out in their household because of lack of money’, *Often or Sometimes*, and they were more likely to report this than smaller households (Figure 3).

NZDep01. Households in NZDep01-V were most likely to ‘run out of food due to lack of money’ *Sometimes* (36.3 percent) and *Often* (8.9 percent), compared to those in NZDep01-I to IV (Figure 4).

Ethnic. Households with Pacific children (53.9 percent) were more likely than those with Māori (37.5 percent), and NZEO children (13 percent) to say food runs out in their household *Often or Sometimes*. Māori, Pacific and NZEO households with five or more children, compared to those with one or two children, were more likely to report that food runs out in their household due to lack of money, *Often or Sometimes*.

We eat less because of lack of money.

NZ Households. About 18 percent of households said that they ‘eat less because of lack of money’ *Sometimes* (15.3 percent) and *Often* (2.8 percent). This was again a greater issue for the largest households (more than 7 members) than those with fewer members, with about one third eating less *Sometimes* and *Often*.

NZDep01. Households in NZDep01-V were more likely than in all other NZDep01 households to ‘eat less because of lack of money’, *Sometimes* (29.1 percent) and *Often* (5.6 percent).

Ethnic. Eating less because of lack of money was experienced *Often* or *Sometimes* most frequently by households with Pacific children (47.7 percent), compared to those with Māori (30.7 percent) and NZEO children (10.2 percent). A higher proportion of Māori, Pacific and NZEO households with 5 or more children reported that they ate less *Often* or *Sometimes* because of lack of money more than households with 1 or 2 children.

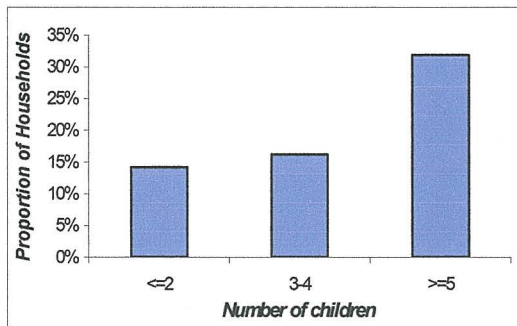


Figure 3: Food runs out *Sometimes* (number of children)

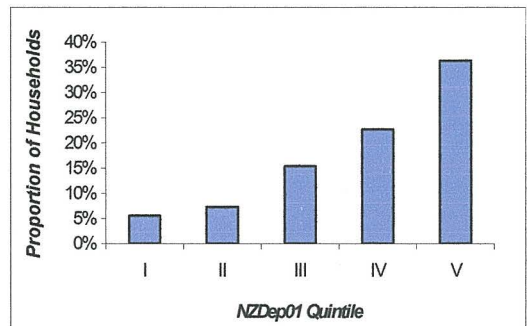


Figure 2: Food runs out *Sometimes* (NZDep01 quintile)

The variety of foods we are able to eat is limited by lack of money.

NZ Households. Over one third (34.6 percent) of households reported that the variety of foods they were able to eat was limited by a lack of money *Sometimes* (25.6 percent) or *Often* (9.0 percent). Limiting the variety of foods due to lack of money was reported *Often* or *Sometimes* most frequently by households with 7 or more members, or at least 5 children.

NZDep01. Households in NZDep01-V were most likely to 'limit the variety of food they were able to eat because of a lack of money' *Often* (14.4 percent) and *Sometimes* (38.8 percent) than households in all other NZDep01 quintiles (Figure 5).

Ethnic. Māori, Pacific and NZEO households with five or more children were more likely to 'limit the variety of food they were able to eat because of lack of money' *Often* or *Sometimes*, than households with one or two children. Households with Pacific children (60.4 percent) were more likely to report this *Often* or *sometimes* than households with Māori (45.2 percent) and NZEO children (27.8 percent).

We rely on others to provide food and/or money for food for our household when we don't have enough money.

NZ Households. This was an issue *Often* for only 1.5 percent of households but 10.3 percent had to do this *Sometimes* over the previous year. The largest households (23.3 percent) and those with the most children (24.6 percent) were more likely to *Often* or *Sometimes* 'rely on others' to provide food and/or money for food for their household, than smaller households and those with fewer children.

NZDep01. Households in NZDep01-I and II were less likely to ‘rely on others’ to provide food and/or money for food for their household when they did not have enough money compared to those households in NZDep01-III, IV and V. Households in NZDep01-V (23.9 percent) were most likely to experience this *Often* or *Sometimes*.

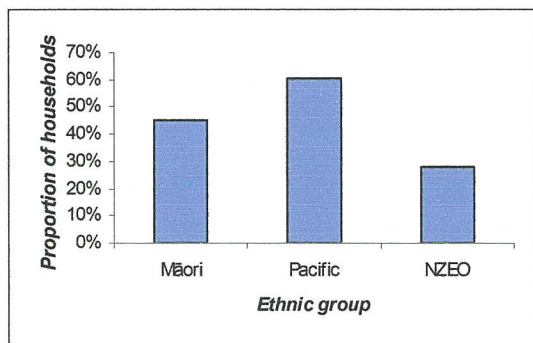


Figure 5: Variety of foods limited *Often* or *Sometimes*

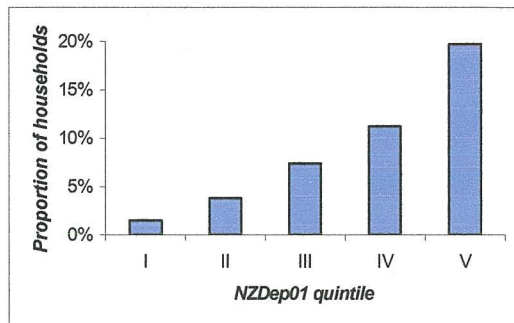


Figure 6: Use of food grants/banks *Often* or *Sometimes*

Ethnic. Households with Pacific children (29.1 percent) were most likely to ‘rely on others’ to provide food and/or money for food when they did not have enough money *Often* or *Sometimes* compared to those with Māori (23.4 percent) and NZEO children (5.8 percent).

Māori and Pacific households with 5 or more children were more likely to ‘rely on others to provide food and/or money for food for their household’ than households with fewer children.

We make use of special food grants or foodbanks when we do not have enough money for food.

NZ Households. While less than 1 percent of households made use of special food grants or food banks *Often*, 8.6 percent did this *Sometimes* during the previous year. This was also more frequently an issue *Often* or *Sometimes* among households with 7 or more members (17.5 percent) and at least 5 children (20.7 percent) compared to those with fewer members and fewer children.

NZDep01. Households in NZDep01-IV and V (11.2 percent; 19.7 percent) were more likely to ‘use special food grants or foodbanks’ *Often* or *Sometimes* when they did not have enough money for food compared to households in other NZDep01 quintiles (Figure 6).

Ethnic. Households with Māori (20.0 percent) and Pacific children (19.3 percent) *Often* or *Sometimes* made use of special food grants or foodbank more frequently than households with NZEO children (4.5 percent).

Māori, Pacific and NZEO households with five or more children were more likely to use special food grants or foodbanks *Often* or *Sometimes* than households with 1 or 2 children.

I feel stressed because of not having enough money for food.

NZ Households. Over 18 percent of households experienced this *Sometimes* and 6.4 percent *Often*. Close to 40 percent of households with 7 or more members and 44.0 percent of those with 5 or more children were stressed about lack of money for food *Often* or *Sometimes* over the previous year.

NZDep01. Households in NZDep01-I and II (7.7 percent; 10.3 percent) were less likely to be 'stressed about not having enough money for food' *Often* or *Sometimes* than those households in NZDep01-III, IV and V (27.4 percent; 29.3 percent; 43.8 percent).

Ethnic. Feeling ‘stressed because of not having enough money for food’ was most frequently experienced *Often* or *Sometimes* by households with Pacific children (46.6 percent) followed by those with Māori (40.0 percent) and NZEO children (16.5 percent). Across all ethnic groups, households with five or more children were more likely to experience this stress *Often and Sometimes* than those households with one or two children (Figure 7).

I feel stressed because we can’t provide the food we want for social occasions.

NZ Households. Just over 20 percent of households experienced this (*Often* or *Sometimes* 20.2 percent). The largest households, those with 7 or more members, (29.7 percent) and those with the 5 or more children (32.4 percent) were *Often* or *Sometimes* the most likely to feel ‘stressed because they could not provide the food they wanted for social occasions’ compared to smaller households and households with fewer children.

NZDep01. Households in NZDep01-I and II were less likely to feel ‘stressed because they could not provide the food they wanted for social occasions’ *Often* and *Sometimes*, compared to those living in households in other NZDep01 quintiles. More than one third (33.5 percent) of NZDep01-V households experienced this stress *Often* or *Sometimes*, compared with NZDep01-I to IV households (8.8 percent to 26.7 percent).

Ethnic. Feeling ‘stressed because they could not provide the food they wanted for social occasions’ was experienced less by households with NZEO children (*Often* 2.0 percent; *Sometimes* 12.8 percent) compared to those with Māori (6.5 percent; 21.5

percent) and Pacific children (5 percent; 37.4 percent) (Figure 8). This issue was not related to the number of children in NZEO households, but was experienced more frequently by households with Māori and Pacific children with the greatest number of members and by households with the most children, compared to smaller households.

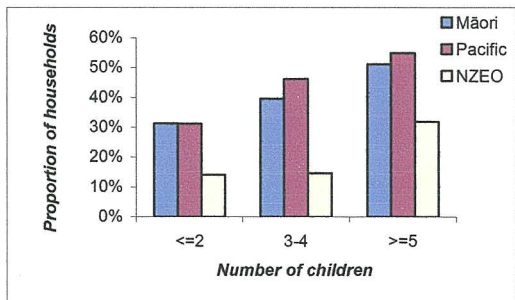


Figure7: Stressed about lack of money for food *Often or Sometimes*

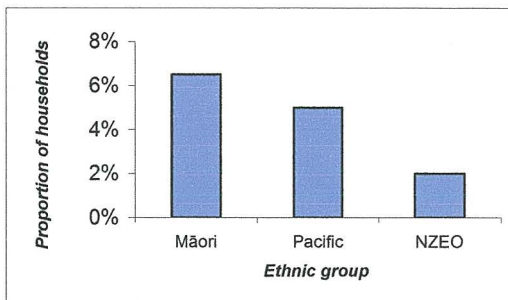
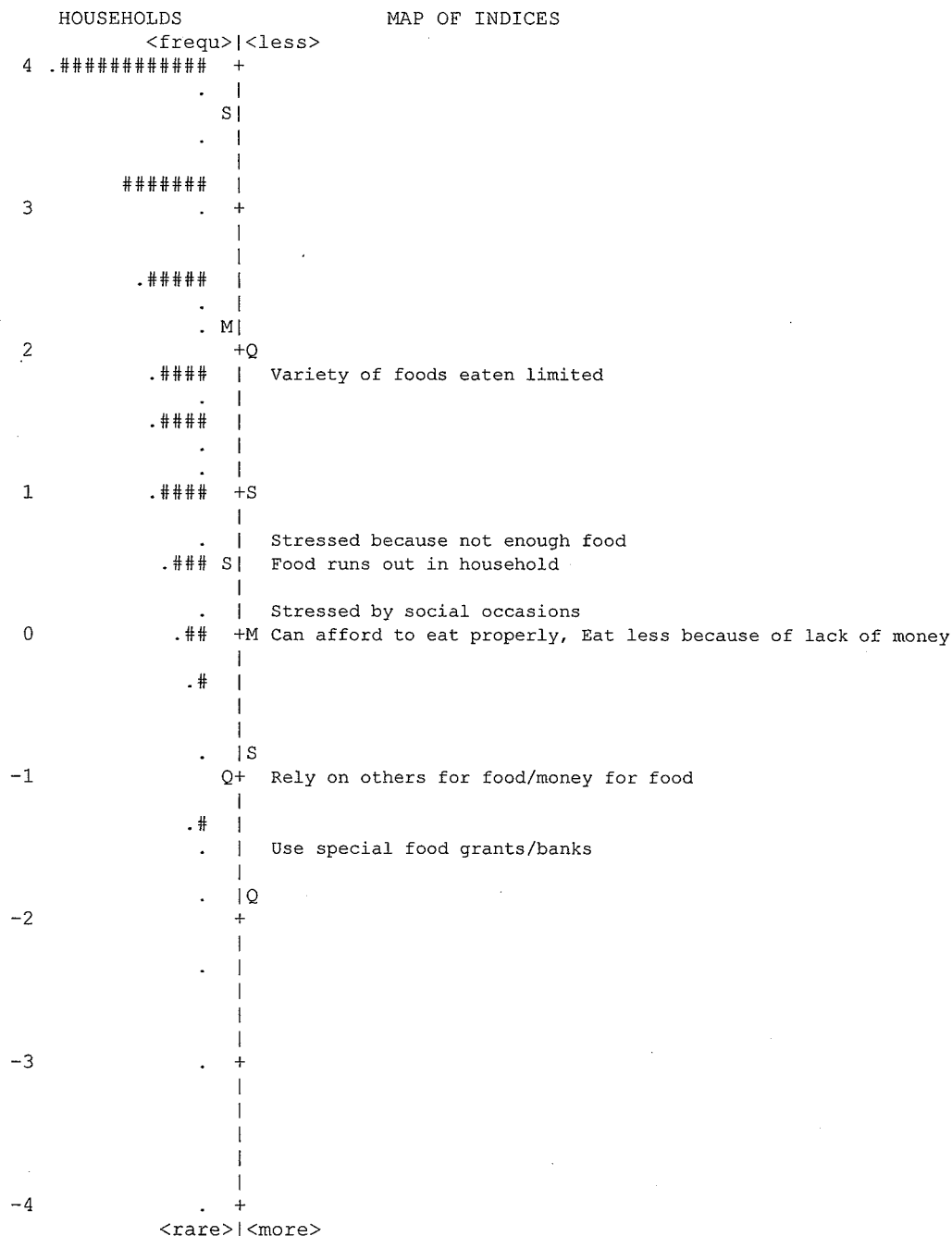


Figure.8: Stressed when no food for social occasions *Often*

3. Rasch analyses for NNS---participants from households with children.



= Approximately 50 households.

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