OTHER NUTRITIONAL INDICATORS

Introduction

Optimal nutrition during childhood is vital for good health, growth and development, and the prevention of obesity [1]. Children's dietary patterns and food choices are strongly influenced by their parents and caregivers. For example, parental modelling is associated with healthy food intake, and family/whānau meals taken together are associated with a higher intake of fruit and vegetables, highlighting the importance of involving parents in efforts to improve children's diets [2,3,4]. Children's diets are also influenced by a complex interplay of personal, social, cultural, and economic factors [1,4]. The wider food environment has been implicated in the food choices families make, including the increased availability of highly palatable, relatively inexpensive, energy dense and nutrient poor food in increased portion sizes [1]. Understanding the role such factors play is important, as patterns of diet and physical activity established during childhood continue to influence health on into adulthood.

Food insecurity, defined as the inability to acquire nutritionally adequate and safe food that meets cultural needs, is influenced by family income, the number of people living in a household and the location of a household in relation to food sources. Food insecurity can result in both under-nutrition and over-nutrition [1,5,6]. New Zealand research suggests that food insecurity is more common for Māori and Pacific families and households with lower incomes. For example, data from the longitudinal Survey of Families, Income and Employment (SoFIE) (n=18,950) found that households in the lowest income quintile were significantly more likely to be food insecure than those in the highest quintile (OR 4.9, 95%CI 4.0 to 5.9) [5]. Another study found that families on low incomes need to spend between 43% and 89% of their income (once rent was deducted), to purchase a 'basic' healthy diet [7].

The following section reviews a range of nutritional indicators of relevance to children and young people using data from two different sources: The 2011/12 New Zealand Health Survey, and the Youth'12 Survey of secondary school students.

The 2011/12 New Zealand Health Survey

Data Sources and Methods

Definitions

The proportion of children aged 2–14 years who ate breakfast at home every day in the past week

The proportion of children aged 2–14 years who ate fast food three or more times in the past week

The proportion of children aged 2–14 years who had fizzy drinks three or more times in the past week

Data Source

The 2011/12 New Zealand Health Survey

The data on children aged 2–14 years in this section were derived from *The Health of New Zealand Children 2011/12: Key Findings of the New Zealand Health Survey*, and its associated data tables, downloadable at http://www.health.govt.nz/publication/health-new-zealand-children-2011-12 Regional results were sourced from http://www.health.govt.nz/publication/regional-results-2011-12-new-zealand-health-survey

Notes on Interpretation

Sample Size and Weighting: The 2011/12 NZHS [8] was a cross sectional survey carried out between July 2011 and August 2012, which collected information on 4,478 children aged from birth to 14 years, and 12,370 adults aged 15 years and over. The child survey included 2,968 European/Other, 1,592 Māori, 730 Pacific and 432 Asian children, with the data being weighted (e.g. to take into account response rates and individual item non-responses) to ensure that the results were representative of the total New Zealand child population. The weighted response rate for the child questionnaire was 85%, with the primary caregiver answering the questionnaire on their child's behalf.

Ethnicity: In the Survey, four ethnic groups were reported: Māori, Pacific, Asian and European/Other. Total response ethnicity was used throughout, with an individual being included in the analysis for each ethnic group to which they affiliated. As a result, ethnic groups cannot be directly compared with each other, with adjusted rate ratios which compare children by ethnicity comparing those in a particular group (e.g. Pacific) with those who are not in that ethnic group (e.g. non-Pacific) [8].

Age Standardisation: Age is an important determinant of health status. In the NZHS, all time trend results have been age-standardised, so that populations can be compared over time, and so that any differences reported are not due to changes in the population age structure. Similarly all rate ratio comparisons by gender, ethnicity and NZ Deprivation Index (NZDep) decile have been age adjusted, so that any differences identified cannot be attributed to differing age structures between the different population groups. The method of age standardisation used was the direct method using the World Health Organization world population age distribution [8]. Regional rates however, are presented as unadjusted prevalences, so that the actual prevalence of those affected in each region can be assessed, including by age group.

Other Standardisation and the Relative Index of Inequality: In addition to age standardisation, any ethnic comparisons have also been adjusted for gender. For neighbourhood deprivation comparisons (i.e. by NZDep) rate ratios refer to the relative index of inequality [8]. This compares neighbourhood deprivation after adjusting for age, sex and ethnic differences. The relative index of inequality can be interpreted in the same way as adjusted rate ratios, although it is calculated in a slightly different way.

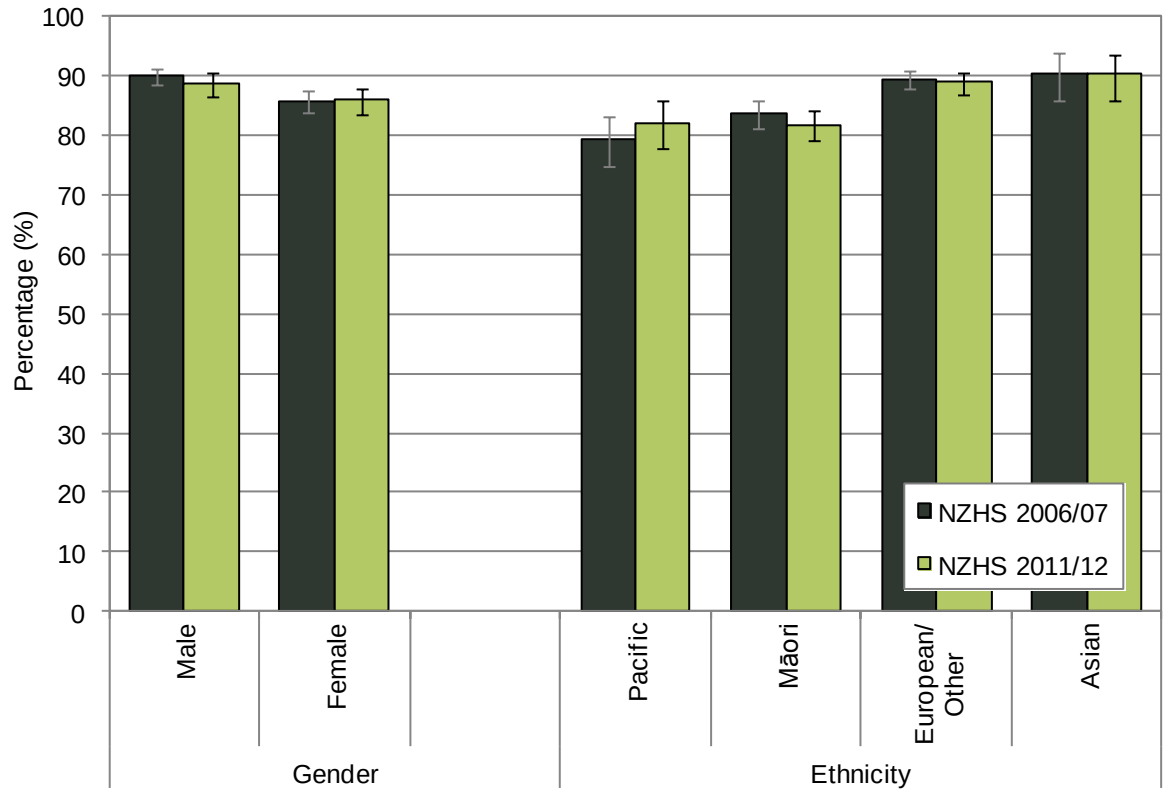
Regional Results: NZHS results are reported by region, with DHBs being grouped as follows: *Northern Region*: Northland, Waitemata, Auckland, Counties Manukau; *Midland Region:* Waikato, Bay of Plenty, Lakes, Tairawhiti, Taranaki; *Central Region*: Hawke's Bay, Whanganui, MidCentral, Hutt Valley, Capital and Coast, Wairarapa; *Southern Region*: Nelson Marlborough, Canterbury, South Canterbury, West Coast, Southern. It is anticipated that results will become available by DHB in future years, as more survey data is collected.

Differences between estimates are said to be statistically significant when the confidence intervals for each rate do not overlap. Sometimes, however, even when there are overlapping confidence intervals, the difference between the groups can be statistically significant. Any differences between two variables where the confidence intervals overlap are tested using a t-test. The significance of a t-test is represented by the p-value. If a p-value is below 0.05, then we are 95 percent confident the difference between the two estimates is statistically significant [9].

Breakfast Eaten at Home

Eating breakfast every day was used in the 2011/12 NZ Health Survey as a proxy for healthy eating behaviour, as children who eat breakfast at home are less likely to eat high fat or high sugar snacks [8]. Further, the 2002 National Children's Nutrition Survey [10] found that children who usually eat breakfast at home have, on average, a lower BMI than those who do not, even once other potentially confounding risk factors are taken into account.

Figure 1. Proportion of Children Aged 2–14 Years Who Ate Breakfast at Home Every Day in the Past Week by Gender and Ethnicity, 2006/07 and 2011/12 NZ Health Surveys



Source: 2011/12 New Zealand Health Survey; Note: Rates have been age-standardised

Trends in Proportion of Children Who Ate Breakfast at Home

Overall: The proportion of children aged 2–14 years who ate breakfast at home every day in the last week did not change *significantly* (p=0.52) between NZ Health Surveys, with rates being 87.9% (95% CI 86.6–89.0) in 2006/07 and 87.3% (95% CI 85.7–88.7) in 2011/12.

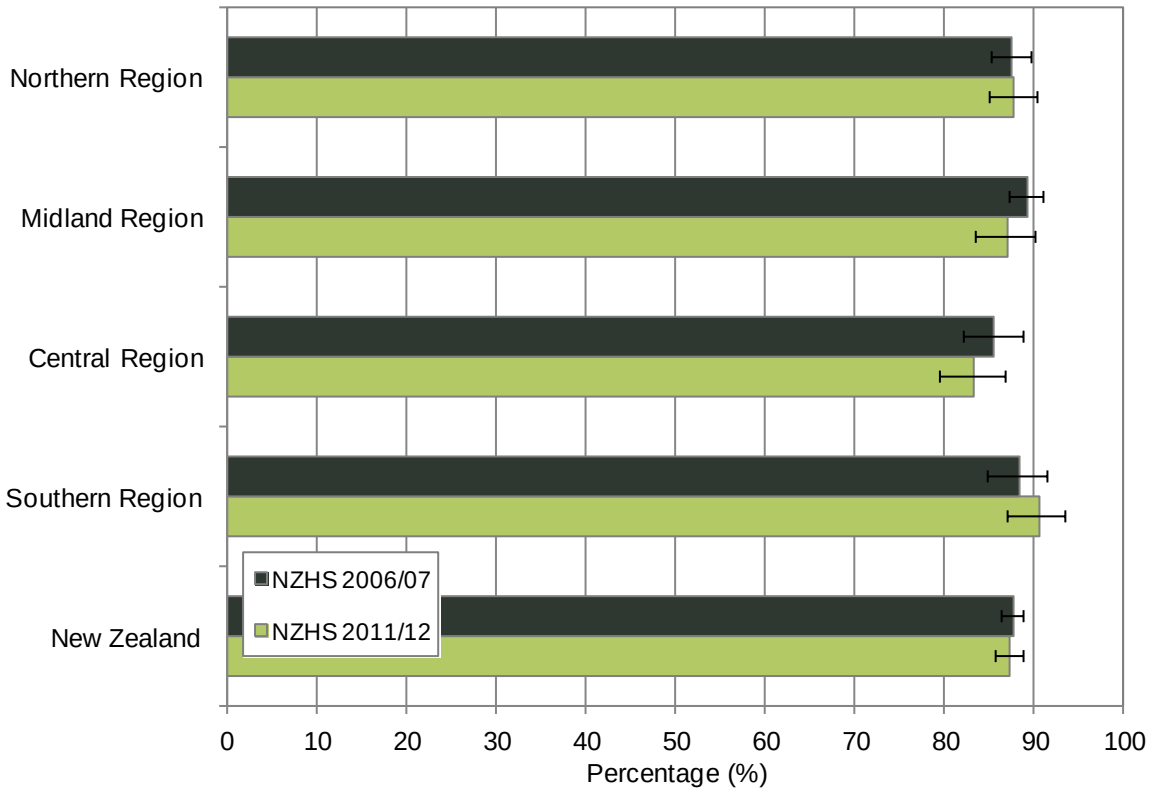
By Gender: When broken down by gender, the proportion of boys and girls aged 2–14 years who ate breakfast at home every day in the last week did not change *significantly* between the 2006/07 and 2011/12 Surveys (**Figure 1**). In the 2011/12 NZHS, once adjusted for age, there were also no *significant* gender differences in the proportion of children aged 2–14 years who ate breakfast at home every day in the last week, with rates being 88.6% (95% CI 86.6–90.4) for boys and 85.9% (95% CI 83.5–88.0) for girls.

By Ethnicity: When broken down by ethnicity, there were no *significant* changes in the proportion of Māori, Pacific, Asian and European/Other children who ate breakfast at home every day in the last week, between the 2006/07 and 2011/12 Surveys. In the 2011/12 NZHS, 81.8% (95% CI 79.1–84.2) of Māori, 81.9% (95% CI 77.7–85.7) of Pacific, 90.2% (95% CI 85.9–93.6) of Asian and 88.9% (95% CI 87.0–90.6) of European/Other children ate breakfast at home every day in the last week (**Figure 1**).

Distribution by Region

When broken down by region, there were no *significant* changes in the proportion of Northern, Midland, Central or Southern children who ate breakfast at home every day in the last week, between the 2006/07 and 2011/12 NZ Health Surveys. In the 2011/12 NZHS, 87.7% (95% CI 84.9–90.2) of Northern, 87.0% (95% CI 83.3–90.1) of Midland, 83.4% (95% CI 79.4–86.8) of Central and 90.5% (95% CI 87.0–93.3) of Southern children ate breakfast at home every day in the last week (**Figure 2**).

Figure 2. Proportion of Children Aged 2–14 Years Who Ate Breakfast at Home Every Day in the Past Week by Region, 2006/07 and 2011/12 New Zealand Health Surveys



Source: 2011/12 New Zealand Health Survey; Note: Rates are unadjusted for age

Current Distribution of Children Who Ate Breakfast at Home

Distribution by Age

In the 2011/12 NZ Health Survey, children aged 10–14 years (81.2% (95% CI 78.3–83.9)) were *significantly* less likely to eat breakfast at home every day in the last week than children aged 2–4 years (93.9% (95% CI 91.7–95.6)). Similar age-related differences were evident when rates were broken down by gender (**Figure 3**).

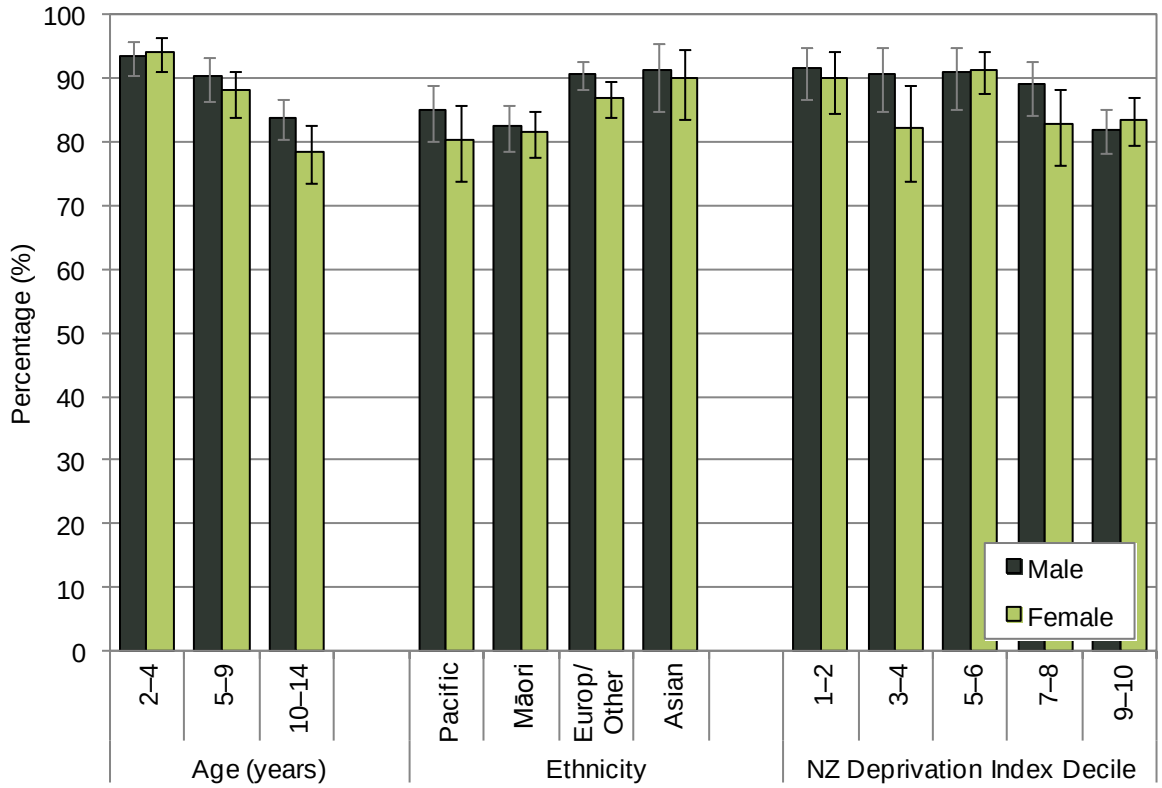
Distribution by Ethnicity

In the 2011/12 NZ Health Survey, once adjusted for age and gender, Māori children were *significantly* less likely (aRR 0.92 (95% CI 0.88–0.95)) than non-Māori children to have eaten breakfast at home every day in the last week, with rates also being *significantly* lower for Pacific children (aRR 0.93 (95% CI 0.89–0.98)) than for non-Pacific children. No *significant* differences however were evident between Asian and non-Asian children.

Distribution by NZ Deprivation Index Decile

In the 2011/12 NZ Health Survey, once adjusted for age, ethnicity and gender, children from the most deprived (NZDep06 deciles 9–10) areas were *significantly* less likely to eat breakfast at home every day in the last week than children in the least deprived (NZDep06 deciles 1–2) areas (aRR 0.94 (95% CI 0.88–1.00)).

Figure 3. Proportion of Children Aged 2–14 Years Who Ate Breakfast at Home Every Day in the Past Week by Gender, Age Group, Ethnicity and NZ Deprivation Index Decile, 2011/12 New Zealand Health Survey



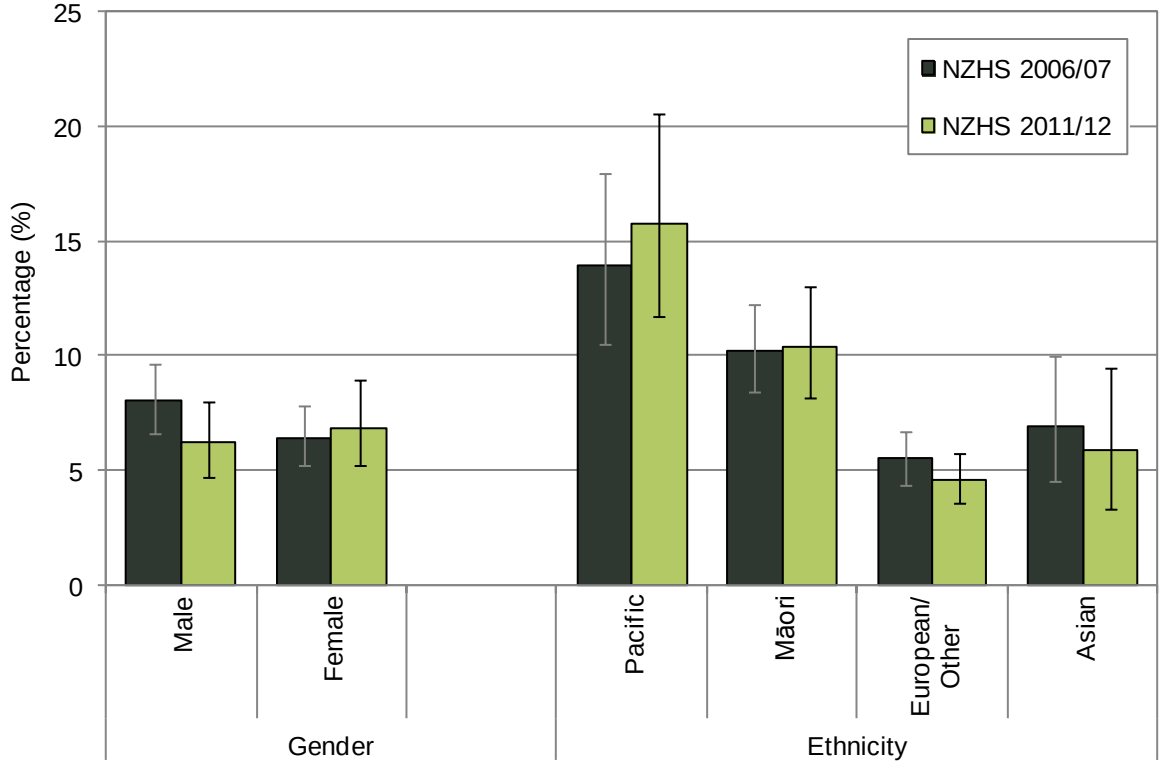
Source: 2011/12 New Zealand Health Survey; Note: Rates are unadjusted for age

Fast Food Consumption

Trends in Proportion of Children Who Ate Fast Food

Overall: The proportion of children aged 2–14 years who ate fast food three or more times in the past week did not change *significantly* (p=0.39) between NZ Health Surveys, with rates being 7.2% (95% CI 6.3–8.2) in 2006/07 and 6.5% (95% CI 5.3–7.9) in 2011/12.

Figure 4. Proportion of Children Aged 2–14 Years Who Ate Fast Food Three or More Times in the Past Week by Gender and Ethnicity, 2006/07 and 2011/12 New Zealand Health Surveys



Source: 2011/12 New Zealand Health Survey; Note: Rates have been age-standardised

By Gender: When broken down by gender, the proportion of boys and girls aged 2–14 years who had eaten fast food three or more times in the past week did not change *significantly* between the 2006/07 and 2011/12 Surveys. In the 2011/12 NZHS, once adjusted for age, there were also no *significant* gender differences in the proportion of children aged 2–14 years who had eaten fast food three or more times in the past week, with rates being 6.2% (95% CI 4.7–8.0) for boys and 6.8% (95% CI 5.2–8.9) for girls (**Figure 4**).

By Ethnicity: When broken down by ethnicity, there were also no *significant* changes in the proportion of Māori, Pacific, Asian and European/Other children who had eaten fast food three or more times in the past week between the 2006/07 and 2011/12 Surveys. In the 2011/12 NZHS, 10.3% (95% CI 8.1–13.0) of Māori, 15.7% (95% CI 11.7–20.5) of Pacific, 5.9% (95% CI 3.3–9.5) of Asian and 4.5% (95% CI 3.5–5.7) of European/Other children had eaten fast food three or more times in the past week (**Figure 4**).

Current Distribution of Children Who Ate Fast Food

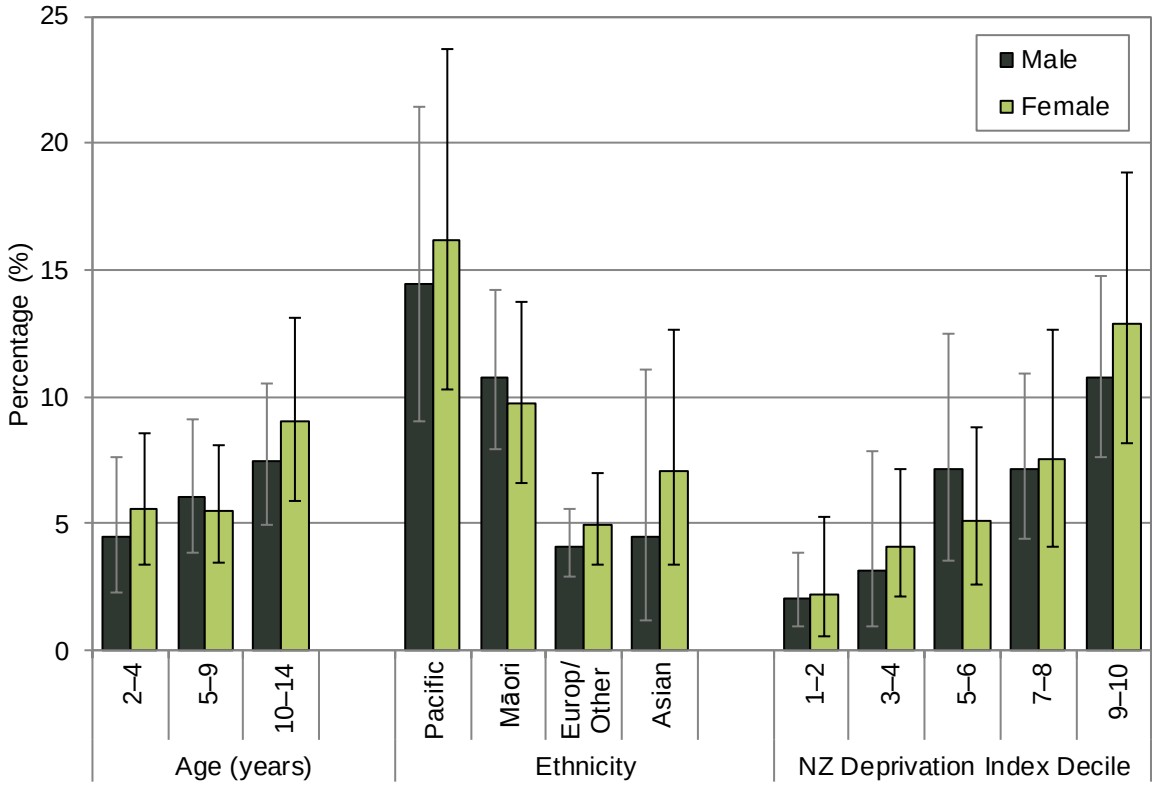
Distribution by Age

In the 2011/12 NZ Health Survey, while a higher proportion of children aged 10–14 years (8.2% (95% CI 6.2–10.6)) had eaten fast food three or more times in the past week than children aged 2–4 years (5.0% (95% CI 3.3–7.2)) these differences did not reach statistical significance. A similar pattern was seen when age specific rates were broken down by gender (**Figure 5**).

Distribution by Ethnicity

In the 2011/12 NZ Health Survey, once adjusted for age and gender, Māori children were *significantly* more likely (aRR 1.96 (95% CI 1.45–2.64)) than non-Māori children to have eaten fast food three or more times in the past week, with rates also being *significantly* higher for Pacific children (aRR 3.20 (95% CI 2.34–4.36)) than for non-Pacific children. No *significant* differences however were evident between Asian and non-Asian children.

Figure 5. Proportion of Children Aged 2–14 Years Who Ate Fast Food Three or More Times in the Past Week by Gender, Age, Ethnicity and NZ Deprivation Index Decile, 2011/12 New Zealand Health Survey



Source: 2011/12 New Zealand Health Survey; Note: Rates are unadjusted for age

Distribution by NZ Deprivation Index Decile

In the 2011/12 NZ Health Survey, once adjusted for age, ethnicity and gender, children from the most deprived (NZDep06 deciles 9–10) areas were *significantly* more likely have eaten fast food three or more times in the past week than children in the least deprived (NZDep06 deciles 1–2) areas (aRR 3.23 (95% CI 1.66–6.29)).

Fizzy Drink Consumption

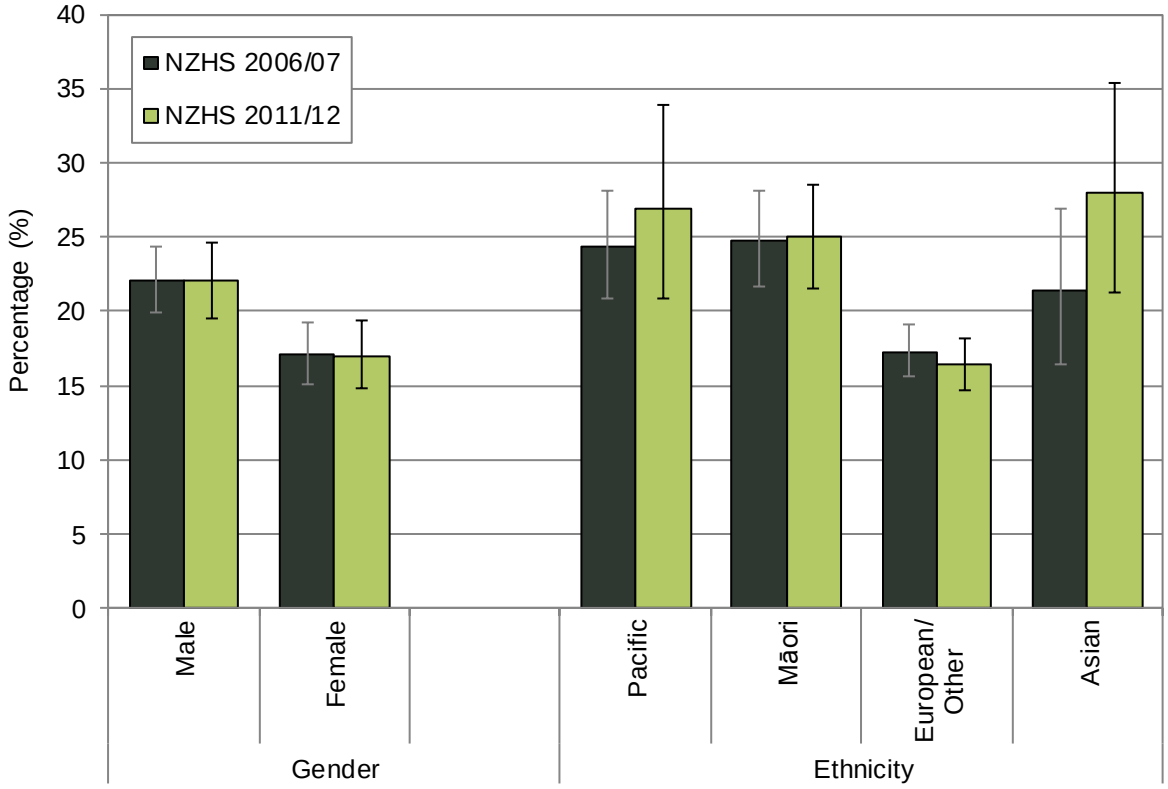
Trends in the Proportion of Children Who Consumed Fizzy Drinks

Overall: The proportion of children aged 2–14 years who had consumed fizzy drinks three or more times in the past week did not change *significantly* (p=0.98) between NZ Health Surveys, with rates being 19.6% (95% CI 18.0–21.2) in 2006/07 and 19.6% (95% CI 17.9–21.4)) in 2011/12.

By Gender: When broken down by gender, the proportion of boys and girls aged 2–14 years who had consumed fizzy drinks three or more times in the past week did not change *significantly* between the 2006/07 and 2011/12 Surveys. In the 2011/12 NZHS however, once adjusted for age, boys (22.1% (95% CI 19.6–24.7)) were *significantly* more likely than girls (16.9% (95% CI 14.8–19.3)) to have consumed fizzy drinks three or more times in the past week (**Figure 6**).

By Ethnicity: When broken down by ethnicity, there were no *significant* changes in the proportion of Māori, Pacific, Asian and European/Other children who had consumed fizzy drinks three or more times in the past week between the 2006/07 and 2011/12 Surveys. In the 2011/12 NZHS, 25.0% (95% CI 21.6–28.6) of Māori, 26.9% (95% CI 20.8–33.8) of Pacific, 27.9% (95% CI 21.3–35.4) of Asian and 16.4% (95% CI 14.7–18.2) of European/Other children had consumed fizzy drinks three or more times in the past week (**Figure 6**).

Figure 6. Proportion of Children Aged 2–14 Years Who Had Fizzy Drinks Three or More Times in the Past Week by Gender and Ethnicity, 2006/07 and 2011/12 New Zealand Health Surveys



Source: 2011/12 New Zealand Health Survey; Note: Rates have been age-standardised

Current Distribution of Children Who Consumed Fizzy Drinks

Distribution by Age

In the 2011/12 NZ Health Survey, children aged 10–14 years (28.4% (95% CI 25.4–31.6)) were *significantly* more likely have consumed fizzy drinks three or more times in the past week than children aged 2–4 years (12.9% (95% CI 9.5–16.9)). Similar age-related differences were evident when rates were broken down by gender (**Figure 7**).

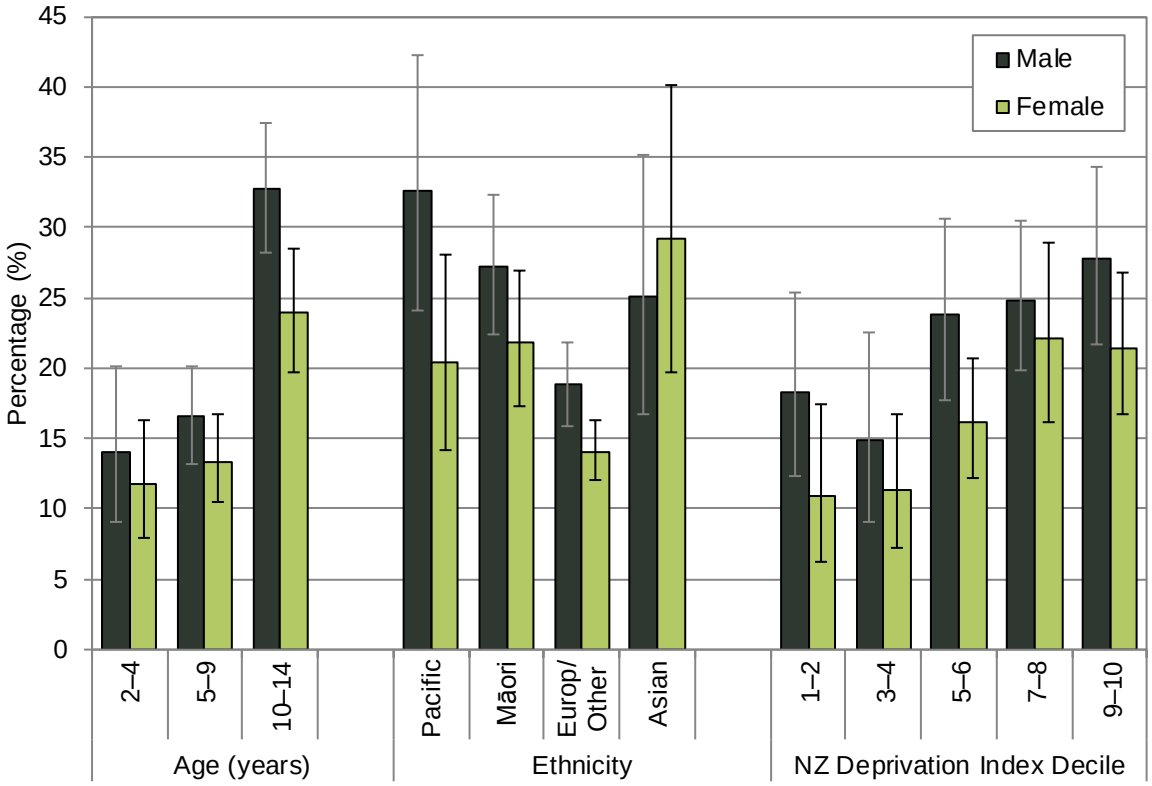
Distribution by Ethnicity

In the 2011/12 NZ Health Survey, once adjusted for age and gender, Māori children were *significantly* more likely (aRR 1.40 (95% CI 1.19–1.65)) than non-Māori children to have consumed fizzy drinks three or more times in the past week. Rates were also *significantly* higher for Pacific children (aRR 1.49 (95% CI 1.23–1.81)) than for non-Pacific children and for Asian children (aRR 1.49 (95% CI 1.17–1.91)) than for non-Asian children.

Distribution by NZ Deprivation Index Decile

In the 2011/12 NZ Health Survey, once adjusted for age, ethnicity and gender, children from the most deprived (NZDep06 deciles 9–10) areas were *significantly* more likely have consumed fizzy drinks three or more times in the past week than children in the least deprived (NZDep06 deciles 1–2) areas (aRR 1.81 (1.30–2.51)).

Figure 7. Proportion of Children Aged 2–14 Years Who Had Fizzy Drinks Three or More Times in the Past Week by Gender, Age, Ethnicity and NZ Deprivation Index Decile, 2011/12 New Zealand Health Survey



Source: 2011/12 New Zealand Health Survey; Note: Rates are unadjusted for age

Youth'12 Survey

Youth'12 was the third national survey of Year 9–15 students (Years 14 and 15 are those students who are repeating Years 12 and 13) in New Zealand, with previous surveys being undertaken in 2001 and 2007. The Youth'12 sample included 8,500 students aged 13–17+ years, which was approximately 3% of the 2012 New Zealand secondary school roll. In the survey students were asked how often they ate breakfast, as well as about their daily fruit and vegetable consumption [11].

Data Sources and Methods

Definitions

1. Frequency of eating breakfast in secondary school students aged 13–17+ years

2. Proportion of secondary school students aged 13–17+ years who ate 2+ fruit and 3+ vegetables per day

Data Sources

The Youth'12 Survey

In this section, data on nutrition in secondary school students was derived from *The Youth'12 Overview: The Health and Wellbeing of New Zealand Secondary School Students in 2012* [12], and its companion document the *Youth'12 Prevalence Tables* [11].

Notes on Interpretation

Survey Methodology and Sample: Youth'12 is the third national health and wellbeing survey of secondary school students in New Zealand, with previous surveys being undertaken in 2001 and 2007. The Youth'12 Survey was a random survey of composite and secondary schools. For schools with more than 150 Year 9–15 students, a random sample of 20% of the roll were invited to participate, while for schools with a roll of <150, 30 students were randomly asked to participate. Overall, 73% of invited schools took part, with 68% of students who were invited to participate agreeing to do so. This resulted in total sample of 8,500 students (3% of the 2012 New Zealand secondary school roll) [11].

Ethnicity Reporting: The Youth'12 ethnicity question was based on the NZ Census 2001/2006 ethnicity question, which asked students which ethnic group they belonged to, with multiple responses being possible. For the purposes of comparing ethnic groups, Statistics NZ's ethnicity prioritisation methods were used [13], which reported five ethnic groups: Māori, Pacific, Asian, European and Other.

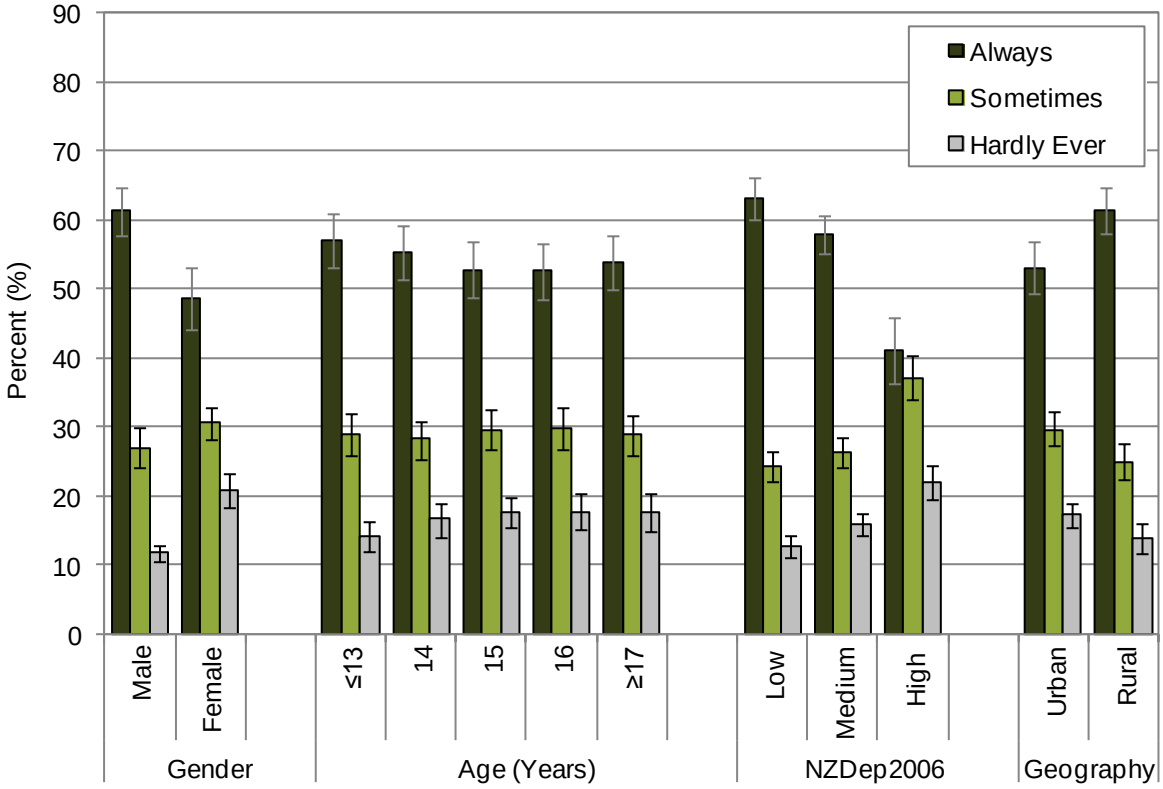
How Often Students Eat Breakfast

In the Youth'12 Survey, 16.7% (95% CI 15.1–18.2) of secondary school students said they hardly ever ate breakfast, with the proportion of females (20.8% (95% CI 18.4–23.3)) being *significantly* higher than for males (11.7% (95% CI 10.6–12.8)).

While there were no age-related differences in the proportion of students who hardly ever ate breakfast, a *significantly* higher proportion of students from the most deprived (NZDep deciles 8–10) areas (21.8% (95% CI 19.4–24.3)) said they hardly ever ate breakfast, than students from the least deprived (NZDep06 deciles 1–3) areas (12.7% (95% CI 11.0–14.3)).

There were no *significant* urban (17.2% (95% CI 15.5–19.0) vs. rural (13.8% (95% CI 11.5–16.0) differences in the proportion of students who said they hardly ever ate breakfast (**Figure 8**).

Figure 8. Frequency of Eating Breakfast in Secondary School Students Aged 13–17+ Years by Gender, Age, NZ Deprivation Index Decile and Geography, New Zealand Youth'12 Survey

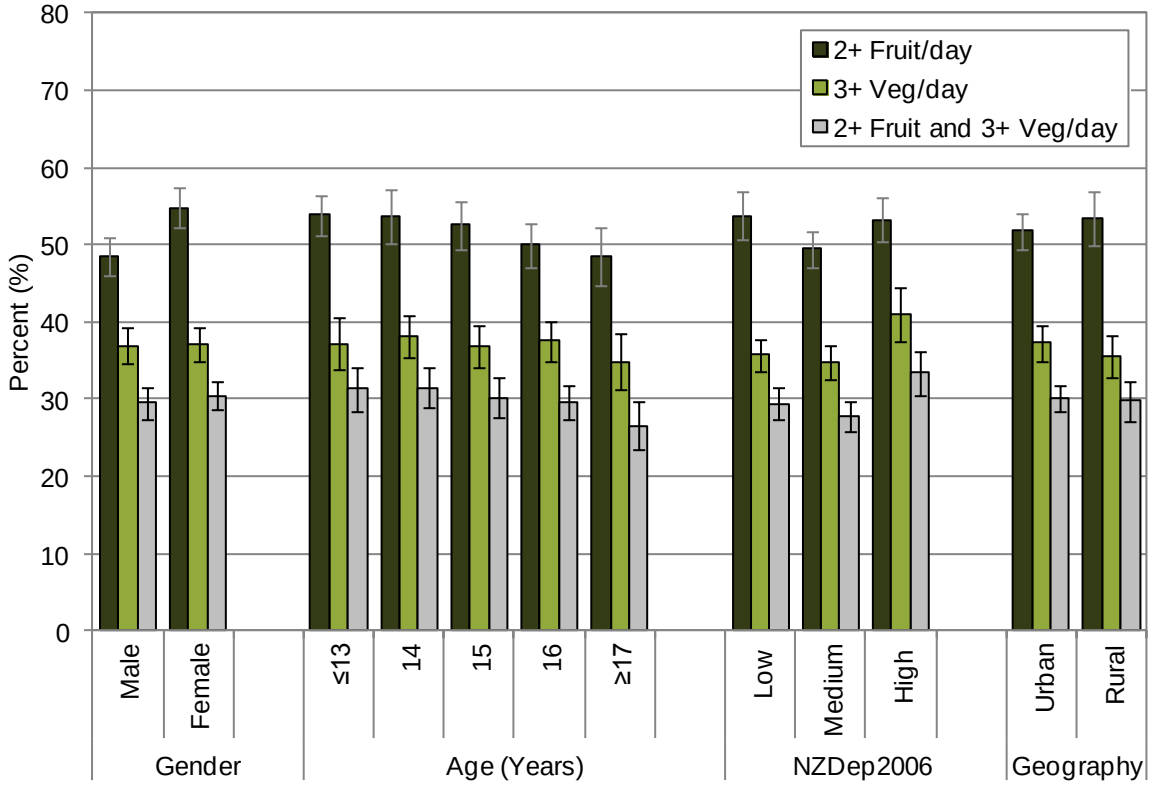


Source: Youth'12 Survey; Note: NZDep2006: Low = Deciles 1–3; Medium = Deciles 4–7; High = Deciles 8–10

Fruit and Vegetable Consumption

In the Youth'12 survey, 30.0% (95% CI 28.4–31.6) of secondary school students said that they ate 2+fruit and 3+ vegetables per day. There were no *significant* gender or age differences in the proportion of students who ate 2+ fruit and 3+ vegetables per day. Rates were also not *significantly* different between those living in the most and least deprived NZDep06 areas, or in urban and rural areas (**Figure 9**).

Figure 9. Fruit and Vegetable Consumption in Secondary School Students Aged 13–17+ Years by Gender, Age, NZ Deprivation Index Decile and Geography, New Zealand Youth'12 Survey



Source: Youth'12 Survey; Note: NZDep2006: Low = Deciles 1–3; Medium = Deciles 4–7; High = Deciles 8–10

Local Policy Documents and Evidence-Based Reviews Relevant to Nutrition in Children and Young People

In New Zealand a number of local policy documents relate to nutrition in children and young people, and these are briefly summarised in **Table 1**, along with a range of systematic and other reviews which consider these issues in the overseas context.

In addition, Table 119 (Local Policy Documents and Evidence-Based Reviews Relevant to Breastfeeding and Infant Nutrition) on Page 382 summarises publications relevant to breastfeeding and infant nutrition, while Table 109 **(**Local Policy Documents and Evidence-Based Reviews Relevant to Overweight and Obesity in Children and Young People) on Page 320, reviews publications relevant to the prevention and management of obesity.

In addition there are two in-depth topics related to Overweight and Obesity:
The Determinants and Consequences of Overweight and Obesity, and
The Treatment of Obesity in Children and Adolescents.

Table 1. Local Policy Documents and Evidence-Based Reviews Relevant to Nutrition

Ministry of Health Policy Documents
Ministry of Health. 2012. **Food and Nutrition Guidelines for Healthy Children and Young People (Aged 2 –18 years): A background paper**. Wellington: Ministry of Health. http://www.health.govt.nz/publication/food-and-nutrition-guidelines-healthy-children-and-young-people-aged-2-18-years-background-paper This background paper provides evidence-based technical information and best practice recommendations on nutrition and physical activity for health practitioners working in clinical and population health settings, and is used as the basis health education resources for the public. The paper includes a set of guideline statements on food, nutrition and physical activity, and recommendations for meal patterns, measurement of body size and nutrient intake. The paper includes reviews of meal patterns, physical activity and body size among New Zealand children and adolescents, and the wider determinants of health and the food environment. Further chapters address food and nutrition among tamariki and rangatahi Māori and their whānau, Pacific children and young people and their families, and Asian and other populations.
National Health and Medical Research Council & Ministry Of Health. 2006. **Nutrient Reference Values for Australia and New Zealand**. Canberra: National Health and Medical Research Council. http://www.health.govt.nz/publication/nutrient-reference-values-australia-and-new-zealand This publication is the result of a joint initiative of the Australian National Health and Medical Research Council and the New Zealand Ministry of Health. An expert working party reviewed recommendations from other countries, particularly from the US and Canada, as well as scientific data, information from recent dietary surveys in Australia and New Zealand and research and other information specific to Australian and New Zealand conditions to develop local reference values. Each chapter covers one nutrient and provides recommended dietary intakes and upper levels of intake by life stage and gender. A comprehensive list of references is included for each chapter.
Cochrane Systematic Reviews
Wolfenden L, et al. 2012. **Interventions for increasing fruit and vegetable consumption in children aged 5 years and under**. Cochrane Database of Systematic Reviews doi:10.1002/14651858.CD008552.pub2 http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD008552.pub2/abstract This review assessed the effectiveness, cost-effectiveness and associated adverse events of interventions designed to increase the consumption of fruit and/or vegetables amongst children aged five years and under. Only five trials (2 RCTs and 3 cluster RCTs, 3967 participants) were included in the review. Two trials examined the impact of specific feeding practices (e.g. repeated food exposure) in increasing child intake of a target vegetable. Two trials assessed the effectiveness of home visiting programmes implemented in disadvantaged communities and one trial investigated the effect of a preschool-based intervention in increasing child fruit and vegetable intake. Meta-analysis of two trials examining repeated food exposure versus a no intervention comparison found no significant difference in target vegetable consumption in the short term (mean difference 1.37, 95% CI -2.78 to 5.52). One trial found that coupling repeated food exposure with a tangible non-food or social reward was effective in increasing targeted vegetable consumption in the short term. The home visiting programmes did not significantly increase overall fruit intake in the short term (standardised mean difference 0.01, 95% CI -0.09 to 0.11), and the multi-component preschool-based intervention failed to significantly increase child consumption of vegetables, but did report a small significant increase in mean child consumption of fruit, six months following baseline assessment. None of the trials investigated intervention cost-effectiveness or reported information regarding any adverse events or unintended adverse consequences. The authors conclude that the review highlights the paucity of evidence for effective interventions.
Other Systematic Reviews
Hamel LM & Robbins LB. 2013. **Computer- and web-based interventions to promote healthy eating among children and adolescents: a systematic review**. Journal of Advanced Nursing, 69(1), 16-30. This review assessed the effectiveness of computer- and web-based interventions on improving eating behaviour (e.g. increasing fruit and vegetable consumption; decreasing fat consumption) and/or diet-related physical outcomes (e.g. body mass index) among children and adolescents. Fifteen, mostly US based, controlled trials were included in the review. All the studies were directed towards improving some type of eating behaviour. While a majority of interventions resulted in statistically significant positive changes in eating behaviour and/or diet-related physical outcomes, interventions that included post intervention follow-up (ranging from 3 to 18 months) showed that changes were not maintained. The authors suggest that interventions delivered in schools, and incorporating individually tailored feedback may be more successful. Further research is required to assess the effect and that post-intervention follow-up on maintenance of change is needed and studies should also include objective physical measurements where possible.
Evans CE, et al. 2012. **Systematic review and meta-analysis of school-based interventions to improve daily fruit and vegetable intake in children aged 5 to 12 y**. The American Journal of Clinical Nutrition, 96(4), 889-901. This review aimed to quantify the impact of school-based interventions on fruit and vegetable intake in children aged five to 12 years. Twenty seven (mostly cluster RCTs) studies were included in the review, 21 of which met the criteria for meta-analysis. The meta-analyses indicated an improvement of 0.25 portions (95% CI 0.06 to 0.43 portions) of fruit and vegetable daily intake if fruit juice was excluded and an improvement of 0.32 portions (95% CI 0.14 to 0.50 portions) if fruit juice was included. Improvement was mainly due to increases in fruit consumption: the results for fruit (excluding juice) and vegetables separately indicated an improvement of 0.24 portions (95% CI 0.05 to 0.43 portions) and 0.07 portions (95% CI 20.03 to0.16 portions), respectively. The overall quality of the studies was poor with a high risk of bias. The authors conclude that while school-based interventions can moderately increase fruit intake, they appear to have minimal effect on vegetable intake and further research is required to address the barriers to improving vegetable intake.

Jensen JD, et al. 2011. **Economic incentives and nutritional behavior of children in the school setting: A systematic review**. Nutrition Reviews, 69(11), 660-74.

This review assessed the effectiveness of economic incentives, such as free fruit and vegetables, price manipulation of healthy and energy-dense snack foods and rewards for tasting fruit and vegetables, for improving nutritional behaviour in schools. Twenty-eight studies, using a variety of methodologies including four RCTs, were included in the review. Outcome measures included self-reports, monitoring of sales and observation by researchers. The majority of studies took place in the US. A narrative review was undertaken. The studies addressing price incentives suggested that such incentives are effective for altering consumption in the school setting. Other types of economic incentives have been included in combined intervention schemes, but the inclusion of other intervention elements made it difficult to draw conclusions about the effectiveness of these economic incentive instruments and further research is suggested.

Van Cauwenberghe E, et al. 2010. **Effectiveness of school-based interventions in Europe to promote healthy nutrition in children and adolescents: systematic review of published and 'grey' literature**. British Journal of Nutrition, 103(6), 781-97.

This review assessed the effect of school-based interventions in Europe to promote a healthy diet in children and adolescents aged six to 18 years. Forty-two studies, mostly conducted in the UK, were included for review (n=72,600): 29 studies of children (n=42,060) and 13 studies of adolescents (n=30,540). Included studies evaluated educational programmes, environmental modifications (school lunch modifications, increased availability of healthy foods, fruit and vegetable distribution) or a combined educational and environmental modification programme. Most interventions included some family involvement and were classroom based. Intervention duration ranged from two weeks to five years in children and from one week to two years in adolescents. Some studies targeted low socioeconomic status groups or ethnic minority groups. Given the heterogeneity of the studies a narrative synthesis was undertaken. In children there was limited evidence that educational interventions improved dietary behaviour, six of 12 studies found no effect. The evidence for the effect on anthropometric outcomes was inconclusive (4 studies). Six studies found positive effects of fruit and vegetable distribution or breakfast initiatives on dietary behaviour; however, all studies were of moderate or weak quality. All nine of the studies of interventions that combined fruit and vegetable distribution and education improved fruit and vegetable intake reported positive effects. In adolescents there was moderate evidence that educational interventions in adolescents improved dietary intake (5 studies). Evidence for beneficial effects of education interventions on anthropometric outcomes was inconclusive. Two weak trials reported conflicting results for the effect of environmental interventions on dietary behaviour in adolescents. There was limited evidence for the impact of environmental intervention combined with nutrition education on dietary behaviour in adolescents (4 weak studies). The authors conclude that multicomponent interventions that promoted a healthy diet in school-age children in European Union countries had a positive impact on self-reported dietary behaviour, but evidence of effectiveness on anthropometric outcomes is lacking.

Note: The publications listed were identified using the search methodology outlined in Appendix 1 (Search Methods for Policy Documents and Evidence-Based Reviews)

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