A Focus on Pacific Nutrition

Findings from the 2008/09 New Zealand Adult Nutrition Survey

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The content of this report, in particular the introductory statements for each section, has drawn heavily from *A Focus on Nutrition*. The authors of this report were:

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The *Methodology Report for the 2008/09 New Zealand Adult Nutrition Survey* provides further information on contributions to data collection and analysis.

All Health and Disability Intelligence publications are subject to peer review by experts in their fields. This report was peer reviewed by internal and external reviewers, who provided valuable insight and contributions to this document.

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Executive summary

This report presents key findings on energy and nutrient intake, dietary supplement use, dietary habits, nutrition-related health and food security for Pacific people from the 2008/09 New Zealand Adult Nutrition Survey.

Energy, macronutrient and micronutrient intake

Energy is required in the body for metabolic processes, physiological functions, muscular activity, heat production, growth and the synthesis of new tissues. The macronutrients (protein, carbohydrate, fat and alcohol from food and drinks) are the only sources of energy for humans. Vitamins and minerals (micronutrients) are nutrients needed in small amounts. This report includes findings for the median usual daily intakes of vitamins A and B (riboflavin and B_{12}) and the minerals calcium, zinc and selenium.

The median daily energy intake from foods and beverages was 10,711 kJ for Pacific males and 7970 kJ for Pacific females. Pacific females had a significantly higher energy intake compared to non-Pacific females.

There were no differences between Pacific and non-Pacific males and females in the mean percent of total energy from protein, fat, and carbohydrates.

Overall, there were no significant differences in the median usual daily intake of vitamin A, vitamin B_{12}, zinc and selenium between Pacific and non-Pacific people. Pacific males had a significantly lower median usual daily intake of riboflavin compared to non-Pacific males. Pacific males and females had a significantly lower median usual daily intake of calcium compared to non-Pacific males and females

Dietary supplement use

About one in five Pacific males (19%) and females (18.6%) had consumed a dietary supplement at any time in the past 12 months. Pacific males and females were significantly less likely to have taken supplements in the past 12 months compared to non-Pacific males and females.

Dietary habits

Dietary habits and eating patterns are associated with nutrient intake, nutritional status and health conditions. A number of dietary factors are important protective factors for chronic diseases, including vegetable and fruit intake, whereas high intakes of fat (particularly saturated fat), sodium and total energy are risk factors.

Dietary habits were generally similar between Pacific and non-Pacific people. Specifically, there were few differences between Pacific and non-Pacific people in the use of margarine as the preferred spread, the use of cooking oil and the use of iodised salt.

However, the survey also found some differences in dietary habits between Pacific and non-Pacific people. Pacific males and females were more likely to eat fresh and frozen or canned fish and shellfish one or more times a week than non-Pacific people. Pacific males were less likely to eat processed meat three or more times a week. Pacific males and females were less likely than non-Pacific males and females to eat breakfast daily, choose reduced fat or trim milk, trim fat off meat, remove the skin from chicken, and to rarely or never add salt to food. Pacific males and females were more likely to drink soft drinks or energy drinks three or more times a week than non-Pacific people. Pacific females were almost three times more likely than non-Pacific females to eat fast foods or takeaways, and to eat hot chips three or more times a week.

From 1997 to 2008/09 there was an increase in the proportion of Pacific males who consumed two or more servings of fruit a day. About half of Pacific males and 63% of Pacific females consumed two or more servings of fruit a day (similar to non-Pacific males and females).

From 1997 to 2008/09 there was no change in the prevalence of having adequate vegetable intake for Pacific people. Less than half of Pacific males (40.9%) and Pacific females (48.9%) met this recommendation in 2008/09, significantly lower than for non-Pacific people.

Household food security

'Food security' is an internationally recognised term that encompasses the ready availability of nutritionally adequate and safe foods, and the assured ability to acquire personally acceptable foods in a socially acceptable way.

Approximately one-quarter of Pacific males and females live in a household that has *full/almost full food security*, approximately half live in a household that has *moderate food security*, and one in five live in a household that has *low food security*. Pacific people were more likely to live in households classified as having low and moderate food security and less likely to live in households classified as having full/almost full food security compared to non-Pacific people.

Between 1997 and 2008/09 there has been a decrease in the proportion of Pacific people living in households with full / almost full food security.

Nutrition-related health outcomes

A range of anthropometric, biochemical and clinical measures were used to assess nutritional status and nutrition-related health outcomes in the 2008/09 NZANS.

Body size and obesity

Mean BMI was 31.5 kg/m^2 for Pacific males and 33.0 kg/m^2 for Pacific females. Pacific males and females had a significantly higher mean BMI than non-Pacific males and females. From 1997 to 2008/09 there was an increase in mean BMI in both Pacific males and Pacific females.

The prevalence of obesity was 56.2% in Pacific males and 59.5% in Pacific females – an increase from 1997. Both Pacific males and Pacific females were more than twice as likely to be obese compared to non-Pacific males and females.

Blood pressure

High blood pressure is an important risk factor for heart disease, stroke and renal failure. Mean systolic blood pressure was 127 mmHg for Pacific males and 117 mmHg for Pacific females.

Blood cholesterol

Blood cholesterol is an important risk factor for cardiovascular disease, particularly ischaemic heart disease. Mean total cholesterol was 4.97 mmol/L for Pacific males and 4.68 mmol/L for Pacific females. Mean HDL cholesterol was 1.20 mmol/L for Pacific males and 1.27 mmol/L for Pacific females. Pacific females had significantly lower mean total cholesterol and mean HDL cholesterol levels than non-Pacific females, and a significantly higher total:HDL cholesterol ratio. There was a decrease in mean total cholesterol levels for both Pacific males and Pacific females from 1997 to 2008/09.

Diabetes and HbA1c

Glycated haemoglobin (HbA1c) was measured in blood samples to allow the prevalence of undiagnosed diabetes to be estimated and to measure diabetes control.

Overall, 14.8% of Pacific males and 14.9% of Pacific females aged 15 years and over have diabetes (combined diagnosed and undiagnosed). The prevalence of undiagnosed diabetes was 7.9% for Pacific males and 6.2% for Pacific females, meaning that approximately half had not reported being told by a doctor that they had diabetes. Pacific females were nearly three times more likely to have diabetes than non-Pacific females, after adjusting for age.

Folate status

Inadequate folic acid levels during pregnancy have been associated with an increased risk of neural tube defects (NTDs), a major group of birth defects in the developing fetus. Overall, 6.4 percent of Pacific females of childbearing age (16–44 years) had red blood folate levels associated with a high risk of having a baby with a neural tube defect. There was no difference in the proportions of Pacific and non-Pacific females who had a high risk of having a baby with neural tube defects.

Iodine status

Iodine is an essential component of thyroid hormones, which play a critical role in maintaining the body's metabolic rate and normal growth and mental development. Pacific males and females are classified as mildly iodine deficient because the median urinary iodine concentration of 74 µg/L for Pacific males and 72 µg/L for Pacific females falls within the range defined by the International Council for the Control of Iodine Deficiency Disorders as mild iodine deficiency (50–99 µg/L). This survey took place before the implementation of mandatory fortification of bread with iodised salt (to reduce the prevalence of iodine deficiency) in September 2009.

1 Introduction

Background

This publication is a companion report to *A Focus on Nutrition: Key findings from the 2008/09 Adult Nutrition Survey* (University of Otago and Ministry of Health 2011a). It provides key findings on nutrition, nutrition-related health and food security for Pacific people from the 2008/09 New Zealand Adult Nutrition Survey (NZANS).

Findings for key indicators for energy and macronutrient intake, intake of selected vitamins and minerals, dietary habits, dietary supplement use, nutrition-related health and food security are presented for Pacific people. The report also looks at differences between Pacific and non-Pacific people, as well as changes in selected indicators between 1997 and 2008/09, where possible.

A Focus on Māori Nutrition is a further companion report that provides information on nutrition, nutrition-related health and food security for Māori.

All reports can be accessed at www.health.govt.nz/nz-health-statistics/national-collections-and-surveys/surveys/current-recent-surveys/nutrition-survey

How is this report different from *A Focus on Nutrition*?

A Focus on Nutrition: Key findings from the 2008/09 Adult Nutrition Survey (hereafter referred to as *A Focus on Nutrition*) should be used to gain an overall picture of nutrition in the New Zealand population aged 15 years and over. That report includes unadjusted/crude results by ethnic group (New Zealand European & Other, Māori, Pacific). It should be used if you want information on the actual burden experienced by the ethnic group of interest, but do not use it to compare one ethnic group with another.

The focus of this report is Pacific people, and all analyses refer to Pacific people as the point of focus. In this report, two mutually exclusive groups (Pacific and non-Pacific people) are compared, taking into account differences by age. The use of total response standard output to define ethnicity in *A Focus on Nutrition* meant that it was not appropriate to include ethnic group comparisons in that report.

Overview of the survey

The 2008/09 NZANS was carried out from October 2008 to October 2009, collecting information from 4721 adult New Zealanders aged 15 years and over. The survey included 3374 New Zealand European/Other people, 1040 Maori and 757 Pacific people. The background and objectives of the survey are outlined in *A Focus on Nutrition*.

The 2008/09 NZANS collected information on dietary intake over 24 hours, dietary habits, dietary supplement use, food security, body size, blood pressure and nutrition-related health, including biochemical indices.

All results have been weighted in order to be representative of New Zealand's estimated resident population living in permanent private dwellings at 31 June 2007. The final weighted response rate for the 2008/09 NZANS was 61%. Because the number of respondents who gave blood and urine samples was lower, the final weighted response rates were calculated separately for the blood and urine samples, and they were both 44%.

It was not possible to calculate the overall response rate by demographic subgroups such as sex, ethnic group, age group and New Zealand Deprivation Index 2006[1] due to the unavailability of such information for some participants at the recruitment stage. However, partial response rates by demographic subgroups (including Pacific people) are presented in the *Methodology Report for the 2008/09 Adult Nutrition Survey* (University of Otago and Ministry of Health 2011b).

Methods

This section provides a brief overview of the methods relevant to this report. Full details of the methodology used for the 2008/09 NZANS are presented in the *Methodology Report for the 2008/09 Adult Nutrition Survey* (University of Otago and Ministry of Health 2011b).

The 2008/09 NZANS used a multi-stage, stratified, probability-proportional-to-size (PPS) sample design, with increased sampling of some ethnic groups and age groups. A three-step process was used to achieve the sample: a random sample of meshblocks, a sample of dwellings from within each meshblock, and selection of one eligible adult (aged 15 years and over, if any) from each selected dwelling. CBG Health Research Ltd recruited participants, and the University of Otago collected data and conducted the recipe analysis and nutrient matching from the 24-hour diet recall.

The survey was carried out by face-to-face computer-assisted personal interviews. Firstly, a 24-hour diet recall was used to collect quantitative information on all foods and drinks consumed by the participant the previous day. Foods and beverages were matched to food composition data to calculate nutrient intake.

Secondly, respondents were asked questions about their dietary habits, use of dietary supplements, nutrition-related health and food security, and socio-demographic information was collected. Blood pressure, height, weight and waist circumference were then measured by the interviewers in the participant's home using professional equipment and standardised protocols. Each participant who gave informed consent to provide blood and urine samples was provided with a specimen collection kit, and the sample was collected at a Canterbury Health Laboratory affiliated laboratory in their area.

[1] The New Zealand Index of Deprivation 2006 is an area-based index of deprivation, which measures the level of socioeconomic deprivation for each neighbourhood (meshblock) according to a combination of the following 2006 Census variables: income, benefit receipt, transport (access to a car), household crowding, home ownership, employment status, qualifications, support (sole-parent families), and access to a telephone.

Ethnicity

Ethnicity is self-defined, and participants were able to report affiliation with up to nine different groups, using the Statistics New Zealand standard ethnicity question. All survey participants reported affiliation with at least one ethnic group.

In this report, all participants who identified as Pacific are included in the 'Pacific' group; all other participants are included in the 'non-Pacific' group. These two groups do not overlap.

A series of separate two-way comparisons are presented in this report, such that Pacific people are compared with non-Pacific people (the comparator group). It is important to note that the non-Pacific comparator group should not be treated as a valid ethnic group in its own right, because it does not meet Statistics New Zealand's definition of an ethnic group. Therefore, the non-Pacific group should not be the focus of analysis, but rather should be used as a statistical reference group (Statistics New Zealand 2005).

Analysis

Crude data are presented for Pacific people for means, medians and proportions, with 95% confidence intervals. Crude (or unadjusted) data are data that have not been adjusted for other factors (such as age). Crude data are used to show the burden of a particular indicator on a population group.

Crude data are not presented for non-Pacific people. Instead, where comparisons between Pacific and non-Pacific people are made, age-standardised ratios and differences (and the equivalent measures for means; ie, ratios of means and differences of means) are presented. Age standardisation was performed by the direct method using the World Health Organization (WHO) world population age distribution (Ahmad et al 2000), which takes into account any differences in the age distribution of two populations.

Ratios give a measure of relative difference in burden for the group of interest, while differences give a measure of the absolute difference in burden. Ratios and differences complement each other and give different perspectives on the difference between the two groups with respect to the outcome measure. For example, a 20% difference (eg, Pacific people = 40%, non-Pacific people = 20%, difference = 40% – 20% = 20%) can be interpreted as placing a much higher burden on Pacific people than a 1% difference (eg, Pacific people = 2%, non-Pacific people = 1%, difference = 1%), even though in both examples Pacific people have twice the risk as non-Pacific people (ie, the same ratio of 2). Ratios and differences are explained in more detail below.

Ratios

In this document, a ratio is a ratio of estimates for two populations. The estimate can be a proportion (prevalence), mean or median.

$$\text{Ratio} = \frac{\text{prevalence (or mean or median) in Pacific people}}{\text{prevalence (or mean or median) in non-Pacific people}}$$

Ratios can be interpreted in the following ways.

- A value of 1.00 shows that there is no difference between Pacific and non-Pacific people.
- A value higher than 1.00 means that the result is higher for Pacific people than for non-Pacific people.
- A value lower than 1.00 means that the result is lower for Pacific people than for non-Pacific people.
- Values that have an asterisk (*) are statistically significant.

All the comparisons in this report refer to Pacific people as the 'group of interest' compared with non-Pacific people as the 'reference group'. Conversely, to obtain the ratio for the reference group (non-Pacific people) compared to the group of interest (Pacific people), divide 1 by the ratio.

Differences

The difference is a measure of the difference between estimates for Pacific and non-Pacific people.

$$\text{Difference} = \text{prevalence (or mean or median) in Pacific people} - (\text{prevalence (or mean or median) in non-Pacific people})$$

It should be noted that in a few cases, for a particular comparison, the difference is statistically significant at the 5% level (noted with an asterisk) while the ratio is not statistically significant. This may occur when both the difference and the ratio are close to the cut-off of statistical significance (ie, close to a p-value of 0.05).

Statistical significance and 95% confidence Intervals

In this report, information about statistical significance is given as either 95% confidence intervals (for means, medians and proportions) or as asterisks (for ratios and differences) noting statistical significance at the 5% level of significance (p-value < 0.05).

Ninety-five percent confidence intervals represent the sample error for estimates. A 95% confidence interval means there is a 95% chance that the true value of the estimate (if we were to survey the whole population) lies between the lower and upper confidence interval values.

Only statistically significant differences have been discussed in the text. However, if there was no statistically significant difference between subgroups, this does not necessarily mean there was no difference; it could be that the sample size was too small to detect a significant difference at the 95% level based on non-overlapping confidence intervals.

Age standardisation

In this report, ratios and differences were adjusted for possible confounding factors to make comparisons more accurate and meaningful. The Pacific population is generally younger than the total New Zealand population, and therefore it is important to adjust for age when comparing Pacific and non-Pacific people. In this report, age standardisation was performed by the direct method using the WHO world population age distribution (Ahmad et al 2000).

Usual intake distributions

Using a repeat 24-hour diet recall from a subsample (23%) of Pacific participants, nutrient intakes for each subgroup were adjusted for intra-individual variability using the PC-SIDE programme to obtain usual intake distributions. Nutrient ratios (eg, percent energy from protein) were not adjusted for intra-individual variation because the only methods that have been developed for ratios use multiple-day repeats.

Accuracy of energy and nutrient intake estimates

The accuracy of nutrient estimates depends on two factors: the accuracy of information provided by participants in the 24-hour diet recall and the accuracy of the food composition data. Misreporting of a food intake, especially under-reporting, is a well-known problem in all types of dietary surveys. If food intake is under-reported, energy and nutrient intakes will be underestimated. For more information on potential sources of error, see the *Methodology Report* (University of Otago and Ministry of Health 2011b).

Nutrient adequacy

For selected nutrients, the probability of inadequate intake was estimated by comparing the *usual* intake distribution to the estimated average requirement (EAR) from the nutrient reference values (NRV) for Australia and New Zealand (NHMRC 2006). Nutrient adequacy could not be determined if there was no EAR for a nutrient.

When interpreting the prevalence of inadequate intakes, it is important to note the following.

- Nutrient intake estimates are from food and drinks only and exclude intake from dietary supplements (other than supplements providing energy, such as meal replacements).
- Nutrient intake estimates depend on the accuracy of the information provided by participants in the 24-hour diet recall and the accuracy of the food composition data.
- The prevalence of inadequate intakes partly reflects the criterion on which the requirement is based. A cautionary comment on the interpretation of adequacy of intake for a nutrient has been made when the derivation of the reference value is either unclear or scientifically debatable.
- Accurate assessment of nutritional status requires a combination of dietary, anthropometric, biochemical and clinical measurements (Gibson 2005). Adequacy or inadequacy of nutritional status cannot be determined from dietary data alone.

Given these potential sources of error in the estimation of inadequate intake and the smaller sample size for Pacific people (resulting in large standard errors and wide confidence intervals), comparisons of nutrient adequacy between Pacific and non-Pacific people are not presented in this report.

Sex differences

Males have a higher body weight and a greater proportion of lean body mass than females. They therefore require more food (energy) to maintain their body mass and to meet their requirements for physical activity and basal metabolic rate. Therefore, daily energy intake, on average, for males is expected to exceed that for females, as will their intake of macronutrients.

Time trends

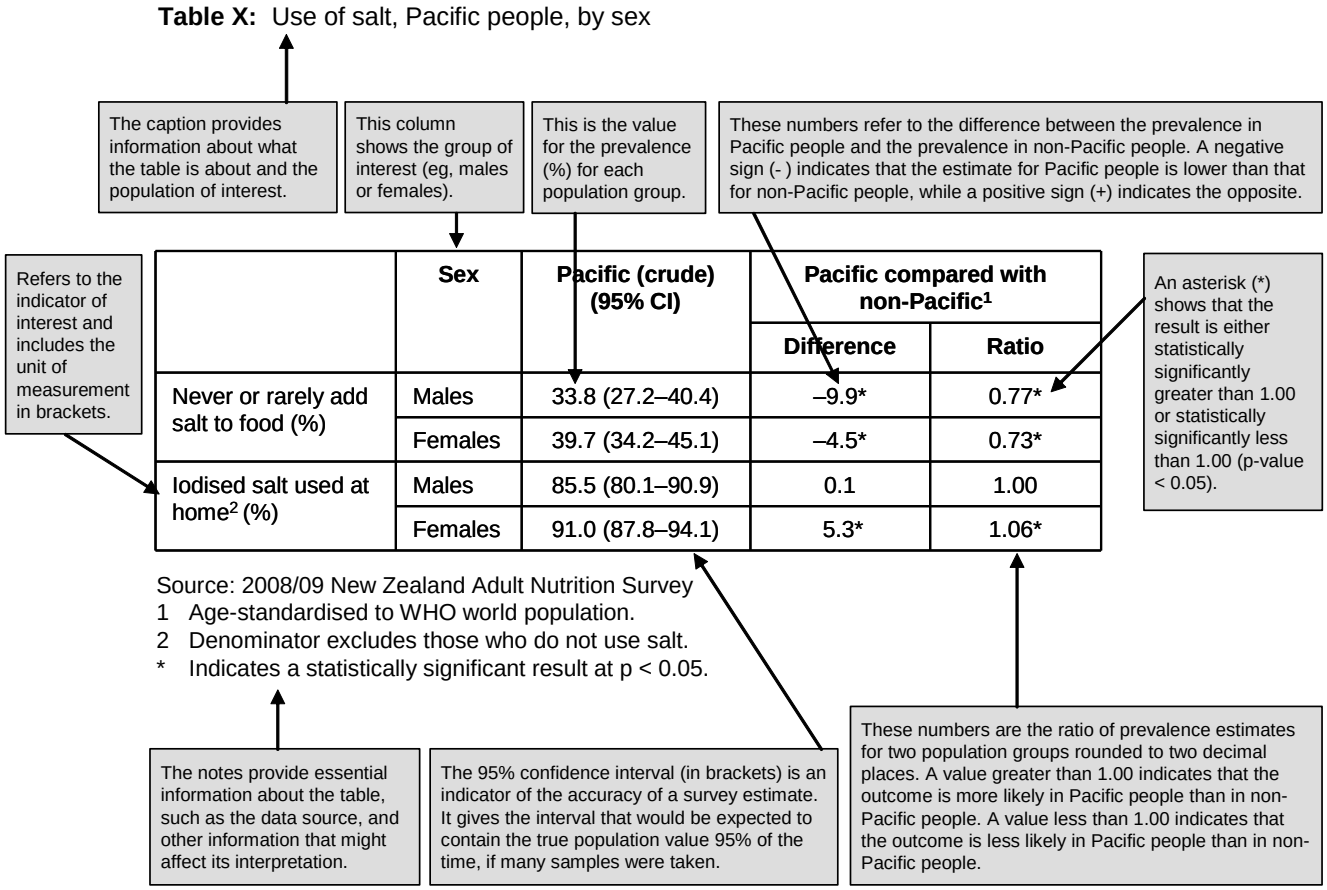
Where possible, comparisons between the 2008/09 NZANS and 1997 National Nutrition Survey (NNS) have been reported. Time trend analyses were restricted to nutrition indicators that were considered comparable across surveys. Because the age structure of the New Zealand population has changed since 1997, age-standardised data are presented in the time-trend tables. Age-standardised ratios were used to compare the 1997 and 2008/09 surveys.

The ratios presented in the time trend sections can be interpreted in the following ways.

- A value of 1.00 shows that there is no difference between 1997 and 2008/09.
- A value higher than 1.00 means that there has been an increase in the indicator between 1997 and 2008/09.
- A value lower than 1.00 means that there has been a decrease in the indicator between 1997 and 2008/09.
- Values that have an arrow (↑ or ↓) indicate a statistically significant (p-value < 0.05) increase or decrease between 1997 and 2008/09.

How to interpret tables in this report

The following diagram shows how to interpret the tables of comparisons presented in this report. Further information on how to interpret differences and ratios is available on page 4.



	Sex	Pacific (crude) (95% CI)	Pacific compared with non-Pacific[1]	
			Difference	Ratio
Never or rarely add salt to food (%)	Males	33.8 (27.2–40.4)	–9.9*	0.77*
	Females	39.7 (34.2–45.1)	–4.5*	0.73*
Iodised salt used at home[2] (%)	Males	85.5 (80.1–90.9)	0.1	1.00
	Females	91.0 (87.8–94.1)	5.3*	1.06*

2 Energy and macronutrient intake

New Zealanders obtain the energy and nutrients they require from a wide variety of foods and beverages, and in some cases from dietary supplements as well. This chapter on energy and macronutrients presents the intake of energy and nutrients from food and beverages, without adding the nutrients from supplements (other than supplements providing energy, such as meal replacements).

Energy

Overall, the median usual daily energy intake was 10,711 kJ for Pacific males and 7970 kJ for Pacific females. There was no significant difference in the median usual daily energy intake between Pacific and non-Pacific males, after adjusting for age. Pacific females had a higher median energy intake than non-Pacific females, after adjusting for age.

Percent energy from macronutrients

Percent energy from macronutrients per day was calculated from day 1 of recall as follows (NHMRC 2006):

- percent energy from fat = (fat [g/day] x 37.7 kJ/g) / energy (kJ/day)
- percent energy from carbohydrate = (carbohydrate [g/day] x 16.7 kJ/g) / energy (kJ/day)
- percent energy from protein = (protein [g/day] x 16.7 kJ/g) / energy (kJ/day).

Protein

The acceptable macronutrient distribution range for protein intake is 15% to 25% of energy (NHMRC 2006). Pacific males and females consumed 16.8% and 16.9% of energy from protein, respectively (Table 2.1). There were no significant differences between Pacific and non-Pacific males and females, respectively, in the contribution of protein to energy, after adjusting for age.

Fat

The acceptable macronutrient distribution range for fat intake is 20% to 35% of total daily energy intake (NHMRC 2006). In addition, to reduce chronic disease, saturated fats and trans fats together should be limited to no more than 10% of energy (NHMRC 2006).

Pacific males consumed 34.2% of energy from total fat and Pacific females consumed 34.7% of energy from fat (Table 2.1). Pacific males consumed 13.3% of energy from saturated fat, 12.9% of energy from monounsaturated fat and 4.6% of energy from polyunsaturated fat. Pacific females consumed 13.5% of energy from saturated fat, 12.9% of energy from monounsaturated fat and 4.8% of energy from polyunsaturated fat.

There were no significant differences between Pacific and non-Pacific males in the mean daily intake of energy from total fat or the type of fat, after adjusting for age. Pacific females consumed a slightly higher percentage of energy from monounsaturated fat than non-Pacific females, after adjusting for age.

Carbohydrate

The acceptable macronutrient distribution range for carbohydrate intake is 45% to 65% of energy (NHMRC 2006). Pacific males consumed 46.8% of energy from carbohydrate and Pacific females consumed 48.1% of energy from carbohydrate (Table 2.1). There were no significant differences between Pacific and non-Pacific males and between Pacific and non-Pacific females in the contribution of carbohydrates to energy, after adjusting for age.

Dietary fibre

The median usual daily intake of dietary fibre was 21.4 g for Pacific males and 17.5 g for Pacific females (Table 2.1). There were no significant differences in the median usual daily intakes of fibre between Pacific and non-Pacific males and females, respectively, after adjusting for age.

Table 2.1: Median energy and macronutrient intake, Pacific people, by sex

	Sex	Pacific (95% CI)	Pacific compared with non-Pacific[1]	
			Difference	Ratio
Energy − median intake (kJ)	Males	10,711 (9843–11,579)	310	1.03
	Females	7970 (7564–8376)	543*	1.07*
Protein – mean percent of total energy	Males	16.8 (16.1–17.5)	0.6	1.04
	Females	16.9 (16.2–17.5)	0.7	1.04
Fat – mean percent of total energy	Males	34.2 (32.2–36.1)	0.0	1.00
	Females	34.7 (33.7–35.7)	1.2	1.04
Saturated fat – mean percent of total energy	Males	13.3 (12.4–14.1)	–0.2	0.98
	Females	13.5 (12.9–14.0)	0.4	1.03
Monounsaturated fat – mean percent of total energy	Males	12.9 (12.1–13.7)	0.3	1.03
	Females	12.9 (12.4–13.4)	0.7*	1.05*
Polyunsaturated fat – mean percent of total energy	Males	4.6 (4.1–5.0)	– 0.1	0.97
	Females	4.8 (4.6–5.0)	0	0.99
Carbohydrate – mean percent of total energy	Males	46.8 (45.2–48.5)	1.1	1.02
	Females	48.1 (46.9–49.3)	0.4	1.01
Dietary fibre – median intake (g)	Males	21.4 (19.6–23.2)	–0.3	0.99
	Females	17.5 (16.3–18.7)	–0.5	0.98

Source: 2008/09 New Zealand Adult Nutrition Survey

1 Age-standardised to WHO world population.

* Indicates a statistically significant result at p-value < 0.05.

3 Micronutrient intake

This chapter on selected vitamins and minerals presents the intake of nutrients from food and beverages, without adding the nutrients from supplements (other than supplements providing energy, such as meal replacements).

Vitamins

Vitamin A

'Vitamin A' is a generic term which describes retinol and related structures and the pro-vitamin A carotenoids. The activity of retinol is described by retinol equivalents (RE), whereby 1 µg RE is equivalent to 1 µg of retinol, 6 µg of β-carotene or 12 µg of other carotenoids (Mann and Truswell 2007).

Vitamin A is required for vision, immune function, regulation of cell growth and normal reproduction (Mann and Truswell 2007). Animal foods such as liver, milk, butter, cheese, egg yolk, some fatty fish and table margarine (which is usually fortified with vitamin A to a similar level to that found in butter) provide retinol. The pro-vitamin A carotenoids come from plant foods such as dark-green leafy vegetables and some yellow or orange-coloured fruits and vegetables (Mann and Truswell 2007; Rolfes et al 2009).

Pacific males and females had a median usual daily intake of vitamin A of 736 µg RE and 655 µg RE, respectively (Table 3.1). There was no significant difference in the median intake of vitamin A between Pacific males and females and non-Pacific males and females, after adjusting for age.

The estimated prevalence of inadequate intake of vitamin A RE for Pacific people was 37.3% for males and 37.1% for females.

Riboflavin

Riboflavin is involved in energy metabolism. The best sources are milk and milk products (Rolfes et al 2009).

Overall, Pacific males and females had a median usual daily intake of riboflavin of 1.8 mg and 1.5 mg, respectively (Table 3.1). Pacific males had a significantly lower median usual daily intake of riboflavin than non-Pacific males, after adjusting for age.

The estimated prevalence of inadequate intake of riboflavin for Pacific people was 14.4% for males and 13.1% for females.

Vitamin B_{12}

Adequate intake of vitamin B_{12} is essential for normal blood and neurological function (NHMRC 2006). Vitamin B_{12} is found almost exclusively in foods derived from animals.

Overall, Pacific males and females had a daily median usual daily intake of vitamin B_{12} of 5.1 mg and 3.8 mg, respectively (Table 3.1). There were no significant differences in the median usual daily intake of vitamin B_{12} between Pacific and non-Pacific males, or between Pacific and non-Pacific females, after adjusting for age.

The estimated prevalence of inadequate intake of vitamin B_{12} for Pacific people was 8.9% for males and 20.0% for females.

Table 3.1: Median usual daily intake of selected vitamins, Pacific people, by sex

	Sex	Pacific (95% CI)	Pacific compared with non-Pacific[1]	
			Difference	Ratio
Vitamin A (µg RE)	Males	736 (626–846)	–148	0.83
	Females	655 (561–749)	–79	0.89
Riboflavin (mg)	Males	1.8 (1.6–1.9)	–0.5*	0.80*
	Females	1.5 (1.4–1.6)	–0.2	0.90
Vitamin B_{12} (mg)	Males	5.1 (4.1–6.1)	0.2	1.05
	Females	3.8 (3.3–4.3)	0.5	1.15

Source: 2008/09 New Zealand Adult Nutrition Survey

1 Age-standardised to WHO world population.

Minerals

Calcium

Calcium is required for the normal development and maintenance of the skeleton. Calcium also plays an essential role in regulating muscle contraction, nerve conductivity, blood clotting and many other important bodily functions (Mann and Truswell 2007; Rolfes et al 2009).

Milk and some milk products (eg, yoghurt and cheese) are good sources of calcium. Non-dairy sources of calcium include tinned fish (with bones), green leafy vegetables, nuts and seeds, and fortified soy and rice milk.

Pacific males and females had a median usual daily intake of calcium of 693 mg and 604 mg, respectively (Table 3.2). Pacific males and females had a significantly lower median usual daily intake of calcium than non-Pacific males and females, respectively, after adjusting for age.

The estimated prevalence of inadequate intake of calcium for Pacific people was 71.2% for males and 92.3% for females. These data should be interpreted cautiously, however, because the EAR values have been augmented by 320 mg to take into account 'unspecified low absorption that occurs at about 500 mg/day' (NHMRC 2006). While calcium is of major importance for attaining and maintaining bone health, other factors such as vitamin D intakes, exercise levels and habitual levels of intake all influence bone health.

Zinc

Zinc is essential for many functions, including protein synthesis, insulin synthesis and action, growth, immune function, wound healing, transport of vitamin A, taste perception, appetite and reproduction (Mann and Truswell 2007; Rolfes et al 2009). Zinc is widely available in the food supply, but it is more bioavailable from animal products than from plant foods. Rich sources include oysters, red meat, lamb's liver and cheese (Mann and Truswell 2007). Cereal grains, legumes and nuts are also rich sources of zinc, but they are high in phytates, which reduce zinc absorption (Mann and Truswell 2007).

Pacific males and females had a median usual daily intake of zinc of 14.3 mg and 10.6 mg, respectively (Table 3.2). There was no significant difference in the median usual daily intake of zinc between Pacific males and females and non-Pacific males and females.

The estimated prevalence of inadequate intake of zinc for Pacific people was 36.1% for males and 10.5% for females.

Selenium

Selenium is involved in a range of processes, including thyroid hormone metabolism, immune function, reproduction and antioxidant defence (Mann and Truswell 2007). The selenium content of plant foods is dependent on the selenium content of the soils in which they are grown. Fruit, vegetables and grains grown in New Zealand tend to have lower selenium levels than plant foods from countries where the soil selenium concentrations are higher. The selenium content of animal foods is less variable than that of plant foods.

Pacific males and females had a median usual daily intake of selenium of 70.0 µg and 57.0 µg, respectively (Table 3.2). There were no significant differences in the median usual daily intake of selenium between Pacific and non-Pacific males and Pacific and non-Pacific females, after adjusting for age.

The estimated prevalence of inadequate intake of selenium for Pacific people was 40.9% for males and 54.4% for females.

Table 3.2: Median usual daily intake of selected minerals, Pacific people, by sex

	Sex	Pacific (95% CI)	Pacific compared with non-Pacific[1]	
			Difference	Ratio
Calcium (mg)	Males	693 (621–765)	–241*	0.74*
	Females	604 (565–643)	–152*	0.80*
Zinc (mg)	Males	14.3 (12.9–15.7)	1.3	1.10
	Females	10.6 (9.3–11.9)	1.8	1.20
Selenium (µg)	Males	70.0 (60.9–79.1)	16.0	1.24
	Females	57.0 (47.2–66.8)	10.5	1.23

Source: 2008/09 New Zealand Adult Nutrition Survey

1 Age-standardised to WHO world population.

* Indicates a statistically significant result at p-value < 0.05.

4 Dietary supplements

Dietary supplements are products the participant considered or intended 'as a supplement to their diet'. In the survey, participants were asked if they had taken any dietary supplements at any time during the last 12 months. Regular dietary supplement users were those who had consumed at least one supplement at least once a week. Occasional dietary supplement users were those who had consumed fewer than one supplement a week during the last 12 months.

Approximately one in five Pacific males (19.0%) and females (18.6%) had consumed a dietary supplement in the past 12 months (Table 4.1). Of those who consumed supplements, about 46.9% of Pacific males and 62.2% of Pacific females consumed dietary supplements regularly. Pacific males and females were significantly less likely to have taken dietary supplements in the past 12 months than non-Pacific males and females, after adjusting for age.

Table 4.1: Dietary supplement use in the past 12 months, Pacific people, by sex

	Sex	Pacific (95% CI)	Pacific compared with non-Pacific[1]	
			Difference	Ratio
Any time in past 12 months[2] (%)	Males	19.0 (13.9–24.2)	–24.6*	0.43*
	Females	18.6 (14.4–22.7)	–36.0*	0.34*
Regularly[3] (%)	Males	46.9 (32.5–61.4)	–13.6	0.77
	Females	62.2 (48.9–75.6)	–0.8	0.99
Occasionally[4] (%)	Males	53.1 (38.6–67.5)	13.6	1.33
	Females	37.8 (24.4–52.6)	0.8	1.02

Source: 2008/09 New Zealand Adult Nutrition Survey

1 Age-standardised to WHO world population.

2 Any consumption over the past 12 months.

3 At least one supplement consumed daily, more than once per week or once per week, among those who consumed a supplement any time in the past 12 months.

4 Any consumption less than once per week among those who consumed a supplement any time in the past 12 months.

* Indicates a statistically significant result at p-value < 0.05.

5 Dietary habits

The 2008/09 NZANS included a series of questions on key dietary patterns or habits associated with diet quality and/or nutritional status. Participants were asked about the frequency of eating certain foods, the type of food eaten, and the frequency of certain food preparation or cooking practices.

Consumption of breakfast

Eating breakfast regularly is associated with better nutrient intake, the prevention of weight gain and a lower body mass index (BMI) compared with skipping breakfast (Cho et al 2003; Ma et al 2003; van der Heijden et al 2007). Survey participants were asked how many days in an average week they have something to eat for breakfast (at home, in a car, at work or in a café).

Overall, 42.2% of Pacific males ate breakfast daily, 29.3% ate breakfast 3–6 days per week and 28.6% ate breakfast 0–2 times a week (Table 5.1). Less than half (48.1%) of Pacific females ate breakfast daily; 33.1% ate breakfast 3–6 days per week and 18.8% ate breakfast 0–2 times a week.

Pacific males and females were significantly less likely to eat breakfast daily and more likely to eat breakfast 3–6 days a week than non-Pacific males and females, respectively, after adjusting for age. Pacific males were more likely to eat breakfast 0–2 times a week than non-Pacific males, after adjusting for age.

Table 5.1: Consumption of breakfast, Pacific people, by sex

	Sex	Pacific (95% CI)	Pacific compared with non-Pacific[1]	
			Difference	Ratio
Breakfast eaten daily (%)	Males	42.2 (36.1–48.3)	–17.4*	0.72*
	Females	48.1 (42.9–53.3)	–14.4*	0.78*
Breakfast eaten 3–6 days per week (%)	Males	29.3 (23.0–35.5)	6.6*	1.30*
	Females	33.1 (28.3–38.0)	10.8*	1.55*
Breakfast eaten 0–2 days per week (%)	Males	28.6 (21.9–35.2)	10.8*	1.64*
	Females	18.8 (14.1–23.5)	3.6	1.25

Source: 2008/09 New Zealand Adult Nutrition Survey

1 Age-standardised to WHO world population.

* Indicates a statistically significant result at p-value < 0.05.

Vegetable and fruit intake

The Ministry of Health recommends that adults eat at least three servings of vegetables and at least two servings of fruit each day (Ministry of Health 2003). In the survey, participants were asked how many servings of vegetables (fresh, frozen or canned) were eaten a day on average. They were asked not to include vegetable juices. A serving was defined as being the same as one potato, half a cup of peas or a cup of salad.

Participants were also asked how many servings of fruit (fresh, frozen, canned or stewed) were eaten a day, on average. They were asked not to include fruit juice or dried fruit. A serving was defined as being the same as a medium piece of fruit like an apple, or two small pieces of fruit like two apricots, or half a cup of stewed fruit. Note that the Ministry of Health recommendation allows up to one serving of juice to be consumed, whereas the survey question excluded juice.

Under half of Pacific participants met the recommended guideline of three or more servings of vegetables a day (Table 5.2). Over half of Pacific participants met the recommended guideline of two or more servings of fruit per day.

Pacific males and females were significantly less likely to eat three or more servings of vegetables a day than non-Pacific males and females, respectively, after adjusting for age. There was no difference in the proportion of Pacific and non-Pacific males and females who ate two or more servings of fruit per day, after adjusting for age.

Table 5.2: Vegetable and fruit intake, Pacific people, by sex

	Sex	Pacific (95% CI)	Pacific compared with non-Pacific[1]	
			Difference	Ratio
3 or more servings of vegetables per day (%)	Males	40.9 (34.4–47.4)	–18.4*	0.68*
	Females	48.9 (43.5–54.2)	–21.8*	0.69*
2 or more servings of fruit per day (%)	Males	54.3 (47.5–61.1)	0.8	1.02
	Females	62.4 (56.9–67.9)	–2.7	0.96

Source: 2008/09 New Zealand Adult Nutrition Survey

1 Age-standardised to WHO world population.

* Indicates a statistically significant result at p-value < 0.05.

Time trends in vegetable and fruit intake

There was no change from 1997 to 2008/09 in the proportion of Pacific males and females who consumed the recommended three or more servings of vegetables per day, after adjusting for age (Table 5.3). From 1997 to 2008/09 there was an increase in the proportion of Pacific males who consumed the recommended two or more servings of fruit a day.

Table 5.3: Vegetable and fruit intake, Pacific people, by sex,[1] 1997 and 2008/09

	Sex	1997 (95% CI)	2008/09 (95% CI)	Ratio	Trend for non-Pacific
3 or more servings of vegetables per day (%)	Males	26.4 (9.3–43.5)	39.9 (33.2–46.6)	1.51	nc
	Females	43.0 (32.0–54.0)	49.1 (43.3–54.8)	1.14	nc
2 or more servings of fruit per day (%)	Males	35.4 (25.6–45.3)	54.3 (47.7–61.0)	1.54↑	↑
	Females	53.1 (43.8–62.4)	62.2 (56.3– 68.0)	1.17	↑

Source: 1997 National Nutrition Survey; 2008/09 New Zealand Adult Nutrition Survey

1 Age-standardised to WHO world population.

↑ Statistically significant increase from 1997 to 2008/09 at p-value < 0.05.

nc No change from 1997 to 2008/09 at p-value < 0.05.

Consumption of bread

The *Food and Nutrition Guidelines for Healthy Adults* (Ministry of Health 2003) recommend that adults eat at least six servings of breads and cereals each day, preferably whole-grain varieties. In the survey, participants were asked what type of bread, rolls or toast they eat most of. Response options included white, high-fibre white, light grain, heavy grain, and other types of bread.

Among those who eat bread, white bread was selected most of the time by both Pacific males (62.7%) and females (50.2%) (Table 5.4). Pacific males and females were almost twice as likely to choose white bread most of the time as non-Pacific males and females, respectively, after adjusting for age.

Among those who eat bread, 32.3% of Pacific males and 43.4% of Pacific females chose grain bread (light or heavy). Pacific males and females were less likely to choose grain bread (light or heavy) most of the time than non-Pacific males and females, respectively, after adjusting for age.

Table 5.4: Type of bread selected most of the time among those who eat bread, Pacific people, by sex

	Sex	Pacific (95% CI)	Pacific compared with non-Pacific[1]	
			Difference	Ratio
Light grain or heavy grain bread (%)	Males	32.3 (26.0–38.7)	–26.8*	0.55*
	Females	43.4 (38.5–48.3)	–19.1*	0.71*
High-fibre white bread (%)	Males	2.8 (1.4–4.9)	–2.2	0.57*
	Females	4.4 (2.4–7.4)	–0.1	0.98
White bread (%)	Males	62.7 (56.3–69.0)	29.0*	1.90*
	Females	50.2 (45.3–55.1)	20.7*	1.78*
Other (%)	Males	1.4 (0.5–3.3)	–0.7	0.71
	Females	2.0 (0.9–3.9)	–1.2	0.62

Source: 2008/09 New Zealand Adult Nutrition Survey

1 Age-standardised to WHO world population.

* Indicates a statistically significant result at p-value < 0.05.

Consumption of milk

The *Food and Nutrition Guidelines for Healthy Adults* (Ministry of Health 2003) recommend that adults choose low- or reduced-fat options for milk and milk products. In the survey, participants were asked the type of milk they consumed most often. Response options included whole or standard milk, reduced-fat, skim or trim, soy, and other types of milk. Respondents were also able to indicate if they didn't drink milk.

Overall, 25.2% of Pacific males and 33.1% of Pacific females chose reduced- or low-fat milk most of the time (Table 5.5). Pacific males and females were more likely to choose whole or standard milk most of the time and less likely to used reduced-fat, trim or skim milk than non-Pacific males and females, respectively, after adjusting for age.

Only a small proportion of Pacific males and females consumed soy milk or some other type of milk; 5.9% of Pacific males and 1.9% of Pacific females did not consume milk.

Table 5.5: Type of milk[2] selected most of the time, Pacific people, by sex

	Sex	Pacific (95% CI)	Pacific compared with non-Pacific[1]	
			Difference	Ratio
Reduced-fat, trim or skim milk (%)	Males	25.2 (19.5–30.9)	–17.0*	0.62*
	Females	33.1 (28.6–37.6)	–17.0*	0.67*
Whole or standard milk (%)	Males	68.2 (62.3–74.1)	16.9*	1.35*
	Females	61.9 (57.1–66.7)	21.6*	1.56*
Soy (%)	Males	0.5 (0.1–1.6)	–1.0	0.33*
	Females	2.3 (1.0–4.4)	–1.4	0.60
None (%)	Males	5.9 (3.3–9.6)	1.7	1.39
	Females	1.9 (0.9–3.5)	–2.6*	0.47*

Source: 2008/09 New Zealand Adult Nutrition Survey

1 Age-standardised to WHO world population.

2 Other milk = 0.5% so not displayed in table.

* Indicates a statistically significant result at p-value < 0.05.

Consumption of fish and shellfish

Survey participants were asked if they had eaten fish or shellfish in the past four weeks, and if so, how often they ate fresh and frozen fish or shellfish; canned fish or shellfish; and battered fish or shellfish.

Fresh and frozen fish or shellfish

Over half of Pacific males (52.9%) and Pacific females (58.2%) ate fresh or frozen fish or shellfish at least once a week (Table 5.6), which was significantly higher than for non-Pacific males and females, respectively, after adjusting for age.

Table 5.6: Frequency of eating fresh or frozen fish or shellfish, Pacific people, by sex

	Sex	Pacific (95% CI)	Pacific compared with non-Pacific[1]	
			Difference	Ratio
Eats fresh or frozen fish or shellfish at least once a week (%)	Males	52.9 (45.6–60.2)	16.7*	1.43*
	Females	58.2 (52.9–63.5)	21.3*	1.55*
Eats fresh or frozen fish or shellfish less than once a week (%)	Males	21.0 (15.2–26.9)	–10.3*	0.67*
	Females	20.8 (16.7–24.8)	–9.7*	0.69*
Never, or have not consumed fresh or frozen fish or shellfish in the past 4 weeks (%)	Males	26.1 (19.9–32.2)	–6.4	0.79*
	Females	21.0 (16.4–25.7)	–11.6*	0.62*

Source: 2008/09 New Zealand Adult Nutrition Survey

1 Age-standardised to WHO world population.

* Indicates a statistically significant result at p-value < 0.05.

Canned fish or shellfish

Overall, 39.9% of Pacific males and 47.6% of Pacific females ate canned fish or shellfish at least once a week (Table 5.7), which was significantly higher than non-Pacific males and females, respectively, after adjusting for age.

Table 5.7: Frequency of eating canned fish or shellfish, Pacific people, by sex

	Sex	Pacific (95% CI)	Pacific compared with non-Pacific[1]	
			Difference	Ratio
Eats canned fish or shellfish at least once a week (%)	Males	39.9 (32.3–47.6)	15.2*	1.60*
	Females	47.6 (43.0–52.1)	20.1*	1.70*
Eats canned fish or shellfish less than once a week (%)	Males	22.9 (16.8–29.1)	–2.3	0.92
	Females	19.3 (14.8–23.9)	–9.7*	0.68*
Never, or have not consumed canned fish or shellfish in the past 4 weeks (%)	Males	37.1 (30.1–44.1)	–12.9*	0.73*
	Females	33.1 (28.2–38.0)	–10.4*	0.75*

Source: 2008/09 New Zealand Adult Nutrition Survey

1 Age-standardised to WHO world population.

* Indicates a statistically significant result at p-value < 0.05.

Battered or fried fish or shellfish

Overall, 27.8% of Pacific males and 25.4% of Pacific females ate battered or fried fish or shellfish at least once a week (Table 5.8) with a significant difference in rates between Pacific and non-Pacific males and females, respectively (although the ratio was not significant for Pacific males).

Table 5.8: Frequency of eating battered or fried fish or shellfish, Pacific people, by sex

	Sex	Pacific (95% CI)	Pacific compared with non-Pacific[1]	
			Difference	Ratio
Eats battered or fried fish or shellfish at least once a week (%)	Males	27.8 (21.4–34.2)	7.2*	1.35
	Females	25.4 (21.1–29.6)	13.0*	2.10*
Eats battered or fried fish or shellfish less than once a week (%)	Males	30.7 (24.6–36.8)	–11.1*	0.74*
	Females	37.0 (31.4–42.5)	–4.8	0.89
Never, or have not consumed battered or fried fish or shellfish in the past 4 weeks (%)	Males	41.5 (33.8–49.2)	3.9	1.10
	Females	37.7 (32.2–43.1)	–8.1*	0.82*

Source: 2008/09 New Zealand Adult Nutrition Survey

1 Age-standardised to WHO world population.

* Indicates a statistically significant result at p-value < 0.05.

Consumption of processed meat

The World Cancer Research Fund and the American Institute for Cancer Research (2007) recommend avoiding processed meat due to convincing evidence that as more processed meat is consumed there is an increased risk of colorectal cancer. Processed meat is also likely to be relatively high in saturated fatty acids and sodium – also risk factors for a number of chronic diseases. Survey participants were asked how often they ate processed meats such as ham, bacon, sausages, luncheon, canned corned beef, pastrami and salami.

Overall, 31.6% of Pacific males and 24.4% of Pacific females ate processed meat three or more times per week (Table 5.9). Pacific males were less likely to have consumed processed meat three or more times a week compared with non-Pacific males, after adjusting for age. There was no difference in the frequency of Pacific and non-Pacific females consuming processed meats, after adjusting for age.

Table 5.9: Frequency of eating processed meat, Pacific people, by sex

	Sex	Pacific (95% CI)	Pacific compared with non-Pacific[1]	
			Difference	Ratio
Eats processed meat 3 or more times a week (%)	Males	31.6 (25.6–37.6)	–8.2*	0.78*
	Females	24.4 (19.7–29.2)	0.4	1.02
Eats processed meat 1–2 times a week (%)	Males	43.1 (36.2–50.0)	2.9	1.07
	Females	44.7 (39.9–49.6)	3.7	1.09
Eats processed meat less than once a week / never eats processed meat (%)	Males	25.3 (19.3–31.3)	5.3	1.24
	Females	30.8 (25.7–36.0)	–4.1	0.88

Source: 2008/09 New Zealand Adult Nutrition Survey

1 Age-standardised to WHO world population.

* Indicates a statistically significant result at p-value < 0.05.

Consumption of butter and margarine

The *Food and Nutrition Guidelines for Healthy Adults* (Ministry of Health 2003) recommend choosing a margarine or spread (polyunsaturated or monounsaturated) instead of butter. Survey participants were asked what type of butter or margarine spread they use the most of. Response options included butter, butter and margarine blend, margarine (full-fat), light/lite or reduced-fat margarine, plant sterol margarine, and no spread used.

The majority of Pacific people use full-fat or light margarine as a spread, with a smaller proportion using butter (Table 5.10). Pacific males and females were more likely to choose full-fat margarine and less likely to use light/lite or reduced-fat margarine or plant sterol margarine as a spread most of the time than non-Pacific males and females, respectively.

There was no difference in the proportion of Pacific and non-Pacific males and females in the choice of butter or butter/margarine blend as a spread most of the time, after adjusting for age.

Table 5.10: Type of spread used most of the time, Pacific people, by sex

	Sex	Pacific (95% CI)	Pacific compared with non-Pacific[1]	
			Difference	Ratio
Butter (%)	Males	19.0 (13.1–25.0)	–2.6	0.87
	Females	17.1 (13.0–21.3)	–4.0	0.80
Butter/margarine blend (%)	Males	2.5 (1.1–4.7)	–1.2	0.68
	Females	3.2 (1.9–5.0)	–0.4	0.87
Full-fat margarine (%)	Males	52.7 (46.0–59.4)	17.6*	1.48*
	Females	53.5 (48.2–58.9)	20.3*	1.61*
Light/lite or reduced-fat margarine (%)	Males	19.5 (13.9–25.1)	–8.3*	0.69*
	Females	21.1 (16.7–25.5)	–8.6*	0.72*
Plant sterol margarine (%)	Males	0.1 (0–0.8)	–3.9*	0.05*
	Females	1.1 (0.2–3.4)	–2.7*	0.33*
No spread used (%)	Males	6.1 (3.2–10.5)	–1.8	0.79
	Females	3.9 (1.8–7.1)	–4.6*	0.44*

Source: 2008/09 New Zealand Adult Nutrition Survey

1 Age-standardised to WHO world population.

* Indicates a statistically significant result at p-value < 0.05.

Use of cooking fat

The *Food and Nutrition Guidelines for Healthy Adults* (Ministry of Health 2003) recommend using vegetable oil or oil high in monounsaturated fat for cooking. Survey participants were asked what type of fat or oil they use most often when cooking. Response options included butter, butter-blend, margarine, oil, dripping or lard, other type of fat or oil, and no fat or oil used.

The majority of Pacific people chose cooking oil or margarine for cooking most of the time instead of butter, butter-blend, dripping or lard. Pacific males and females were less likely to use cooking oil or margarine than non-Pacific males and females, respectively.

Table 5.11: Type of cooking fat used most of the time, Pacific people, by sex

	Sex	Pacific (95% CI)	Pacific compared with non-Pacific[1]	
			Difference	Ratio
Oil or margarine used most of the time for cooking (%)	Males	88.4 (84.5–92.4)	–4.2*	0.95*
	Females	87.7 (84.6–90.9)	–4.5*	0.95*
Butter, butter-blend, dripping or lard used most of the time for cooking (%)	Males	8.7 (5.1–12.3)	3.7	1.72
	Females	7.7 (5.0–10.4)	2.6	1.56
No oil or margarine used for cooking (%)	Males	2.9 (1.2–5.6)	0.5	1.18
	Females	4.6 (3.0–6.7)	1.9	1.70

Source: 2008/09 New Zealand Adult Nutrition Survey

1 Age-standardised to WHO world population.

* Indicates a statistically significant result at p-value < 0.05.

Trimming fat from meat and removing skin from chicken

The *Food and Nutrition Guidelines for Healthy Adults* (Ministry of Health 2003) recommend trimming all visible fat from meat and removing the skin from chicken. Survey participants were asked how often they removed the excess fat from meat and how often they removed the skin from chicken.

Of those who ate meat, 39.0% of Pacific males and 50.7% of Pacific females regularly or always trimmed the fat off meat (Table 5.12). Pacific males and females were significantly less likely to regularly or always trim the excess fat from meat than non-Pacific males and females, respectively, after adjusting for age.

Of those who ate chicken, 25.0% of Pacific males and 39.4% of Pacific females regularly or always removed the skin off chicken. Pacific males and females were significantly less likely to remove the skin off chicken than non-Pacific males and females, respectively, after adjusting for age.

Table 5.12: Trimming fat off meat and removing skin from chicken, Pacific people, by sex

	Sex	Pacific (95% CI)	Pacific compared with non-Pacific[1]	
			Difference	Ratio
Regularly or always trim fat off meat among those who eat meat (%)	Males	39.0 (31.9–46.1)	–16.6*	0.70*
	Females	50.7 (45.5–55.9)	–15.8*	0.76*
Regularly or always remove skin off chicken among those who eat chicken (%)	Males	25.0 (19.0–30.9)	–18.2*	0.57*
	Females	39.4 (34.5–44.3)	–14.1*	0.74*

Source: 2008/09 New Zealand Adult Nutrition Survey

1 Age-standardised to WHO world population.

* Indicates a statistically significant result at p-value < 0.05.

Use of salt

The *Food and Nutrition Guidelines for Healthy Adults* (Ministry of Health 2003) encourage reducing sodium consumption by preparing foods with minimal added salt. If salt is used, the Ministry of Health recommends using iodised salt.

Survey participants were asked how often they add salt to their food after it has been cooked or prepared. They were also asked how often they choose low- or reduced-salt varieties of foods instead of the standard variety. Where possible, survey interviewers viewed the salt packet used in the household to determine the use of iodised salt.

Overall, 33.8% of Pacific males and 39.7% of Pacific females never or rarely add salt to food (Table 5.13). Pacific males and females were less likely to never or rarely add salt to food than non-Pacific males and females, respectively, after adjusting for age.

Of those who used salt at home, 85.5% of Pacific males and 91.0% of Pacific females used iodised salt. There was no difference in the use of iodised salt between Pacific and non-Pacific males, after adjusting for age. Pacific females were significantly more likely to use iodised salt than non-Pacific females, after adjusting for age.

Table 5.13: Use of salt, Pacific people, by sex

	Sex	Pacific (95% CI)	Pacific compared with non-Pacific[1]	
			Difference	Ratio
Never or rarely add salt to food (%)	Males	33.8 (27.2–40.4)	–9.9*	0.77*
	Females	39.7 (34.2–45.1)	–14.5*	0.73*
Iodised salt used at home among those who use salt (%)	Males	85.5 (80.1–90.9)	0.1	1.0
	Females	91.0 (87.8–94.1)	5.3*	1.06*

Source: 2008/09 New Zealand Adult Nutrition Survey

1 Age-standardised to WHO world population.

* Indicates a statistically significant result at p-value < 0.05.

Consumption of pre-prepared foods

The *Food and Nutrition Guidelines for Healthy Adults* (Ministry of Health 2003) recommend choosing pre-prepared foods and snacks that have minimal added fat, especially saturated fat, and that are low in salt.

Survey participants were asked how often they ate fast food or takeaways from places like McDonalds, KFC, Burger King, pizza shops or fish-and-chip shops. They were also asked how often they ate hot chips, French fries, wedges or kumara chips.

Eighteen percent of Pacific males and 13.2% of Pacific females ate fast food and takeaways three or more times a week (Table 5.14). Pacific males were twice as likely, and Pacific females three times as likely, to eat fast food or takeaways three or more times a week than non-Pacific males and females, respectively, after adjusting for age.

Seventeen percent of Pacific males and 13.4% of Pacific females ate hot chips three or more times a week. There was no significant difference between Pacific and non-Pacific males for the proportion eating hot chips three or more times a week, after adjusting for age. Pacific females were almost three times more likely to eat hot chips three or more times a week than non-Pacific females, after adjusting for age.

Table 5.14: Consumption of pre-prepared foods, Pacific people, by sex

	Sex	Pacific (95% CI)	Pacific compared with non-Pacific[1]	
			Difference	Ratio
Eat fast food or takeaways three or more times a week (%)	Males	18.3 (12.8–23.7)	7.3*	1.84*
	Females	13.2 (10.3–16.1)	7.5*	2.83*
Eat fast food or takeaways 1–2 times a week (%)	Males	34.7 (26.9–42.4)	–0.5	0.99
	Females	30.5 (25.4–35.6)	0.9	1.03
Eat fast food or takeaways less than once a week or never (%)	Males	47.1 (39.2–55.0)	–6.9	0.88
	Females	56.3 (50.9–61.6)	–8.3*	0.88*
Eat hot chips 3 or more times a week (%)	Males	17.2 (13.1–21.2)	3.0	1.25
	Females	13.4 (9.3–17.6)	7.9*	2.78*
Eat hot chips 1–2 times a week (%)	Males	36.8 (29.9–43.7)	–7.4	0.83*
	Females	35.9 (31.0–40.7)	1.3	1.04
Eat hot chips less than once a week or never (%)	Males	46.1 (39.2–52.9)	4.4	1.10
	Females	50.7 (45.4–56.0)	–9.2*	0.85*

Source: 2008/09 New Zealand Adult Nutrition Survey

1 Age-standardised to WHO world population.

* Indicates a statistically significant result at p-value < 0.05.

Consumption of soft drinks or energy drinks

The *Food and Nutrition Guidelines for Healthy Adults* (Ministry of Health 2003) recommend limiting the consumption of fruit juice, cordial, energy and soft drinks because of their high sugar content. Survey participants were asked how often they drank soft drinks or energy drinks (not including diet varieties).

Forty-five percent of Pacific males and 31.7% of Pacific females drank soft drinks or energy drinks three or more times a week (Table 5.15). Pacific males and females were significantly more likely to drink soft drinks or energy drinks three or more times a week than non-Pacific males and females, respectively, after adjusting for age.

Table 5.15: Soft drink or energy drink consumption, Pacific people, by sex

	Sex	Pacific (95% CI)	Pacific compared with non-Pacific[1]	
			Difference	Ratio
Drink soft drinks or energy drinks 3 or more times a week (%)	Males	45.0 (39.7–50.4)	6.9*	1.21*
	Females	31.7 (27.3–36.1)	10.7*	1.57*
Drink soft drinks or energy drinks 1−2 two times a week (%)	Males	22.3 (17.4–27.2)	0	1.00
	Females	19.6 (16.0–23.2)	–0.2	0.99
Drink soft drinks or energy drinks less than once a week or never (%)	Males	32.7 (27.2–38.1)	–6.8*	0.85*
	Females	48.7 (43.7–53.7)	–10.5*	0.83*

Source: 2008/09 New Zealand Adult Nutrition Survey

1 Age-standardised to WHO world population.

* Indicates a statistically significant result at p-value < 0.05.

6 Household food security

Food security is defined as the ready availability of sufficient, nutritionally adequate and safe foods, as well as the ability to acquire such foods in a socially acceptable way (Parnell et al 2001). Survey participants were asked eight questions on food security on behalf of themselves (if they lived alone) or their households.

Based on the distribution of the participants' responses to these statements, households were then assigned to the following three categories:

- *fully / almost fully food secure* – this included households providing no affirmative response to any of the eight statements and households responding to only one statement, which was most likely to be 'the variety of food is limited'
- *low food security* – this included households most likely to report 'relying on others for food or money for food' and 'using special food grants or food banks to acquire the food they needed'
- *moderate food security* – this included households likely to respond positively to the remaining five statements ('I/we can afford to eat properly', 'food runs out due to lack of money', 'eat less because of lack of money', 'stressed because of not having enough money for food', 'stressed because can't provide the food I want for social occasions').

The majority of Pacific males and females lived in households that had moderate or low food security (Table 6.1). Pacific males were almost four times more likely to live in a household that had *low food security* and 1.4 times more likely to live in a household that had *moderate food security* than non-Pacific males, after adjusting for age. Pacific females were almost three times more likely to live in a household that had *low food security* and 1.6 times more likely to live in a household that had *moderate food security* than non-Pacific females.

Table 6.1: Household food security, Pacific people, by sex

	Sex	Pacific (95% CI)	Pacific compared with non-Pacific[1]	
			Difference	Ratio
Low food security (%)	Males	20.2 (15.0–25.4)	15.5*	3.89*
	Females	22.4 (18.0–26.8)	14.9*	2.67*
Moderate food security (%)	Males	50.2 (43.2–57.2)	14.6*	1.42*
	Females	56.6 (51.1–62.0)	19.5*	1.55*
Full/almost full food security (%)	Males	29.6 (22.5–36.7)	–30.0*	0.50*
	Females	21.0 (16.4–25.6)	–34.4*	0.38*

Source: 2008/09 Adult Nutrition Survey

1 Age-standardised to WHO world population.

* Indicates a statistically significant result at p-value < 0.05.

Time trends in household food security

From 1997 to 2008/09 there was a significant decrease in the number of Pacific people who lived in households that were fully/almost fully food secure (Table 6.2).

Table 6.2: Household food security, Pacific people, by sex,[1] 1997 and 2008/09

	Sex	1997 (95% CI)	2008/09 (95% CI)	Ratio	Trend in non-Pacific
Low food security (%)	Males	11.1 (4.2–22.5)	20.8 (15.2–26.4)	1.88	↑
	Females	10.5 (4.3–20.7)	23.8 (19.5–28.1)	2.26	↑
Moderate food security (%)	Males	44.2 (26.8–61.6)	48.9 (42.7–55.2)	1.11	↑
	Females	49.4 (37.6–61.3)	55.4 (50.1–60.6)	1.12	↑
Full/almost full food security (%)	Males	44.7 (27.4–62.1)	30.3 (24.1–36.5)	0.68 ↓	↓
	Females	40.0 (29.9–50.2)	20.8 (15.4–26.3)	0.52 ↓	↓

Source: 1997 National Nutrition Survey; 2008/09 New Zealand Adult Nutrition Survey

1 Age-standardised to WHO world population.

↑ Statistically significant increase from 1997 to 2008/09 at p-value < 0.05.

↓ Statistically significant decrease from 1997 to 2008/09 at p-value < 0.05.

7 Nutrition-related health outcomes

Body mass index and body size

A healthy body size is important for good health and wellbeing. Obesity is associated with a long list of health conditions, including: cardiovascular disease (ischaemic heart disease, high blood pressure and stroke), various types of cancer, type 2 diabetes, osteoarthritis, sleep apnoea, and psychological and social problems (WHO 2000; World Cancer Research Fund and American Institute for Cancer Research 2007).

Body mass index (BMI) is a measure of weight adjusted for height, and is calculated by dividing weight in kilograms by height in metres squared (kg/m^2). BMI is used internationally to classify underweight, overweight and obesity, providing a good estimate of the proportion of the population with increased risk of health conditions associated with excess body fatness (WHO 2000).

In the 2008/09 NZANS, participants (excluding pregnant women) had their weight and height measured using professional anthropometric equipment and standardised techniques (see the *Methodology Report* for details).

Body mass index

Pacific males had a mean BMI of 31.5 kg/m^2 and Pacific females had a mean BMI of 33.0 kg/m^2 (Table 7.1). Pacific males and Pacific females had a significantly higher mean BMI than non-Pacific males and non-Pacific females, respectively, after adjusting for age.

Table 7.1: Mean body mass index, Pacific people, by sex

	Sex	Pacific (95% CI)	Pacific compared with non-Pacific[1]	
			Difference	Ratio
Body mass index (kg/m^2)	Males	31.5 (30.6–32.3)	4.7*	1.17*
	Females	33.0 (32.2–33.8)	6.2*	1.23*

Source: 2008/09 New Zealand Adult Nutrition Survey

1 Age-standardised to WHO world population.

* Indicates a statistically significant result at p-value < 0.05.

Body size

The following World Health Organization (WHO 2007) BMI cut-off points were used for adults aged 18 years and over:

- underweight: BMI < 18.50 kg/m^2
- normal weight: BMI 18.50–24.99 kg/m^2
- overweight: BMI 25.00–29.99 kg/m^2
- obese: BMI ≥ 30.00 kg/m^2.

For participants aged 15–18 years, the sex- and age-specific BMI cut-off points developed by the International Obesity Taskforce (IOTF) were used to define underweight, normal range, overweight and obesity (Cole et al 2000; Cole et al 2007). The IOTF BMI cut-off points coincide with the WHO BMI cut-off points for adults at age 18 years. The same BMI cut-off points have been used for all ethnic groups.

Overall, 13.1% of Pacific males and 13.7% of Pacific females had a normal weight (Table 7.2). Over half of Pacific males (56.2%) and 59.5% of females were obese, and a further 30.5% of Pacific males and 26.5% of females were overweight.

Pacific males and females were over twice as likely to be obese as non-Pacific males and females, respectively, after adjusting for age. Pacific males and females were less likely to be underweight and normal weight than non-Pacific males and females respectively, after adjusting for age.

Table 7.2: Body size using international cut-off points, Pacific people, by sex

	Sex	Pacific (95% CI)	Pacific compared with non-Pacific[1]	
			Difference	Ratio
Underweight (%)	Males	0.2 (0–1.0)	–0.7*	0.16*
	Females	0.2 (0–1.3)	–1.7*	0.11*
Normal weight (%)	Males	13.1 (7.7–18.5)	–23.0*	0.32*
	Females	13.7 (9.8–17.6)	–29.3*	0.29*
Overweight (%)	Males	30.5 (23.6–37.4)	–8.9*	0.78*
	Females	26.5 (21.5–31.6)	–4.8	0.85
Obese (%)	Males	56.2 (49.4–63.1)	32.7*	2.30*
	Females	59.5 (53.9–65.1)	35.8*	2.42*

Source: 2008/09 New Zealand Adult Nutrition Survey

1 Age-standardised to WHO world population.

* Indicates a statistically significant result at p-value < 0.05.

Time trends in BMI and obesity

There have been no significant changes in mean BMI or in the percentage who were obese from 1997 to 2008/09 for Pacific people.

Table 7.3: Body size, Pacific people, by sex,[1] 1997 and 2008/09

		1997 (95% CI)	2008/09 (95% CI)	Ratio	Trend in non-Pacific
Mean BMI (kg/m^2)	Males	30.7 (29.5–31.8)	31.7 (30.9–32.6)	1.03	↑
	Females	32.9 (31.2–34.7)	33.3 (32.4–34.1)	1.01	↑
Obese (%)	Males	49.0 (38.3–59.7)	57.0 (49.8–64.2)	1.16	↑
	Females	59.7 (49.4–70.0)	59.1 (53.4–64.9)	0.99	↑

Source: 1997 National Nutrition Survey; 2008/09 New Zealand Adult Nutrition Survey

1 Age-standardised to WHO world population.

↑ Statistically significant increase from 1997 to 2008/09 at p-value < 0.05.

Blood pressure

High blood pressure is an important risk factor for heart disease, stroke and renal failure. The relationship between blood pressure and cardiovascular disease is continuous, with the risk increasing as blood pressure increases, even among those within the 'normal' range. Systolic blood pressure is a better predictor of cardiovascular disease risk than diastolic blood pressure (Prospective Studies Collaboration 2002; Neaton et al 1992).

In the 2008/09 NZANS, participants had blood pressure measured using an OMRON HEM 907 instrument. Blood pressure was not measured in pregnant women because pregnancy alters a woman's blood pressure.

Pacific males had a mean systolic blood pressure of 127 mmHg and a mean diastolic blood pressure of 75 mmHg (Table 7.4). Pacific females had a mean systolic blood pressure of 117 mmHg and a mean diastolic blood pressure of 73 mmHg. There were no significant differences in mean systolic or diastolic blood pressure between Pacific and non-Pacific males and between Pacific and non-Pacific females, after adjusting for age.

Table 7.4: Blood pressure, Pacific people, by sex

	Sex	Pacific (95% CI)	Pacific compared with non-Pacific[1]	
			Difference	Ratio
Mean systolic blood pressure (mmHg)	Males	127 (125–129)	–0.9	0.99
	Females	117 (116–119)	0.1	1.00
Mean diastolic blood pressure (mmHg)[1]	Males	75 (73–76)	1.6	1.02
	Females	73 (72–75)	1.1	1.02

Source: 2008/09 New Zealand Adult Nutrition Survey

1 Age-standardised to WHO world population.

* Indicates a statistically significant result at p-value < 0.05.

Cholesterol

Blood cholesterol is an important risk factor for cardiovascular disease, particularly ischaemic heart disease. The relationship between cholesterol and cardiovascular disease is continuous, with the risk increasing as cholesterol increases, even among those within the 'normal' range. Modifiable determinants of blood cholesterol include diet (in particular dietary fat intake), body weight and physical activity levels.

Total cholesterol consists largely of the cholesterol in low-density lipoprotein particles (LDL cholesterol) plus the cholesterol in high-density lipoprotein (HDL cholesterol). LDL cholesterol is associated with a higher risk of cardiovascular disease and HDL with a lower risk. The total:HDL cholesterol ratio is also a strong predictor of vascular disease mortality (Prospective Studies Collaboration 2007; Erqou et al 2009), with the optimum ratio being < 4.5 (New Zealand Guidelines Group 2003). Blood samples in the 2008/09 NZANS were non-fasting, so LDL cholesterol could not be measured.

Mean total cholesterol was 4.97 mmol/L for Pacific males and 4.68 mmol/L for Pacific females (Table 7.5). There were no significant differences in the mean total and HDL cholesterol levels or total:HDL cholesterol ratio between Pacific and non-Pacific males. Pacific females had a significantly lower mean total and HDL cholesterol level, and a significantly higher total:HDL cholesterol ratio, than non-Pacific females, after adjusting for age.

Overall, 41.1% of Pacific males and 22.5% of Pacific females had a total cholesterol:HDL ratio ≥ 4.5. This percentage was not significantly different compared with non-Pacific males, after adjusting for age.

Table 7.5: Cholesterol, Pacific people, by sex

	Sex	Pacific (95% CI)	Pacific compared with non-Pacific[1]	
			Difference	Ratio
Mean total cholesterol (mmol/L)	Males	4.97 (4.77–5.17)	–0.09	0.98
	Females	4.68 (4.52–4.84)	–0.36*	0.93*
Mean HDL cholesterol (mmol/L)	Males	1.20 (1.13–1.26)	0.05	0.96
	Females	1.27 (1.22–1.31)	–0.23*	0.85*
Mean total cholesterol:HDL ratio	Males	4.38 (4.09–4.67)	0.13	1.03
	Females	3.84 (3.69–3.99)	0.32*	1.09*
Total cholesterol:HDL ratio ≥ 4.5 (%)	Males	41.1 (31.4–50.8)	6.2	1.18
	Females	22.5 (15.7–29.3)	8.2*	1.53

Source: 2008/09 New Zealand Adult Nutrition Survey

1 Age-standardised to WHO world population.

* Indicates a statistically significant result at p-value < 0.05.

Time trends in cholesterol

From 1997 to 2008/09 the mean total cholesterol and total cholesterol:HDL ratio decreased in Pacific males and females, after adjusting for age. Mean HDL cholesterol increased in Pacific males but did not change in Pacific females, after adjusting for age.

Since 1997, there has been a decrease in the proportion of Pacific adults who have a total cholesterol:HDL ratio of ≥ 4.5, an approximately 50% decrease for Pacific males and a 60% decrease for Pacific females.

Table 7.6: Cholesterol, Pacific people, by sex,[1] 1997 and 2008/09

	Sex	1997 (95% CI)	2008/09 (95% CI)	Ratio	Trend in non-Pacific
Mean total cholesterol level (mmol/L)	Males	5.78 (5.46–6.11)	4.97 (4.78–5.17)	0.86 ↓	↓
	Females	5.25 (4.78–5.73)	4.72 (4.55–4.89)	0.90 ↓	↓
Mean HDL cholesterol level (mmol/L)	Males	1.07 (1.01–1.14)	1.19 (1.12–1.26)	1.11↑	↑
	Females	1.28 (1.18–1.37)	1.27 (1.22–1.31)	0.99	↑
Mean total cholesterol:HDL ratio	Males	5.56 (5.19–5.94)	4.40 (4.14–4.67)	0.79 ↓	↓
	Females	4.30 (3.91–4.69)	3.87 (3.73–4.02)	0.90 ↓	↓
Total cholesterol:HDL ratio ≥ 4.5 (%)	Males	78.3 (68.3–88.2)	41.3 (32.8–49.9)	0.53 ↓	↓
	Females	39.7 (24.4–55.1)	23.7 (16.3–31.1)	0.60 ↓	↓

Source: 1997 National Nutrition Survey; 2008/09 New Zealand Adult Nutrition Survey

1 Age-standardised to WHO world population.

↑ Statistically significant increase from 1997 to 2008/09 at p-value < 0.05.

↓ Statistically significant decrease from 1997 to 2008/09 at p-value < 0.05.

Diabetes and HbA1c

Diabetes is a metabolic condition which results in raised blood glucose. It is an important cause of morbidity and mortality in New Zealand. The presence of diabetes can lead to cardiovascular disease, blindness, kidney disease and vascular insufficiency. These vascular problems may lead to nerve damage in the feet, and on occasion require amputation of the lower leg (Powers 2005).

Measurement of glycated haemoglobin (HbA1c) is the standard method for assessing long-term glycaemic (blood glucose level) control (over the previous 6–8 weeks) in people with diabetes (Powers 2005). It is the primary predictor of long-term complications of diabetes, with an HbA1c < 7.0% being the target for most people with diabetes (Powers 2011). HbA1c can also be used as a diagnostic test for diabetes, with the diagnosis of diabetes made if HbA1c is ≥ 6.5% (International Expert Committee 2009; WHO 2011).

Survey participants were asked if they had ever been told by a doctor that they have diabetes (other than during pregnancy) and HbA1c levels were measured in participants that provided a blood sample.

The prevalence of total diabetes was calculated by combining the prevalence of diabetes diagnosed by a doctor and the prevalence of undiagnosed diabetes (not diagnosed by a doctor and HbA1c ≥ 6.5%). The denominator for diagnosed diabetes includes all participants, whereas the denominator for undiagnosed diabetes only includes participants who reported they had not been diagnosed with diabetes and provided a blood sample. Therefore, total diabetes is not equal to the sum of diagnosed and undiagnosed because the denominators differ.

Overall, 14.8% of Pacific males and 14.9% of Pacific females aged 15 years and over have diabetes (combined diagnosed and undiagnosed). Among Pacific peoples not diagnosed with diabetes and who provided a blood sample, 7.9% of males and 6.2% of females had HbA1c levels ≥ 6.5%, which is indicative of undiagnosed diabetes.

Pacific females were nearly three times as likely to have diabetes (diagnosed and undiagnosed) as non-Pacific females, after adjusting for age. There was no significance difference between Pacific and non-Pacific males in the prevalence of diabetes (diagnosed and undiagnosed).

The sample size was too small to be able to calculate the prevalence of good management among those diagnosed with diabetes (HbA1c < 7.0%).

Table 7.7: HbA1c and diabetes, Pacific people, by sex

	Sex	Pacific (95% CI)	Pacific compared with non-Pacific[1]	
			Difference	Ratio
Diabetes diagnosed by a doctor (%)	Males	7.8 (5.4–10.2)	5.5*	2.19*
	Females	8.0 (5.5–10.4)	6.9*	3.36*
Undiagnosed diabetes[2] (%)	Males	7.9 (2.6–17.6)	5.7*	4.27
	Females	6.2 (3.5–10.2)	5.8*	6.17*
Total diabetes (diagnosed and undiagnosed)[3] (%)	Males	14.8 (7.0–22.6)	6.4	1.98
	Females	14.9 (10.7–19.2)	8.2*	2.89*

Source: 2008/09 New Zealand Adult Nutrition Survey

1 Age-standardised to WHO world population.

2 Not diagnosed by a doctor and HbA1c ≥ 6.5%.

3 Total diabetes is not equal to the sum of diagnosed and undiagnosed because the denominators differ.

* Indicates a statistically significant result at p-value < 0.05.

Folate status

Folate is essential for DNA synthesis and is especially important during periods of increased cell replication and growth. Folate has a role in erythropoiesis (red blood cell formation/production), and therefore a deficiency in this vitamin can result in megaloblastic anaemia (Mann and Truswell 2007).

Inadequate folic acid levels during pregnancy have been associated with an increased risk of neural tube defects (NTDs), a major group of birth defects in the developing foetus (MRC Vitamin Study Research Group 1991). To reduce the incidence of NTDs, the Ministry of Health recommends that women of child-bearing age who plan to become pregnant take 800 µg of folic acid daily for at least four weeks prior to conception and for 12 weeks after conceiving.

Since 1996 voluntary fortification of selected foods (eg, breakfast cereals, flour, breads) with folic acid has been permitted. A standard for the mandatory fortification of bread with folic acid was to come into effect in September 2009, but the implementation of the standard was deferred for review in May 2012. In the interim, the bread industry has agreed to increase the fortification of bread with folic acid voluntarily. Because the 2008/09 NZANS took place before any increase in uptake of voluntary folic acid fortification, the results presented in this report will provide a baseline with which the effects of this increased voluntary fortification can be compared.

Folate status can be assessed by direct measurement of folate in serum and red blood cells. Red blood folate concentration is an indicator of long-term status, while serum folate indicates folate status at the time the blood sample was drawn. Red blood folate status is presented in this report. Low red blood folate status is defined as red blood folate < 317 nmol/L (Wright et al 1998).

Mean red blood folate concentrations were 739 nmol/L for Pacific males and 734 nmol/L for Pacific females (Table 7.8). Pacific males and females had a significantly lower mean red blood cell folate than non-Pacific males and females, respectively, after adjusting for age.

The prevalence of low red blood folate was low for Pacific people (3.2% males, 2.4% females) and was not significantly different from non-Pacific males and females, respectively, after adjusting for age.

The NTD risk is associated with red blood folate levels in a continuous dose–response relationship (Daly et al 1995). Red blood cell folate levels ≥ 906 nmol/L are associated with a very low risk of NTD, and levels ≤ 339 nmol/L are associated with high risk.

Six percent of Pacific women have a red blood folate concentration associated with a higher risk of an NTD-affected pregnancy. There were no differences between Pacific and non-Pacific females in terms of the risk of having an NTD-affected pregnancy, after adjusting for age.

Table 7.8: Folate status, Pacific people, by sex

		Sex	Pacific (95% CI)	Pacific compared with non-Pacific[1]	
				Difference	Ratio
Red blood folate	Mean red blood folate (nmol/L)	Males	739 (690–787)	–158.9*	0.82*
		Females	734 (693–774)	–144.8*	0.84*
	Low red blood folate (< 317 nmol/L) (%)	Males	3.2 (0.2–6.3)	2.6	2.32
		Females	2.4 (0.0–4.8)	–0.8	0.72
At risk of NTD-affected pregnancy (females 16–44 years)	Low risk (red blood folate ≥ 906 nmol/L) (%)	Females 16–44 years	25.4 (16.2–34.6)	–1.9	0.93
	High risk of NTDs (red blood cell folate ≤ 339 nmol/L) (%)	Females 16–44 years	6.4 (1.7–15.9)	1.9	1.47

Source: 2008/09 New Zealand Adult Nutrition Survey

1 Age-standardised to WHO world population.

* Indicates a statistically significant result at p-value < 0.05.

Iron status

Iron is an essential component of haemoglobin, which is the component of red blood cells that transports oxygen and myoglobin in the muscle cells (Rolfes et al 2009).

There are three stages of iron deficiency. In the first stage, body iron stores start to become depleted but red cell production is not affected. In the second stage (iron deficiency without anaemia), body iron stores are depleted and levels of circulating iron start to fall, although blood haemoglobin concentrations are maintained. In the final stage (iron deficiency with anaemia), body iron stores are severely depleted and the amount of iron circulating is very low, which results in reduced red cell production and low haemoglobin concentrations. Women aged 15–44 are at high risk of iron deficiency because of iron loss due to menstruation.

There are few symptoms associated with low iron stores, but iron deficiency without anaemia and iron deficiency with anaemia are associated with impaired immune function, decreased work capacity, fatigue, and some specific cognitive learning effects (Mann and Truswell, 2007). A range of biochemical indices are needed to assess all stages of iron deficiency, which are noted underneath Table 7.9. Iron-deficiency anaemia is a subset of iron deficiency.

In foods, haem iron is found in meat, fish and poultry and is better absorbed by the body than non-haem iron. Non-haem iron comes from most foods and its absorption is improved by consuming foods containing a meat, fish and poultry factor and vitamin C during the same meal (Mann and Truswell 2007; Rolfes et al 2009). Foods containing phytate and polyphenol, such as whole-grain cereals, nuts, legumes, tea, coffee and some vegetables, reduce the absorption of iron.

Ten percent of Pacific females have low iron stores (Table 7.9). Ten percent of Pacific females are iron deficient and 6.9% have iron-deficiency anaemia. There were no significant differences in the prevalence of low iron stores, iron deficiency or iron-deficiency anaemia between Pacific and non-Pacific females, after adjusting for age. There were no Pacific males with low iron stores or iron deficiency.

Table 7.9: Iron status, Pacific people, by sex

	Sex	Pacific (95% CI)	Pacific compared with non-Pacific[1]	
			Difference	Ratio
Low iron stores (%)[2]	Males	0	–	–
	Females	9.8 (5.0–17.0)	0.3	1.03
	Females 16–44 years	10.4 (4.5–19.7)	–0.7	0.94
Iron deficiency with or without anaemia (%)[3]	Males	0	–	–
	Females	9.4 (4.8–14.1)	1.3	1.18
	Females 16–44 years	9.8 (4.0–19.3)	0.8	1.08
Iron deficiency with anaemia (%)[4]	Males	0	–	–
	Females	6.9 (2.6–11.2)	3.2	2.03
	Females 16–44 years	6.3 (1.6–16.1)	3.0	1.84

Source: 2008/09 New Zealand Adult Nutrition Survey

1 Age-standardised to WHO world population.

2 Serum ferritin < 12 µg/L. Serum ferritin concentration data for participants with serum C-reactive protein > 8 mg/L were not included in calculations of either serum ferritin or iron status.

3 Serum ferritin < 12 µg/L and zinc protoporphyrin > 60 µmol/mol.

4 Serum ferritin < 12 µg/L and zinc protoporphyrin > 60 µmol/mol; and haemoglobin < 136 g/L males 15–19 years; < 137 g/L males 20–49 years; < 133 g/L males 50–69 years; < 124 g/L males 70+ years; < 120 g/L females 15–69 years; < 118 g/L females 70+ years.

* Indicates a statistically significant result at p-value < 0.05.

Iodine status

Iodine is an essential component of thyroid hormones, which play a critical role in maintaining the body's metabolic rate and normal growth and mental development. There is a wide spectrum of iodine deficiency disorders (IDD) affecting all life-cycle groups, from fetus to adult. Mild to moderate iodine deficiency can cause thyroid problems, including the development of a goitre (enlarged thyroid gland) and hypothyroidism. Severe iodine deficiency during fetal development impairs mental development (Mann and Truswell 2007).

More than 90 percent of iodine is excreted in the urine, so urinary iodine is a good indicator of recent iodine status. The following International Council for the Control of Iodine Deficiency Disorders (WHO 2007) cut-offs for iodine deficiencies were used to assess iodine deficiency. Where urinary iodine concentration was measured as 0–10 µg/L it was replaced with the value 10 µg/L, which is the lowest detectable limit of the assay (ICCIDD 2000).

- Mild iodine deficiency is defined as a median urinary iodine concentration of 50–99 µg/L.
- Moderate iodine deficiency is defined as a median urinary iodine concentration of 20–49 µg/L.

Most soils in New Zealand are low in iodine, resulting in low concentrations in locally produced foods. The iodisation of salt was introduced in 1924 to improve iodine

intakes, but most convenience and manufactured foods do not use iodised salt. Due to the re-emergence of iodine deficiency in New Zealand, it became mandatory for bread manufacturers to use iodised salt in all commercially prepared bread (other than organic and unleavened bread) on 27 September 2009. While a small proportion of participants (10%) provided blood samples after 27 September 2009, the survey is considered to provide an indication of iodine status prior to mandatory iodine fortification.

The median urinary iodine concentration (MUIC) of the New Zealand Pacific population aged 15 years and over was 74 µg/L for males and 72 µg/L for females (Table 7.10). This indicates that the Pacific population has mild iodine deficiency. The MUIC for Pacific males and females was significantly higher than the MUIC for non-Pacific males and females, respectively, after adjusting for age.

In the Pacific population, 30% of males and females had urinary iodine concentrations < 50 µg/L, and 68% of males and 65% of females had concentrations < 100 µg/L. The ICCIDD suggests that no more than 20% of a population should have urinary iodine concentrations below 50 µg/L, and that no more than 50% of the population should have urinary iodine concentrations below 100 µg/L. Pacific males and females were significantly less likely to have a urinary iodine concentration below 50 µg/L and below 100 µg/L than non-Pacific males and females, after adjusting for age.

As from 1 July 2010, a subsidised iodine-only tablet (150 µg) has been available in New Zealand, which the Ministry of Health recommends that all pregnant and breastfeeding women take once a day.

Table 7.10: Iodine status, Pacific people, by sex

	Sex	Pacific (95% CI)	Pacific compared with non-Pacific[1]	
			Difference	Ratio
Median urinary iodine concentration µg/L[1]	Males	74 (64–91)	^	^
	Females	72 (64–90)	^	^
Prevalence (%) urinary iodine concentration < 50 µg/L[2]	Males	30 (21–42)	–17*	0.64*
	Females	30 (23–38)	–20*	0.61*
Prevalence (%) urinary iodine concentration < 100 µg/L[2]	Males	68 (58–76)	–16*	0.80*
	Females	65 (55–73)	–16*	0.80*

Source: 2008/09 New Zealand Adult Nutrition Survey

1 Age-standardised to WHO world population.

2 Mild iodine deficiency: median urinary iodine concentration 50–99 µg/L; moderate iodine deficiency: median urinary iodine concentration 20–49 µg/L; severe iodine deficiency: median urinary iodine concentration < 20 µg/L.

3 WHO/UNICEF/ICCIDD recommend that no more than 50% of the population have an MUIC < 100 µg/L, and no more than 20% have an MUIC < 50 µg/L.

^ Confidence intervals for rate ratio and rate difference could not be calculated for median urinary iodine concentration.

* Indicates a statistically significant result at p-value < 0.05.

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