Queensland Government
Queensland Health

The University of Queensland
AUSTRALIA

Healthy Kids Queensland Survey 2006

healthy KIDS QUEENSLAND

Summary Report

The Healthy Kids Queensland Survey 2006 was an initiative funded by Queensland Health, Queensland Government and contracted to The University of Queensland to undertake.

ISBN No 9781 92 1021 879

This document is available on the Queensland Health website at www.health.qld.gov.au/healthieryou/default.asp

Suggested citation:

Abbott RA, Macdonald D, Mackinnon L, Stubbs CO, Lee AJ, Harper C, Davies PSW. Healthy Kids Queensland Survey 2006 — Summary Report. Queensland Health, Brisbane, 2007

Acknowledgments

The HKQ Steering Committee provided advice guidance and support relating to all aspects of the survey.
The HKQ Steering Committee members were:

Ms Jacky Dawson, Education Queensland
Ms Di Farmer, Department of Local Government & Planning, Sport and Recreation Queensland
Ms Maureen Fletcher, Child & Youth Health Unit, Queensland Health
Dr Vicki Gedge, Population Health Branch, Queensland Health
Ms Catherine Harper, Population Health Branch, Queensland Health
Mr Tony Kitchen, Queensland Catholic Education Commission
Dr Amanda Lee, Population Health Branch, Queensland Health (QH Project Sponsor)
Ms Jenene Rosser, Independent Schools Queensland
Ms Kirstine Sketcher-Baker, Health Information Branch, Queensland Health
Ms Christina Stubbs, Population Health Branch, Queensland Health (QH Project Manager)
Mr Jeff Wood, Department of Local Government & Planning, Sport and Recreation Queensland.

The University of Queensland Healthy Kids Queensland Project Committee was instrumental in the design, and the successful implementation of the survey. The members of the Project Committee were:

Dr Rebecca Abbott, School of Human Movement Studies, The University of Queensland.
Ms Karen Bucholz, Children's Nutrition Research Centre, School of Medicine, The University of Queensland
Dr Terry Coyne, School of Population Health, The University of Queensland
Associate Professor Peter SW Davies, Children's Nutrition Research Centre, School of Medicine, The University of Queensland
Mr Robert Hughes, School of Population Health, The University of Queensland
Ms Zoe Lawrie, Children's Nutrition Research Centre, School of Medicine, The University of Queensland
Professor Doune Macdonald, School of Human Movement Studies, The University of Queensland.
Ms Jane Paterson, Children's Nutrition Research Centre, School of Medicine, The University of Queensland.

The Project Committee is appreciative of the dedication and commitment of the Project Director, Jane Paterson, and the Project Coordinator, Karen Bucholz.

The valuable contribution of the following people to the HKQ survey is acknowledged:

Ms Rachel Baudistel, Children's Nutrition Research Centre, School of Medicine, The University of Queensland
Professor Tim Cole, University of London, UK
Ms Pamela Dodrill, Children's Nutrition Research Centre, School of Medicine, The University of Queensland
Mr Simon Forsyeth, School of Population Health, The University of Queensland
Ms Marea Fox, Children's Nutrition Research Centre, School of Medicine, The University of Queensland
Dr Barry Maher, IT Services, The University of Queensland
Dr Megan McCrory, Bastyr University, Seattle, USA
Ms Margaret Miller, Marg Miller Health Consulting, WA (Consultant)
Ms Deborah Noon, School of Human Movement Studies, The University of Queensland
Mr Robert Shandga Li, School of Population Health, The University of Queensland
Professor Gail Williams, School of Population Health, The University of Queensland
Ms Rebecca Williams, Children's Nutrition Research Centre, School of Medicine, The University of Queensland.

The Steering and Project Committee are very grateful to the school systems, schools, teachers, students and their families who so enthusiastically embraced this project.

Contents

List of Figures

List of Tables

Foreword

All children need good nutrition and adequate physical activity to grow to their full cognitive and physical potential, achieve a healthy weight, and to be protected against chronic disease in later life. Poor nutrition and physical inactivity in childhood are associated with increased risk factors for chronic disease, including obesity and raised blood pressure, cholesterol and blood sugar.

National surveys of childhood nutrition and body measurements were undertaken in 1985 and 1995. Comparison of these studies showed that the prevalence of overweight doubled and the prevalence of obesity in children tripled during that period. The rapid increase in the prevalence of overweight and obesity worldwide since the 1970s has been described as a global epidemic. Overweight including obesity now contributes 8.6 % of the burden of disability and premature death in Queensland - that's more than cigarette smoking. As the current generation of overweight children become adults, greatly increased rates of heart disease, type 2 diabetes, certain cancers, gall bladder disease, osteoarthritis, asthma, endocrine disorders and other weight-related conditions will occur in young adult populations, affecting quality of life and health treatment needs for the rest of their lives.

The Queensland Government is committed to working with the whole community to help promote healthy weight in children and young people through improved nutrition and increased physical activity. At the Queensland Obesity Summit, held by the Premier in May 2006, more than 90 industry, business, community and government representatives explored ways to help more Queenslanders achieve and maintain a healthy weight. Following the Summit, the Premier announced a $21 million commitment over three years for partnerships, grants, facilities and other resources to help to promote healthier eating patterns and increased physical activity. The Premier also established the Queensland Eat Well Be Active Taskforce.

These initiatives build on the work within my Department. Since 2002, Queensland Health has employed 119 new nutritionists and health educators to strengthen services that prevent illness by promoting improved nutrition and physical activity throughout the State. By 2009, this will have increased to 148 new positions, with incremental investment to over $16 Million per annum. These frontline staff provide important services including support for parents and carers through resources such as the *Personal Health Record; Child Information: Your guide to the first 12 months;* which is distributed to all new parents in Queensland, and the *Growing Strong, Feeding You and Your Baby* resources for Aboriginal and Torres Strait Islander families. The *Fun not Fuss with Food* workshops were developed by Queensland Health to assist parents of children with behavioural eating problems, and have been shown to effectively improve children's eating behaviour. Over 7000 *Fun not Fuss with Food* parent resources have been distributed across Queensland in the last two years. Implementation of *Optimal Infant Nutrition: evidence-based guidelines*, and the *Queensland Health Work and Breastfeeding Policy* also support parents to breastfeed, which has been shown to reduce the risk of overweight in childhood.

The *Smart Choices: Healthy Food and Drink Supply Strategy for Queensland Schools* was developed in partnership with Education Queensland to ensure that children have access at school to foods and drinks which comply with the national Dietary Guidelines for children. It has been estimated that this initiative is responsible for removing 8000 litres of soft drink from schools each week.

The Go for 2 & 5™ social marketing campaign conducted by my Department aims to increase the fruit and vegetable consumption of all Queenslanders by one serve a day. Research indicates that since the campaign began in September 2005, consumption has already increased by 0.7 of a serve per day, which represents estimated savings of around $35 Million per year in health treatment services for chronic disease. Independent research by Horticulture Australia support these results, confirming that sales of fresh fruit and vegetables in Queensland increased by over $9 Million in the first month of the campaign.

Queensland Health has developed the *Physical Activity and Nutrition out of School Hours* (PANOSH) resources to assist Outside School Hours Care services to provide healthy food choices, and to keep children active during afternoon and vacation care. Evaluation indicates that the proportion of Queensland centres with nutrition and physical activity policies, provision

of healthy foods and average time allocated to physical activity increased significantly.

The *10,000 Steps* program was a two-year research project funded by Queensland Health to successfully increase physical activity participation in the Rockhampton community. Over 600 registered providers are now implementing the 10,000 steps program in a wide range of communities, workplaces and other settings to promote physical activity.

The Queensland Government is also currently implementing the *Eat Well, Be Active—Healthy Kids for Life Action Plan 2005-2008,* which aims to achieve healthier weight in Queensland children and young people through the collective work of six government agencies in progressing over 100 initiatives addressing physical activity and nutrition. The *Healthy Kids Queensland* survey is a key part of this initiative.

The study shows that the prevalence of overweight and obesity amongst Queensland school-aged children in 2006 was about the same as it was nationally in 1995, and lower than in recent surveys in some other states. This is very good news and indicates that the Queensland Government's investment in this area is on the right track. Positive evaluation of individual programs suggests that our initiatives over the last five years have contributed to this encouraging finding.

However, there is still much more to be achieved. Our children are still eating too little fruit, vegetables and milk products, and too much sugar and fat. Many children are not active enough, and boys particularly spent too much time on television and computer games.

The Queensland Government is committed to continued improvements to help make healthier choices easier choices for all Queenslanders. The results of this study will inform public health policy and practice throughout Queensland, and help to evaluate the impact of Queensland Government initiatives to promote healthy weight, nutrition and physical activity, to improve the future health of our children and young people.

Stephen Robertson MP
Minister for Health

Executive Summary

Introduction

The Healthy Kids Queensland Survey was commissioned by Queensland Health as part of the Queensland Government's ongoing commitment to promoting healthy weight, nutrition and physical activity for Queensland's children and young people. This survey provides important data to help plan, develop and implement effective policies and programs to improve young Queenslanders' dietary and physical activity behaviour, and to achieve healthy weight. This summary report is complemented by a full report that provides more detailed methodological information and data sets.

Methods

Data were collected throughout Queensland from April to September 2006. A total of 3691 children aged 5-17 undertaking years 1, 5 or 10 at school participated in the survey. Government and non-government schools (n = 112) were selected to participate using a random cluster design and the data were weighted to ensure the equal probability of inclusion of all children in the target population. The following information was collected:

Anthropometric assessment to indicate the proportion of Queensland children who are underweight, of a healthy weight, overweight or obese:

- height, weight (to determine Body Mass Index)
- waist circumference

Dietary assessment to understand the eating patterns and nutrient intake of Queensland children:

- food-frequency
- 24-hour dietary record

Physical activity assessment to understand the physical activity behaviours and exercise patterns of Queensland children:

- physical activity questionnaire
- pedometer study.

Outline of the Summary Report

After outlining the background to the Survey and its demographics and survey tools, each section provides more detail of the assessment tools, significant results and key points. Individual sections address the anthropometric assessment, dietary assessment, and physical activity patterns measured in this sample of Queensland children and where appropriate, comparisons are made to other data sets.

Key Findings

Weight and waist circumference

- 77% of Queensland children aged 5-17 were of healthy weight.
- 19.5% of boys and 22.7% of girls aged 5-17 were overweight or obese.
- Overall, 21% of Queensland children aged 5-17 were overweight or obese.
- The prevalence of overweight and obesity generally increased with age, although the prevalence was highest in Year 5 girls.
- Overall, and within most age groups, the prevalence of overweight and obesity was slightly lower in Queensland children compared with children of similar ages in NSW and WA in recent surveys.
- Comparison with national data from 1985 and 1995 shows that the prevalence of overweight and obesity for Queensland 5-17-year olds has continued to increase; within most age groups the prevalence is twofold greater than national rates of 1985, but results suggest that the rate of increase has slowed in Queensland since 1995.
- Waist circumference has also increased from 1985 to 2006 in Queensland children aged 9-11 and 14-16 (No comparative data were available for children of Year 1 age in the 1985 data set). The largest increases have occurred at the upper end of the waist circumference distribution. The data suggests that over time there has been a relative increase in abdominal obesity at the upper end of the distribution.
- In the older age groups the BMI distribution is stretched towards the upper end, i.e. as the age group increases, the proportion of children or young people who are obese or very obese increases.

- No consistent differences in the prevalence of overweight or obesity were observed between children in urban centres and children in rural areas.

Diet

On the day of survey:

- The mean daily energy intake was within the recommended levels for boys and girls in years 1 and 5, and boys in Year 10. Year 10 girls' intake was about 15% lower than expected, which may reflect greater under-reporting in this age group.
- On average, Queensland children aged 5-17 consumed diets in which 50% of the energy intake was derived from carbohydrate. Nearly half of this (22-25% of energy) was derived from sugars.
- On average, Queensland children aged 5-17, consumed diets in which 32.5% of the energy intake was derived from fat, and 14.5% was derived from saturated fat. This compares to current NHMRC dietary guidelines recommending approximately 30% of energy intake as fat and no more than 10% coming from saturated fat.
- One in six children had diets inadequate in vitamin C and one in two children had diets inadequate in potassium, reflecting very low intakes of vegetables and relatively low intakes of fruit.
- Almost one in ten Year 5 girls and one in four Year 10 girls had diets inadequate in iron.
- One in five Year 1 boys and girls, and half of all children in Years 5 and 10 had diets inadequate in calcium; Diets low in calcium were more common in girls than in boys at all ages. This is matched by lower intakes of milk and other dairy foods amongst girls.
- In contrast to the recommendation that children aged over 2 years should choose low fat milk, most children drank whole milk. Only one in five of Year 1 children reported drinking low fat milk, and this increased to one in three amongst Year 10 girls.
- Approximately two-thirds of Year 1 and just over half of Year 5 boys and girls met recommendations for fruit consumption, but Year 10 children fell significantly short.
- The average Year 1, Year 5 and Year 10 child failed to meet recommendations for serves of vegetables and legumes: with half of the sample consuming less than one serve on the day of the survey.
- Approximately 1 in 5 of Queensland 5-17-year-olds had take-away food on the day of the survey.
- Soft drink consumption (diet and non-diet) increased with age. On the day of the survey, a third of Year 10 boys and a quarter of year 10 girls consumed soft drink.

Over the past year:

- On average, three in five Year 1 and Year 5 children reported consuming two pieces of fruit or more per day, exceeding their minimum daily recommendations for fruit consumption, but only one in six Year 10 children met the recommendations for daily fruit intake.
- On average one-half of Year 1 children, one-third of Year 5 children and just over one-fifth of Year 10 children reported consuming the recommended amount of vegetables, for their age, per day.
- Over 90% of children in years 1 and 5 ate breakfast every day, however this dropped to three quarters of Year 10 boys and just over half of Year 10 girls.
- Three in ten Year 1 children reported drinking soft drink once a week or more and this rose to seven in ten of Year 10 boys and just under half of Year 10 girls.
- No consistent differences in dietary intakes or behaviours were observed between children in urban areas and children in rural areas.

Physical activity behaviours

- On self-report, one in six Year 1 boys met daily physical activity recommendations and this dropped to one in eight by Year 10. Only one in 15 Year 1 girls met physical activity recommendations and this decreased to one in 20 by Year 10.
- Using suggested international targets for daily steps, only about three in ten Year 1 boys and four in ten Year 1 girls met physical activity targets. This increased to four in ten of Year 5 boys and just over half of Year 5 girls.
- Time spent on screen-based electronic media for entertainment increased with age; more than two in five Year 10 boys and one in four Year 10 girls exceeded the current daily recommendations.
- School-based sports and physical education were consistently ranked in the top two of reported forms of physical activities.
- Participation in active transport increased with age; more than one-third of Year 10 children participated in active transport at least once a week and one in ten either cycled or walked to and from school daily.
- Use of public transport to get to school increased with age with more than one in three Year 10 children using some form of public transport on the route to or from school.
- Boys on average took more steps than girls at all ages, and this difference was greatest (by more than 2,000 steps) in Year 10.
- Year 1 children were more active on weekends than during the week; this pattern was reversed in years 5 and 10.
- No consistent differences in physical activity behaviours were observed between children in urban areas and children in rural areas.

Policy implications and recommendations

Recommendation 1:

The rate of increase in the prevalence of overweight and obesity amongst children appears to have slowed in Queensland since the last national nutrition survey in 1995. The prevalence of unhealthy weight amongst Queensland children appears to be lower than that of other Australian States where data are available. These results suggest that the significant investment by the Queensland Government and the broader community over recent years to address the epidemic of childhood obesity and prevent chronic disease though improved nutrition and increased physical activity is beginning to have an impact in Queensland.

The Queensland Government's investment in promotion of nutrition, physical activity and healthy weight must be sustained in order to capitalise on this improvement and to make further gains to achieve better health for our children and young people throughout their lives.

Recommendation 2:

The prevalence of unhealthy weight in this survey was highest amongst girls aged around 10 years, but one in five girls and one in six boys are already overweight in their first year at school.

Interventions to promote nutrition, physical activity and healthy weight must begin early in life to assist parents and carers to raise healthy children and young people.

Recommendation 3:

Comparison of Queensland children in 2006 with national data from 1985 shows waist circumference has increased across all waist circumference centile levels, but the greatest increase has occurred in the heavier categories. In the older age groups the BMI distribution is stretched towards the upper end, i.e. as the age group increases, the proportion of children or young people who are obese or very obese increases. Not only are there more children today who are overweight, the overweight children have more central obesity, and there are more severely obese children and young people today than 20 years ago.

More services are required to treat obesity and its health consequences in children and young people, and greater efforts need to be made to prevent overweight children gaining more weight.

Recommendation 4:

Fewer than one in six boys, and one in 15 girls reported meeting the physical activity guidelines of at least one hour of moderate activity every day in the week before the survey, and the proportion decreased with age. Just over half the children achieved an hour or more of activity on three days a week, although the proportion was higher in Year 10 boys and lower in Year 1 girls. School-based sports and physical education contributed significantly to children's and young people's physical activity. The majority of children had not participated in active transport to school in the week before the survey. Children in Year 1 were more active on weekend days, while those in years 5 and 10 were less active on weekends than on weekdays.

Efforts to increase children's physical activity should continue to be a high priority. Increasing participation in active transport to school, active recreation and sports provide potential opportunities to increase children's physical activity, particularly at weekends for older children.

Recommendation 5:

Use of electronic media for entertainment (eg computer games, television and Internet) was more prevalent amongst boys and increased with age. More than one third of boys and one quarter of girls in Year 10 exceeded the guidelines of less than two hours of screen-based activity during daylight hours in the day before the survey.

Interventions to decrease use of electronic media for entertainment should be encouraged, especially for boys and young people, to reduce sedentary behaviour.

Recommendation 6:

The survey results indicate that few children met the dietary guidelines recommended by the National Health and Medical Research Council (NHMRC). Dietary quality decreased with age. One in six children had an inadequate intake of vitamin C and half of all children had an inadequate intake of potassium, reflecting insufficient intakes of fruit and particularly vegetables. Amongst the adolescents, nearly half the boys and two out of five girls did not eat any fruit, and one in three boys did not eat any vegetables on the day of the survey.

A quarter of Year 10 girls had inadequate iron intake and half the children in Year 5, half the Year 10 boys and three out of four Year 10 girls had inadequate calcium intakes. This is reflected in inadequate intakes of milk products, particularly for girls, and excessive intakes of nutrient-poor "extra" foods such as soft drinks and takeaways. Less than one in five children usually drank low-fat milk, which is recommended by the NHMRC for all children aged over two years. Intakes of saturated fat were about 45% higher than that recommended in all age and sex groups.

Initiatives to promote improved nutrition, including provision of accurate, consistent nutrition information and environmental interventions promoting availability of and access to healthy foods for all children must be a high priority for the Queensland Government and all organisations involved with children. Current efforts to promote fruit and vegetable consumption should be continued. Greater efforts should be made to promote the consumption of iron-rich foods, and low fat milk products for children aged over two years.

Recommendation 7:

All available evidence suggests that poor nutrition and physical inactivity contribute significantly to the poorer health outcomes experienced by Aboriginal and Torres Strait Islander people compared to the general Queensland population. Insufficient resources were available to allow for the development of valid instruments and over sampling to achieve reliable separate data representative of Aboriginal and Torres Strait Islander children in this survey.

The Queensland Government should invest in a targeted survey to assess nutrition, physical activity and body measurement in Aboriginal and Torres Strait Islander children. If feasible, consideration should be given to including other children of culturally and linguistically diverse backgrounds.

Recommendation 8:

The results of the survey are a valuable tool to inform policy and practice.

The Healthy Kids Queensland survey should be repeated in 2009-2010 to help assess the impact of Queensland Government initiatives to promote nutrition, physical activity and healthy weight.

1.0 Background

> "Health and well-being underpins the economic, social and cultural structures of society and contributes to the prosperity and growth of the whole community. Healthy young people are a critical resource for the future of Queensland ."
>
> Queensland Health 2005 [3].

Good health is important for everyone, especially children, whose growth, development and maturation depend on optimal physical, social and emotional well-being. A healthy diet and regular, adequate physical activity are essential to promoting and maintaining good health from infancy and through the entire life course.[4] Patterns of physical activity and healthy food habits are, to a large extent, acquired during childhood and adolescence, and these patterns are likely to be maintained throughout the lifespan.[5] Thus, establishing these patterns early provides the basis for an active and healthy adult life.

The recent worldwide trend of an increasing prevalence of overweight and obesity in children is well documented [6] and Australia is no exception. A recent review of data on Australian children aged 5-15 years, which went as far back as 1901 [7] together with more recent data [8 9] show that the prevalence of overweight and obesity in children has increased dramatically in the past 30-40 years. Obesity in childhood and adolescence is cause for concern because of the short-term detrimental health effects in children and because obese children have a much higher risk of becoming obese adults and experiencing the myriad adverse chronic health effects associated with obesity. [10-12]

Historical data show clearly that the percentage of children categorised as overweight or obese, based on body mass index, was relatively stable at about 7-8% from the early 1900s to the early 1970s.[7] Since the early 1970s, however, this percentage has increased in an almost exponential manner until 2003, when the most recent data were published. Although much of the data were not analysed separately for boys and girls, the overall figures indicate that, at present, between 20% and 30% of Australian children and adolescents are overweight or obese.

This is consistent with trends in many developed countries, in particular the USA and UK.

Obesity is a major health concern because it is a contributing factor to many diseases and disorders including heart disease, stroke, hypertension, dyslipidaemia, type 2 diabetes, some forms of cancer (e.g., bowel and reproductive system), osteoarthritis, and sleep apnoea. In 2005, obesity was estimated to cost Australia $3.7 billion in direct health care costs.[13]

Furthermore, whilst overweight and obesity are important considerations for children, there are many other benefits of a healthy diet and active lifestyle beyond the achievement and promotion of healthy weight.

1.1 Importance of physical activity in childhood and adolescence

> From a health perspective, there are three main rationales for encouraging young people to take part in regular physical activity: to optimize physical fitness, current health and well-being, and growth and development, to develop active lifestyles that can be maintained throughout adult life and to reduce the risk of chronic diseases of adulthood."
>
> Biddle, Sallis & Cavill 1998 [2]

A positive attitude towards physical activity and adoption of a physically active lifestyle are important components of preventive medicine that should begin in childhood.[14] Both physical activity and physical inactivity have a tendency to track into adulthood [15 16] and it is important to establish healthy activity habits while young.

- Children who are physically active are less likely to be overweight.[17 18]
- Children who engage in weight-bearing activities have greater bone density and better skeletal health in both the short- and long-term.[19]
- Physically active children are more likely to have a higher level of self-esteem, more positive body image, and lower levels of stress and anxiety.[20]
- Learning by doing at an early age is fundamental to the quality of skill acquisition.[21] The best time to begin teaching motor skills fundamental to a physically active lifestyle is in the pre-primary and primary years, especially in the 'years of readiness' at age 5-6 years.[22]

1.2 Importance of nutrition in childhood and adolescence

> "Nutrition is a fundamental pillar of human life, health and development across the entire life span. From the earliest stages of fetal development, at birth, and through infancy, childhood, adolescence and on into adulthood, proper food and good nutrition are essential for survival, physical growth, mental development, performance, productivity, health and well-being."
>
> World Health Organisation [1]

Childhood and adolescence are periods of substantial growth and development, and are an important time to shape and consolidate healthy eating behaviours. Establishing healthy eating early is essential to preventing or postponing the onset of nutrition-related chronic diseases in adulthood.[23]

- Adolescence is a critical period for calcium absorption and the optimum period for gaining bone density, particularly for girls.[24] The efficiency of calcium absorption increases during puberty, and the majority of bone formation occurs at this time.
- Vitamins and micronutrients are essential to help regulate the body's metabolism and assist in the formation of bone and tissue. With the high growth demands of childhood and adolescence, adequate consumption of fruit and vegetables is as important for children and adolescents as at any other stage of life.[23]
- A child's rate of growth is a fundamental indicator of dietary adequacy and health; too little or too much over a period can alter the natural progress of physical growth.[23]

1.3 Why Healthy Kids Queensland?

In Queensland, as in the rest of Australia and most developed countries, overweight and obesity, especially in children, has and will have enormous public health consequences. These include both short- and long-term influences on the risk of cardiovascular, metabolic, musculoskeletal and renal diseases, and possible impact on mental health, and the costs associated with these diseases or disorders.

The most recent reliable data on diet behaviours and the prevalence of overweight and obesity in Australian children (including a Queensland sample) were collected in 1995 and showed that slightly more than 20% of children aged 7-15 years were overweight or obese.[9] The 2007 national children's nutrition and physical activity survey will not provide adequate estimates of the prevalence of or the relevant risk factors for overweight and obesity in Queensland children.

To inform policy and practice for promoting nutrition, physical activity and healthy weight for children and to prevent chronic disease, the Queensland Government and other stakeholders need reliable objective current data on the prevalence of healthy weight, overweight and obesity, and data on dietary intake and physical activity patterns in Queensland children. This information is vital to the ongoing development, targeting and evaluation of health promotion programs to improve children's nutrition and physical activity behaviour throughout the state. Queensland Health has funded the *Healthy Kids Queensland Physical Activity and Nutrition Survey* to provide the data needed to plan, develop and refine programs to address the alarming rise in the prevalence of overweight and obesity seen in Australian children from 1985 to 1995. This survey and other multi-sector strategies aimed at making it easier for children to chose healthy foods and be more physically active are part of *Eat Well Be Active — Healthy Kids for Life: the Queensland Government's first action plan 2005-2008.* [3]

2.0 The Survey

The Healthy Kids Queensland Survey took place throughout Queensland from April to September 2006. A random sample of 112 schools from all primary and secondary schools from government and non-government sectors were invited to take part. These schools were chosen using a random cluster design. The school setting was chosen since children in the target age groups spend the majority of their time during the week at school. Further, to maximise the statistical power of the survey, three key age groups were chosen: 5 to 7 years (the first year of compulsory schooling), 9 to 11 years (just prior to puberty) and 14 to 16 years (the last year of compulsory schooling). These years are also critical times in growth and development.

The survey aimed to recruit children across Queensland and, to this end, 59 schools in urban areas and 53 from rural areas were chosen randomly. Of these, 72 agreed to take part — a response rate of 65%. The sample represented a mix of 39 schools in urban areas and 33 schools in rural areas. The definition of an urban school was that the school was based in a location with an Accessibility-Remoteness Index of Australia Plus (ARIA+) [25] category of 1 and was deemed highly accessible. A rural school was defined as a school in a location with an ARIA+ category of 2-4 that was deemed accessible through to remote.

Insufficient resources were available to allow for the development of valid instruments and over sampling to achieve reliable separate data representative of Aboriginal and Torres Strait Islander children in this survey.

The only exclusion criteria were schools with fewer than 25 students, special schools and schools that were classified as 'very remote' according to ARIA+. The exclusion criterion was used primarily for logistic reasons and to ensure as far as possible that the recruitment and measurement of salient data were feasible within the timeframe and budget of the survey.

2.1 Demographics

A total of 3691 children and adolescents from years 1, 5 and 10 participated in the survey. The mean ages of the children participating in the survey are shown in Table 1.

Table 1 Age of the study population (years)

	Year 1		Year 5		Year 10	
	Male	Female	Male	Female	Male	Female
n	568	550	718	804	480	571
Mean	6.2	6.1	10.2	10.1	15.2	15.2
SD	0.4	0.4	0.4	0.4	0.4	0.4
Median	6.2	6.1	10.2	10.1	15.2	15.2
Minimum-maximum	5.4-7.6	5.0-7.4	9.0-12.2	9.4-11.9	14.2-16.6	14.2-17.4

An equal number of boys and girls took part. Overall: 3.8% of the study population identified themselves as being of Aboriginal or Torres Strait Islander origin, 8.4% were born in a country other than Australia and 6.9% spoke a language other than English at home. Whilst these proportions are representative of the Queensland population, the numbers of children are too small to provide separate reliable estimates of the survey outcomes in these groups.

The data arising from the survey were weighted and all results shown in this report relate to these weighted data. The data were weighted because the sampling did not achieve an equal probability of inclusion of all children in the target population for two reasons.

First, the number of classes varied by school, as did the number of classes selected from a given school. For example, a child in a school with two classes would have a one in two or 50% chance of selection (one class selected), whereas a child in a school with five classes would have two chances in five (or 40% chance) of selection (two classes selected). In addition, for various reasons, the sampling protocol was not followed strictly in all situations. For example, if a school insisted that all classes be included, children at that school would have a 100% probability of selection, and the probabilities would also vary between schools.

Second, not all selected children responded, leading to potential response bias. To correct, as far as possible, for selection and response bias and to obtain unbiased estimates, the probability of a child being included in the analysis (that is, selected in the first place and then responding) was multiplied by the probabilities of inclusion at each successive stage; these were the probabilities of school selection, class selection and child inclusion. These probabilities were converted to weights (as the inverse of the probabilities) and applied to the weighted analyses.

The effect of a weighted analysis is to produce estimated prevalences that would correspond to the estimates seen if each child in the target population had the same probability of inclusion.[26]

2.2 Survey tools

The survey used accepted methods to assess the participants' body dimensions, dietary intake, and physical activity. Some of the survey tools have been used previously in other Australian State surveys of physical activity and nutrition.[27 28] These measures allow us to compare the results across time and location (e.g., with previous surveys or surveys in other States or countries). The particulars of each tool are addressed at the start of their respective results section.

The following information was collected about the survey participants:

- Age and date of birth
- Anthropometric assessment to indicate the proportion of Queensland children who are of a healthy weight, overweight or obese:
  - height
  - weight
  - waist circumference
- Dietary assessment to understand the eating patterns and nutrient intake of Queensland children:
  - food-frequency
  - 24-hour dietary record.
- Physical activity assessment to understand the physical activity behaviours and exercise patterns of Queensland children:
  - physical activity questionnaire
  - pedometer study.

Table 2 Sample sizes according to survey tools

Survey tool	Year 1	Year 5	Year 10	total n
Anthropometry	1,102	1,487	1,012	3,601
24-hour food record	235*	1,397	933	2,565
Food frequency	948	1,349	946	3,243
PA questionnaire	944	1,400	956	3,300
Pedometer	915	1,397	933	3,245

PA = physical activity

* 25% of year 1 classes were selected to be asked to complete the 24-hour food record based upon the more intensive nature of collecting, evaluating and processing 24-hour dietary records in children of this age.

The data were analysed by standard procedures and, unless otherwise indicated, all data presented have been weighted to take into account the sampling framework (i.e., recruitment of certain schools and certain children), as discussed above. Table 2 shows the samples sizes for each survey tool for each age group.

The sample sizes varied slightly between survey tools because some children did not consent to participate in all measures. Overall the average response rate for each survey tool was 54%, and the response rates ranged from 39% to 68%, according to the Year group and the survey tool in question.

3.0 Anthropometric assessment

The following variables were measured:

- height
- body weight
- waist circumference.

Height, weight and waist circumference at the level of the umbilicus were measured as described by Davies et al, 2001.[29] A second waist circumference measurement was taken at a level defined as being half way between the last rib and the iliac crest. The latter waist measurement is the preferred protocol for research studies as specified by the World Health Organisation,[30] whereas the measurement taken at the umbilicus enables direct comparison with previous national waist data.

For height and waist circumference, two measurements were taken and recorded. If these differed by 5 mm or more, a third measurement was taken, and the mean of the two closest measures was included in the analysis. Weight was measured once, using digital scales. The methods of data recording and collation were those described by Davies et al, 2001.[29]

Height and weight were used to calculate body mass index (BMI) according to the equation:

$$\text{BMI} = \frac{\text{weight in kg}}{(\text{height in m})^2}.$$

BMI is expressed in kg/m^2 and was used to determine the number and percentage of the sample population who were underweight, overweight or obese.

Overweight and obesity were defined using the international BMI cut offs described by Cole and colleagues.[31] These cut offs were derived from measurements of more than 190,000 individuals aged from birth to 25 years. Centile curves were drawn that, at age 18, passed through the adult accepted cut offs of 25 kg/m^2 and 30 kg/m^2 for overweight and obesity, respectively. This produced the different cut off values for children in six-monthly groups, as published.

Underweight was defined as a BMI less than the third centile for sex and age according to the CDC 2000 growth data.[32] Healthy weight was defined as not underweight, overweight or obese, as classified by the BMI.

Throughout the subsequent analyses, no consistent differences were observed between children in urban areas and children in rural areas.

3.1 Height, body weight and BMI of sample population

The demographics of height, weight and BMI of the study sample are shown by Year and sex in Tables 3-5. In these tables, "n" differs according to sex and survey outcome measures because of variation in the number of children consenting to each measure.

Table 3 Height of the children by year and sex

Height (m)		n	Mean	SD	Median	Min-max
Year 1	Male	556	1.188	0.054	1.191	0.980-1.340
	Female	531	1.168	0.053	1.169	0.870-1.370
Year 5	Male	706	1.410	0.066	1.411	1.140-1.600
	Female	774	1.416	0.069	1.411	1.040-1.680
Year 10	Male	472	1.729	0.076	1.734	1.502-1.986
	Female	536	1.632	0.064	1.636	1.151-1.813

Min-max = minimum to maximum

Table 4 Weights of the children by year and sex

Weight (kg)		n	Mean	SD	Median	Min-max
Year 1	Male	556	23.1	3.8	22.5	14.2-42.7
	Female	540	22.1	3.7	21.4	13.4-47.9
Year 5	Male	705	36.4	8.2	34.8	19.9-69.9
	Female	776	37.3	9.0	35.5	21.9-88.6
Year 10	Male	471	64.8	12.2	63.2	34.9-118.9
	Female	536	57.6	10.8	56.5	31.1-110.0

Min-max = minimum to maximum

Table 5 BMI of the children by year and sex

BMI (kg/m^2)		n	Mean	SD	Median	Min-max
Year 1	Male	554	16.3	1.8	16.0	11.5-27.0
	Female	529	16.1	1.8	15.7	12.3-28.4
Year 5	Male	704	18.2	3.0	17.5	12.2-44.2
	Female	769	18.5	3.6	17.6	12.7-50.8
Year 10	Male	471	21.6	3.4	20.9	13.6-38.7
	Female	534	21.6	3.7	21.1	13.6-48.5

Min-max = minimum to maximum

Centiles were calculated for BMI for both males and females using the LMS method [33] and using the software LMSChartmaker (www.healthforallchildren.co.uk). These data are shown in Tables 6 and 7.

Table 6 Centiles of BMI for males by age

Age (years)	n	3rd	10th	25th	50th	75th	90th	97th
5-6	194	13.6	14.3	15.0	15.9	17.0	18.1	19.4
6-7	348	13.7	14.3	15.0	16.0	17.3	18.8	20.9
9-10	230	14.2	15.0	16.0	17.4	19.4	22.1	26.4
10-11	441	14.5	15.3	16.2	17.5	19.4	21.8	25.8
14-15	153	17.0	18.0	19.3	20.9	23.0	25.4	28.6
15-16	297	16.3	17.6	19.1	21.0	23.4	26.0	29.2

* Centiles were calculated for **each** age group **independently**. There was no attempt to smooth centiles across age groups because of significant missing data for ages 7.00 to 9.00 years and 12.00 to 14.00 years.

Table 7 Centiles of BMI for females by age

Age (years)	n	3rd	10th	25th	50th	75th	90th	97th
5-6	238	13.6	14.2	14.9	15.8	17.0	18.3	20.1
6-7	293	13.5	14.1	14.8	15.8	17.0	18.4	20.4
9-10	307	14.2	15.0	16.1	17.7	19.9	22.8	27.7
10-11	444	14.0	15.0	16.2	17.9	20.1	23.0	27.1
14-15	199	16.4	17.6	18.9	20.6	22.7	24.9	27.6
15-16	321	16.8	18.0	19.4	21.2	23.5	26.2	29.5

* Centiles were calculated for **each** age group **independently**. There was no attempt to smooth centiles across age groups because of significant missing data for ages 7.00 to 9.00 years and 12.00 to 14.00 years.

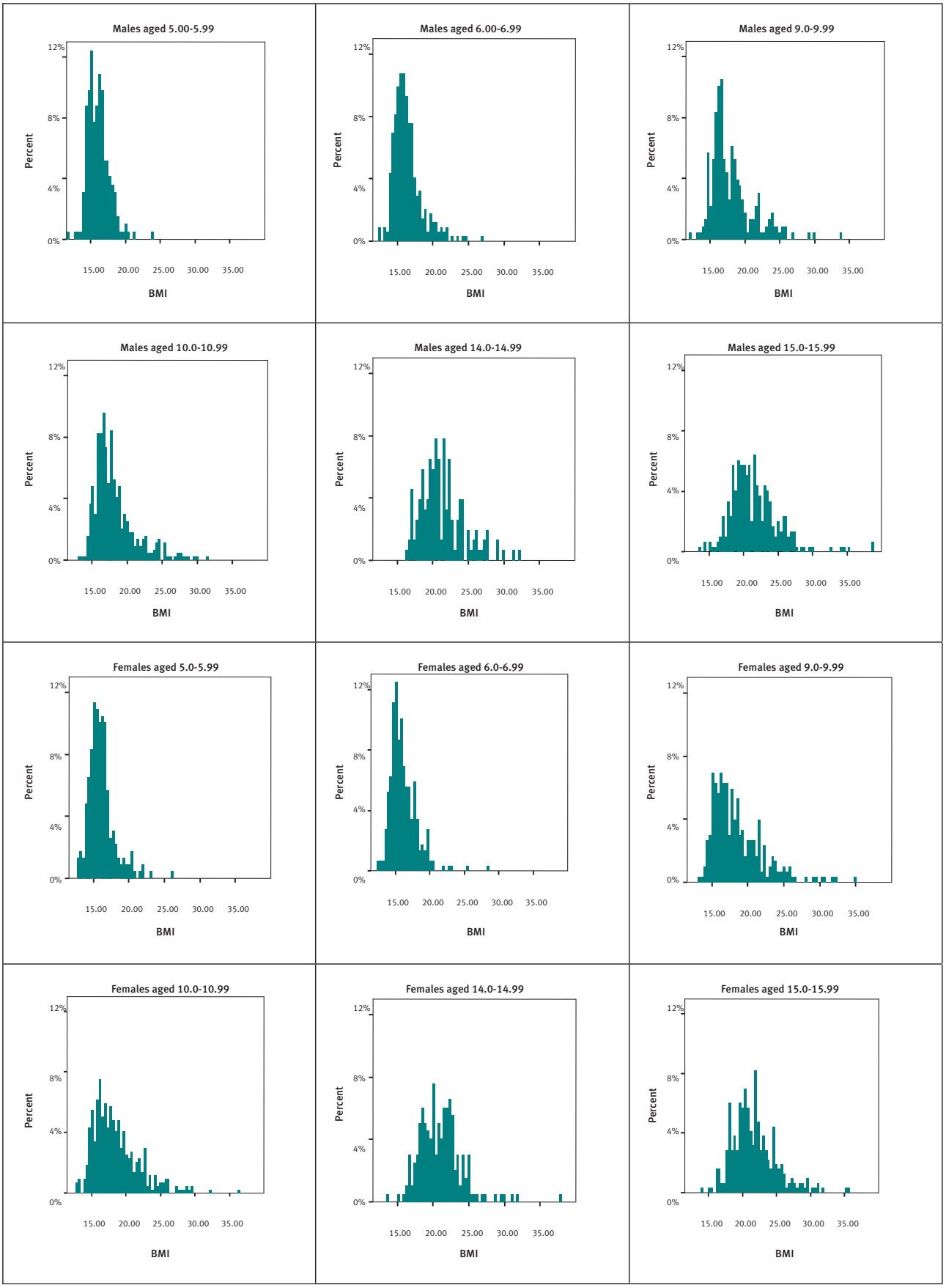
The distribution of BMI within each age and sex grouping is presented in Figure 1. As expected, this figure shows clearly that as children get older, the mean BMI increases and the range of BMI increases.

Furthermore, in the older age groups (Years 5 and 10), the spread of BMI becomes stretched towards the higher end. As the age group increases, the proportion of children or young people who are obese or very obese increases (this is seen in the figure by the appearance of more coloured bars on the right hand side of the individual distribution charts).

KEY POINTS

- In the older age groups the BMI distribution is stretched towards the upper end, i.e. as the age group increases, the proportion of children or young people who are obese or very obese increases.

Figure 1 BMI distributions by age and sex



3.2 BMI categories (underweight, healthy weight, overweight and obese)

Table 8 shows the percentage of children classified as underweight, of healthy weight and 'overweight and obese'. Table 9 shows the percentage of children classified as 'overweight but not obese' and obese, separately. In both tables, the values are the percentage of children in each category according to Year level and sex.

Fewer than 2% of the children in any age group were underweight, which was less than expected from the definition of underweight (< 3rd centile). Overall, about 77% of all children were of healthy weight: 81.7% of boys and 78.3% of girls in Year 1, 79.6% of boys and 72.2% of girls in Year 5, and 75.7% of boys and 78.4% of girls in Year 10. In the younger two groups, slightly more boys than girls were of healthy weight, but the opposite was seen in the older age group. On average, 21% of all children and young people were overweight or obese.

Table 8 Percentage of children classified as underweight, of healthy weight, or overweight and obese

	n	Underweight mean (95% CI)	Healthy weight mean (95% CI)	Overweight and obese mean (95% CI)
Year 1				
Male	554	1.6 (0.6-2.6)	81.7 (78.5-84.9)	16.7(13.6-19.8)
Female	529	2.0 (0.8-3.2)	78.3 (74.8-81.8)	19.7 (16.3-23.1)
Year 5				
Male	704	0.8 (0.1-1.5)	79.6 (76.6-82.6)	19.6 (16.7-22.5)
Female	769	1.4 (0.6-2.2)	72.2 (69.0-75.4)	26.4 (23.2-29.5)
Year 10				
Male	471	1.7 (0.5-2.9)	75.7 (71.8-79.6)	22.6 (18.8-26.4)
Female	534	1.1 (0.2-2.0)	78.4 (74.9-81.9)	20.5 (17.1-23.9)
TOTAL				
Male	1729	1.3 (0.8-1.8)	79.2 (77.3-81.1)	19.5 (17.6-21.4)
Female	1832	1.5 (0.9-2.1)	75.8 (73.8-77.8)	22.7 (20.8-24.6)
All	3561	1.4 (1.0-1.8)	77.5 (76.0-78.8)	21.1 (19.8-22.4)

CI = confidence interval

Underweight was defined as a BMI less than the third centile for sex and age according to the CDC 2000 growth data [32].
Healthy weight was defined as not underweight, overweight or obese, as classified by the BMI.
Overweight and obesity were defined using the international cut offs described by Cole and colleagues [31]

Table 9 Percentage of children classified as overweight or obese				
		n	Overweight but not obese mean (95% CI)	Obese mean (95% CI)
Year 1				
	Male	554	12.2 (9.5-14.9)	4.5 (2.8-6.2)
	Female	529	15.3 (12.2-18.4)	4.4 (2.7-6.1)
Year 5				
	Male	704	13.4 (10.9-15.9)	6.2 (4.4-8.0)
	Female	769	19.9 (17.1-22.7)	6.5 (4.8-8.2)
Year 10				
	Male	471	19.4 (15.8-23.0)	3.2 (1.6-4.8)
	Female	534	16.8 (13.6-20.0)	3.7 (2.1-5.3)
TOTAL				
	Male	1729	14.6 (12.9-16.3)	4.8 (3.8-5.8)
	Female	1832	17.7 (16.0-19.4)	5.1 (4.1-6.1)
All		3561	16.2 (15.0-17.4)	4.9 (4.2-5.6)

CI = confidence interval

Overweight and obesity were defined using the international cut offs described by Cole and colleagues [31]

In boys, the prevalence of overweight increased with age, from 12.2% in Year 1 to 13.4% in Year 5 to 19.4% in Year 10. In girls, the prevalence of overweight increased from Year 1 to Year 5 (15.3% to 19.9%) and then declined to 16.8% in Year 10.

In boys, the prevalence of obesity increased from Year 1 to Year 5 (4.5% to 6.2%) and then declined slightly in Year 10 (to 3.2%). A similar pattern was seen for girls; the prevalence of obesity increased from Year 1 to Year 5 (4.4% to 6.5%) and then decreased in Year 10 (to 3.7%).

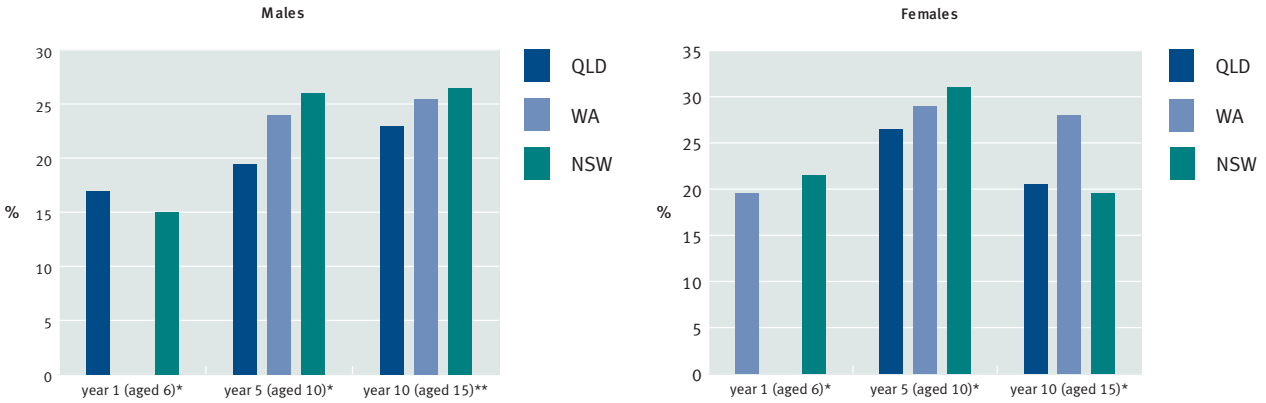
More girls than boys were overweight in years 1 and 5, but this trend reversed in Year 10. The prevalence of obesity was similar in boys and girls at each Year level.

3.2.1 Comparison of overweight and obesity between Queensland children and children in WA and NSW

The prevalence of overweight and obesity from this survey was compared with data from recent comparable State surveys in Western Australia (WA) in 2003 and New South Wales (NSW) in 2004.[27 28] The comparison is shown in Figure 2.

In the WA survey of children aged 7-16 years, overall, 21.7% of boys and 27.8% of girls were overweight or obese. In the NSW survey of children aged 5-16 years, overall, 25% of boys and 23.3% of girls were overweight or obese.

Figure 2 Comparison of the percentage of children who are overweight or obese by State (Queensland, Western Australia and New South Wales)



Values are mean percentage within each category.

No 6-year-olds were available for comparison with WA

Values for NSW are estimates from tables because numbers were not presented in their report.

* Year 1 QLD boys and girls compared with NSW kindergarten boys and girls of similar age (6 years), and Year 5 QLD boys and girls compared with Year 4 NSW boys and girls of similar age (10 years).

** Year 10 boys and girls in NSW were approximately 16 years old, up to one year older than Year 10 boys and girls in QLD.

Comparisons were not possible for each Year group across all three states. Overall, the percentage of overweight and obesity in Queensland children fell within the range of 15% to 30% seen across States within Australia. For boys, Queensland had the lowest prevalence of overweight and obese children in Year 5 and Year 10, but slightly higher than NSW in Year 1. For girls, Queensland had a lower prevalence of overweight and obesity in children of Year 1 and 5 ages, and for Year 10, Queensland rates were lower than WA but similar to NSW.

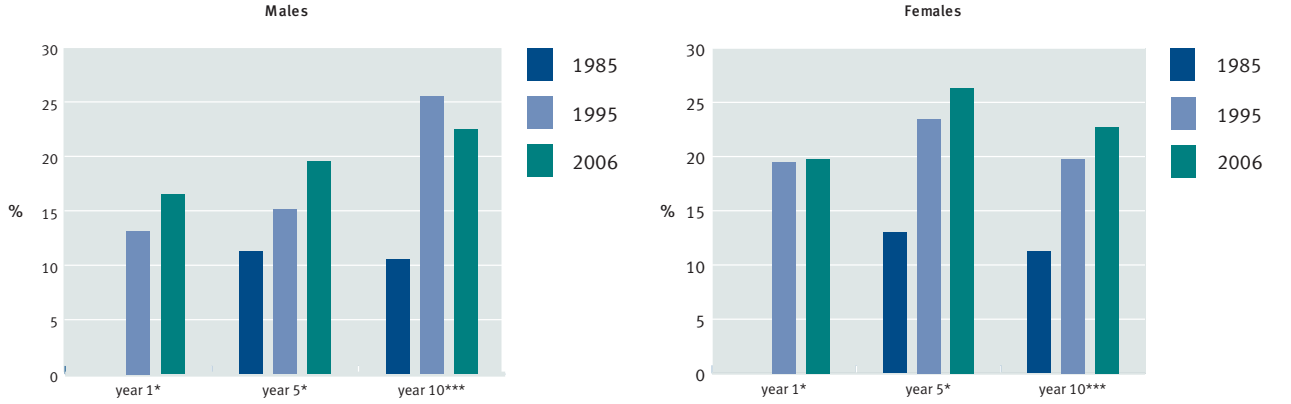
Representative data on the prevalence of overweight and obesity in 4 to 5 year old children (mean age of 56.9 months) in 2004 from the Longitudinal Study of Australian Children have recently been published. The percentage of children who were overweight or obese was 20.7% nationally and 17.9% in Queensland children.[34] The Queensland rate of overweight and obesity from this national study is similar to the rate found for 5-year-olds in Healthy Kids Queensland (17.4% for 437 children aged 5.0 to 5.99 years).

3.2.2 Trends in overweight and obesity over time

The prevalence of overweight and obesity from this survey was also compared with data from previous national surveys: the 1985 Australian Health and Fitness Survey (AHFS)[35] and the 1995 National Nutrition Survey (NNS).[36] Detailed individual state data for Queensland were not available for 1995, and weighted data were not available for 1985. However, available data suggests that the rates of overweight and obesity in Queensland children in 1985 may have been lower than national rates, at least in boys aged 7-11 (unpublished data). Further analysis of trend data for Queensland will be undertaken in 2008.

The increasing trend in overweight and obesity is shown in Figure 3.

Figure 3 Comparison of the percentage of overweight and obese children in the current survey with national percentages observed in 1985 and 1995.



Values are mean percentage within each category.

There were no available data for 1985 children of an age comparable to Year 1 children in QLD

* Year 1 QLD children (aged 5-7) were compared with NNS children (aged 4-6)

**Year 5 QLD children (aged 9-12) were compared with AHFS children (aged 7-11) and NNS children (7-11).

*** Year 10 QLD children (aged 14-17) were compared with AHFS children (aged 12-15) and the averaged value of NNS children (for the groups aged 12-15 and 16-18).

Since 1985, for children of Year 5 and Year 10 age, on average there has been a twofold increase in the prevalence of overweight and obesity. The percentage of children who were overweight or obese in the current survey was higher than the national averages observed in the respective 1995 surveys for Year 1 and Year 5 boys, and Year 5 and Year 10 girls. For Year 10 boys the prevalence of overweight and obesity is still more than double that of 1985, but was less than that observed nationally in 1995, while for Year 1 girls the prevalence is similar to the national prevalence in 1995.

Separate data for Queensland children in 1995 were not available for analysis.

However, compared to the national increase in prevalence of overweight and obesity from 1985 to 1995, the rate of increase for the period 1995 to 2006 is lower in all age and sex groups for which data is available, except for year 5 boys. Further analysis of trend data will be undertaken once individual data for Queensland from 1985 and1995 are available.

KEY POINTS

- Less than 2% of Queensland children aged 5-17 were underweight.
- 77% of Queensland children aged 5-17 were of healthy weight.
- 19.5% of boys and 22.7% of girls aged 5-17 were overweight or obese.
- Overall, 21% of Queensland children aged 5-17 were overweight or obese.
- The prevalence of overweight and obesity generally increased with age, although the prevalence was highest in Year 5 girls.
- The percentage of overweight and obesity in Queensland children fell within the range of 15% to 30%, depending on the age and sex group studied, seen across States within Australia.
- Overall and within most age groups, the percentage of boys and girls who were overweight or obese was lower in Queensland children than in NSW and WA children of the same age in recent surveys.
- Comparison with national data from 1985 and 1995 shows that the prevalence of overweight and obesity for Queensland 5-17-year-olds has continued to increase; with most age groups the prevalence being twofold greater than national rates of 1985. However, the rate of increase appears to have slowed in Queensland since 1995.
- No consistent differences in the prevalence of overweight or obesity were observed between children in urban areas and children in rural areas.

3.3 Waist circumference

BMI is used widely as a determinant of overweight or obesity, but other anthropometric indices can be used to determine risk associated with overweight and obesity. One such index is waist circumference which tracks well from childhood to adulthood and provides information relating to cardiovascular risk factors that cannot be assessed readily using BMI.[37] Table 10 shows the waist measurements at the umbilicus and halfway between the last rib and the iliac crest.

As expected from normal growth, waist circumference increased with age in boys and girls. In boys, waist circumference increased from Year 1 to Year 10 by 21.3 cm at the umbilicus and by 22.4 cm at the iliac crest. In girls, waist circumference increased by 19.6 cm at the umbilicus and by 17.8 cm at the iliac crest.

Table 10 Waist circumference (cm) of sample population by age

Waist (cm)			n	Mean	SD	Median	Minimum-maximum
Year 1	Male	Umbilicus	554	56.2	5.2	55.5	44.5-86.2
		Iliac crest		55.1	4.8	54.5	44.1-81.2
	Female	Umbilicus	529	56.0	5.3	55.0	44.1-83.8
		Iliac crest		54.2	4.8	53.3	44.4-79.0
Year 5	Male	Umbilicus	699	65.5	8.8	63.7	43.7-102.7
		Iliac crest		63.6	8.3	61.7	43.0-99.8
	Female	Umbilicus	778	66.5	9.6	64.2	47.0-108.5
		Iliac crest		63.6	9.0	61.6	47.6-101.2
Year 10	Male	Umbilicus	471	77.5	8.8	76.2	58.0-123.9
		Iliac crest		75.1	8.1	73.8	56.5-110.5
	Female	Umbilicus	538	75.6	8.8	74.9	56.2-112.8
		Iliac crest		72.0	8.1	71.0	55.5-114.5

3.3.1 Trends in waist circumference

There are good historical data relating to waist circumference in Australian children that can be used to make a robust comparison and thus indicate changes that might have significant health implications. The waist measurements taken at the umbilicus level from children in years 5 and 10 of the current survey were compared with the waist measurements of similar-aged children from the 1985 Schools Fitness Survey nationally.[35] Only children who were comparable in age between the two surveys were included in the analysis. No children in Year 1 were included, but 97% of the Year 5 and 95% of the Year 10 children sample populations were.

Children were compared by age; ages 9 and 10 (Year 5) and 14 and 15 (Year 10). These comparisons are presented in Tables 11 and 12 for Year 5 children and Tables 13 and 14 for Year 10 children. The differences between 1985 and 2006 are presented graphically in Figures 4 (Year 5) and 5 (Year 10).

Table 11	Comparison of umbilicus waist circumference (cm) centiles in 9-year-old children* from 2006 with similar-aged children from 1985							
	n	5th	10th	25th	50th	75th	90th	95th
Male								
2006	237	53.8	56.1	59.1	63.2	68.8	76.1	87.9
1985	406	52.2	53.4	55.6	58.6	62.3	66.6	69.7
Female								
2006	308	52.7	55.7	59.3	64.3	70.9	78.8	90.0
1985	432	50.3	51.7	54.2	57.6	61.7	66.5	69.9

* Children aged 9.00 to 9.99 years

Table 12	Comparison of umbilicus waist circumference (cm) centiles in 10-year-old children* from 2006 with similar-aged children from 1985							
	n	5th	10th	25th	50th	75th	90th	95th
Male								
2006	441	54.6	56.4	59.8	64.3	70.0	76.7	81.6
1985	501	53.3	54.5	56.9	60.1	64.1	68.8	72.4
Female								
2006	449	54.7	56.6	60.3	65.3	71.7	79.4	85.3
1985	494	51.3	52.7	55.4	59.0	63.3	68.3	72.0

* Children aged 10.00 to 10.99 years

The differences in waist circumference at the umbilicus between 1985 and 2006 for each centile for the respective age groups are shown in Figure 4.

Figure 4 Increase in umbilicus waist circumference centiles of 9- and 10-year-old children from 1985 to 2006

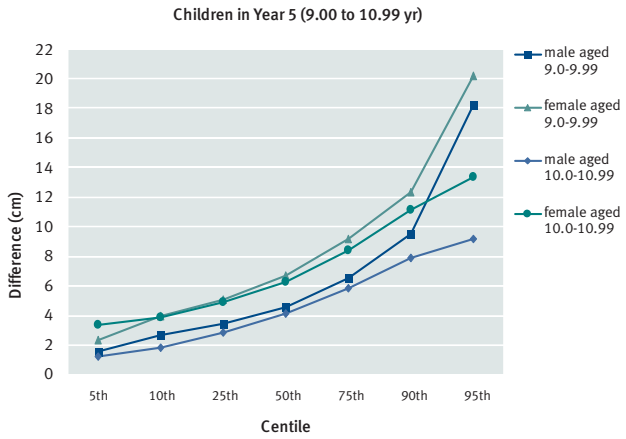


Figure 4 shows that waist circumference in 9- and 10-year-old children increased from 1985 to 2006. Although this change in waist circumference is evident across the Year 5 population (i.e., in all centile groups), it is also clear that the difference between 1985 and 2006 becomes greater as the centile increases.

Table 13	Comparison of umbilicus waist circumference (cm) centiles in 14-year-old children* from 2006 with similar-aged children from 1985							
	n	5th	10th	25th	50th	75th	90th	95th
Male								
2006	156	65.0	67.7	70.8	75.1	80.6	87.0	96.0
1985	479	60.9	62.5	65.5	69.4	74.3	79.9	84.0
Female								
2006	199	62.6	65.5	68.9	73.3	78.8	85.0	92.8
1985	414	58.1	59.7	62.8	66.8	71.7	77.0	80.8

* Children aged 14.00 to 14.99 years

Table 14	Comparison of umbilicus waist circumference (cm) centiles in 15-year-old children * from 2006 with similar-aged children from 1985							
	n	5th	10th	25th	50th	75th	90th	95th
Male								
2006	297	66.1	68.0	71.5	76.0	81.6	87.9	92.5
1985	468	63.0	64.6	67.7	71.6	76.4	81.7	85.6
Female								
2006	324	64.7	66.6	70.2	74.9	80.4	86.4	90.5
1985	423	59.5	61.6	64.2	68.2	73.1	78.4	82.2

* Children aged 15.00 to 15.99 years

Figure 5 Increase of umbilicus waist circumference centiles of 14- and 15-year-old children from 1985 to 2006

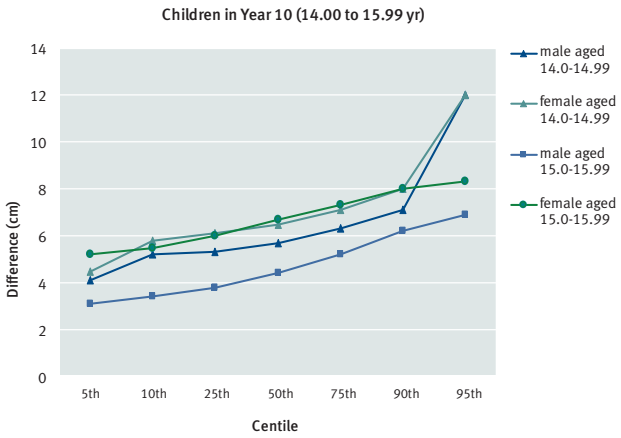


Figure 5 shows that waist circumference increased by an average of 4-6 cm from 1985 to 2006. Although this change in waist circumference is evident across the Year 10 population (i.e., in all centile groups), it is also clear that the difference between 1985 and 2006 becomes greater as the centile increases.

KEY POINTS

- As expected waist circumference increased with age.
- Waist circumference increased between 1985 and 2006 in both 9- and 10- year-old children and 14- and 15- year-old children.
- From 1985 to 2006, the greatest increases in waist circumference, in absolute terms, occurred at the higher end of the waist circumference distribution. The data suggests that over time there has been a relative increase in abdominal obesity at the upper end of the distribution.

4.0 Dietary assessment

Childhood and adolescence is a period of substantial growth and development, and is an important time to shape and consolidate healthy eating behaviours. National dietary guidelines [23] recommend that children and adolescents should be encouraged to:

- eat plenty of vegetables, legumes and fruits
- eat plenty of cereals (including breads, rice, pasta and noodles), preferably wholegrain
- include lean meat, fish, poultry and/or alternatives
- include milks, yoghurts, cheese and/or alternatives
- chose reduced-fat milk varieties (although reduced-fat milks are not suitable for children under 2 years)
- choose water as a drink
- avoid alcohol.

A guide to the number of serves per day from core food groups and extra foods recommended for children and adolescents is shown below. [38]

Recommended daily food intake for children and adolescents (NHMRC 2003)

Food Groups:	Cereal, bread, rice, pasta, noodles	Vegetables, legumes	Fruit	Milk, yoghurt, cheese	Lean meat, fish, poultry, eggs, nuts & legumes	Extra foods (soft drink, pie, oil, chips, sweets, etc)
A single serve size is equal to one of these:	1 cup cereal; or 2 slices bread; or 1 cup cooked rice, pasta or noodles	½ cup cooked vegetables or legumes; or 1 cup salad	1 medium or 2 small pieces; or 1 cup chopped or canned	250ml glass; or200g yoghurt; 40g or 2 slices cheese	65-100g cooked lean meat, fish, or poultry; or 2 eggs; or ⅓ cup nuts or ½ cup legumes	1 small piece cake; or just ½ pizza slice; or just ⅓ meat pie; or 1 can (375ml) soft drink; or just 12 hot chips.
4-7 years	5-7 serves	2 serves	1 serve	2 serves	½ serve	1-2 serves
8-11 years	6-9 serves	3 serves	1 serve	2 serves	1 serve	1-2 serves
12-18 years	5-11 serves	4 serves	3 serves	3 serves	1 serve	1-3 serves

Dietary intakes and food habits were assessed by 24-hour food record and food frequency questionnaire, similar to those used in the 2003 WA CAPANS Survey[28] which were adapted from the 1995 National Nutrition Survey.[36] Although a 24-hour food record is not always representative of an individual's usual intake because of day-to-day variability, it is a valid measure of the diet of a group or population and is a common method used in large nutrition surveys.

Throughout the subsequent analyses of children's diets, no consistent differences were observed between children in urban areas and children in rural areas.

24-hour food record

The participants were asked to record the food and drink consumed for one 24-hour period starting from when they woke up until they went to bed that same day. Parents of years 1 and 5 children were asked to complete this and Year 10 children completed the record themselves. Due to the more intensive nature of collecting, evaluating and processing 24-hour dietary records for young children, 25% of year 1 classes were selected to be asked to complete the 24-hour food record.

Children were encouraged to eat and drink normally, and to measure and record the amount of food or drink as it was served where possible. The record sheet gave detailed instructions about recording this information, including pictures to help the children estimate portion sizes. Each participant was given standard food-measuring instruments including measuring cups, measuring spoons and a ruler. Participants also recorded where the food was prepared (at home, at a canteen, etc). From the food record, the following dietary components were assessed:

- energy
- macronutrients: protein, fat (including saturated fat), carbohydrate (including sugars)
- alcohol
- fibre

- thiamine, niacin, riboflavin
- vitamin C
- iron, zinc
- calcium
- potassium.

The food and drink record was analysed using the Foodworks database (Xyrus Software, Brisbane). Although other nutrients e.g. folate, were of interest, analysis of such nutrients could not be supported by available dietary analysis software and nutrient composition data available for use in Australia in 2006.

Fifty-two percent of the survey population agreed to complete the 24-hour food record; children in Year 5 had the highest response rate (64%). Of the 3,107 completed records, 553 records were either illegible or could not be coded because insufficient information was provided to allow for the coding of either the type or amount of food. A further 136 participants completed a repeat record to assess reproducibility and to provide data on the within-subject variability. These data will be provided in the technical report.

Food frequency questionnaire

A food frequency questionnaire, which included a detailed list of foods organised by food categories (meat, vegetables, fruit, etc) was given to each child. Parents of years 1 and 5 children were asked to complete this and Year 10 children completed the questionnaire themselves. The parents or participant indicated the number of times each particular food was eaten on average, over the previous 12 months. Other questions asked about the types of foods consumed (e.g., type of breakfast cereal) and about the dietary habits from infancy. These questions were chosen for analysis at this stage because consultation with key stakeholders revealed that they were issues with specific policy or health implications. The food habits section reports on the frequency of consumption of the following variables:

- serves of fruit and vegetables
- breakfast
- evening meal with television
- evening meal with parents
- fast food
- milk
- soft drinks (non-diet and diet)
- energy, electrolyte and sports drinks.

4.1 Energy and macronutrients

4.1.1 Energy intake

Table 15 shows the daily energy intake reported in the 24-hour food record.

Table 15 Average daily energy intake (kJ/day) by year and sex

		n	Mean	SD	Median
Year 1					
	Male	113	7,590	1,990	7,360
	Female	121	6,841	2,145	6,332
Year 5					
	Male	648	8,523	2,768	8,345
	Female	746	7,718	2602	7,423
Year 10					
	Male	404	11,142	4,589	10,237
	Female	526	8,072	2,993	7,734

These energy intake data were compared with current recommendations for energy intake[39]. Current recommendations for estimated energy requirements are based on a factorial approach using a prediction of basal metabolic rate (BMR), which is then incremented to take into account the levels of habitual physical activity. Thus, for any age group there are a number of estimates of estimated energy requirements depending on how active the children are.

The mean energy intakes reported here for children in years 1 and 5, and males in Year 10 fall within the range of requirements listed for children categorised as having light to moderate levels of habitual physical activity. The reported mean energy intake for Year 10 females was about 15% lower than that recommended based on the requirements of 15-16-year-old females classified as having light to moderate levels of habitual physical activity. These lower reported intakes by Year 10 females might reflect a greater degree of under-reporting as detailed below.

4.1.2 Critical evaluation of energy intake

The quality of individual dietary records can be examined by comparing the value recorded for energy intake with a factored increment of the predicted Basal Metabolic Rate (BMR)[1] for an individual, often referred to as the 'Goldberg cut off' approach.[40] This method is useful in providing an estimation of the degree of under-reporting of reported food intake. For this survey, the revised cut offs published by Black were used to evaluate the reported energy intakes.[41] These cut offs allow the validation of energy intake at the individual level when the recording period is less than 14 days. When energy intake over a single day has been assessed, the lower 95% confidence limit for an acceptable energy intake: predicted BMR ratios is 0.87. This approach has been used in similar surveys, such as the WA CAPANS 2003 survey.[28]

Using 0.87 as the cut off for an acceptable dietary record, the dietary records for 99% and 96% of Year 1 males and females, 93% and 94% of Year 5 males and females, and 86% and 82% of Year 10 males and females were valid.

When energy expenditure (EE) is measured by objective means, the ratio of energy expenditure to predicted BMR (EE:BMR) gives an estimate of physical activity level. For an individual this could range from 1.2 (bed rest) to 2.2 (vigorous activity).

Theoretically, energy intake is equal to energy expenditure plus growth in a healthy child who is growing normally. When self-reported intake using a variety of dietary assessment instruments has been compared against energy expenditure based on objective measurements, energy intake is typically under-reported by up to 25%.[42] When reported energy intake (EI) is divided by predicted BMR, the result provides an estimate of the degree of accuracy of food intake reporting.

For comparisons with other survey data, the mean ratio of energy intake to predicted BMR (EI:BMR) is also reported. This measure provides an estimate of the extent of under-reporting of food intake. The means were 1.78 and 1.75 for Year 1 males and females, 1.58 and 1.59 for Year 5 males and females and 1.57 and 1.37 for Year 10 males and females. These compare with means of 1.75 for 10-15 year old boys in both the 1985 and 1995 national surveys, and 1.37 in 1985 and 1.53 in 1995 for girls aged 10-15 years.[43] This suggests that the EI:BMR in this survey was within the same range observed nationally in 1985 and 1995 for girls, but was lower for boys. There may have been a greater degree of under-reporting amongst Year 5 and 10 boys in Queensland in 2006 compared with the earlier national surveys.

1 Predicted BMR can be calculated from age, sex, weight and height.

4.1.3 Macronutrients

Tables 16-18 show the average daily intakes, reported in the 24-hour food record, of various macronutrients by Year level and sex.

Table 16 Average daily macronutrient intakes of children in year 1 by sex

	Male (n = 113)			Female (n = 121)		
	Mean	SD	Median	Mean	SD	Median
Protein (g)	68.6	20.3	66.5	62.4	22.5	57.9
Protein (%)	15.8	3.3	15.5	15.8	3.4	15.2
Total Carbohydrate (g)	231.1	65.8	221.6	202.6	67.0	195.0
Total Carbohydrate (%)	52.2	6.6	51.9	51.2	7.4	51.5
Sugar (g)	116.0	49.3	110.1	100.2	45.2	91.7
Sugar (%)	25.4	8.3	24.2	24.4	6.7	23.9
Fat (g)	65.8	23.6	62.4	61.6	25.6	55.4
Fat (%)	32.0	6.1	32.4	33.0	6.7	32.0
Total Saturated Fat (g)	30.1	11.9	29.2	27.1	12.2	25.1
Total Saturated Fat (%)	14.6	3.7	15.3	14.5	3.8	14.2
Alcohol (g)	0	0	0	0	0	0
Alcohol (%)	0	0	0	0	0	0
Fibre (g)	18.2	6.5	17.5	15.9	6.5	14.8

Table 17 Average daily macronutrient intakes of children in year 5 by sex

	Male (n = 648)			Female (n = 746)		
	Mean	SD	Median	Mean	SD	Median
Protein (g)	80.6	33.5	76.5	73.3	30.8	69.1
Protein (%)	16.3	4.6	15.7	16.4	4.4	15.8
Total Carbohydrate (g)	248.8	86.1	238.8	227.4	80.8	217.6
Total Carbohydrate (%)	50.3	8.4	51.6	51.1	8.8	51.1
Sugar (g)	117.5	57.2	108.6	105.7	52.1	97.6
Sugar (%)	23.1	8.9	22.4	22.9	8.1	22.1
Total Fat (g)	77.4	33.0	72.5	68.8	30.9	64.9
Total Fat (%)	33.3	6.9	33.2	32.6	7.2	32.7
Saturated Fat (g)	34.9	16.1	32.3	30.7	15.0	28.3
Saturated Fat (%)	15.1	4.0	15.1	14.5	4.1	14.5
Alcohol (g)	0	0	0	0	0	0
Alcohol (%)	0	0	0	0	0	0
Fibre (g)	18.2	8.4	17.2	17.1	7.3	16.1

Table 18 Average daily macronutrient intakes of children in year 10 by sex

	Male (n = 404)			Female (n = 526)		
	Mean	SD	Median	Mean	SD	Median
Protein (g)	112.4	54.4	102.0	79.4	35.8	74.5
Protein (%)	17.4	4.8	16.9	17.1	5.6	16.5
Total Carbohydrate (g)	320.5	137.2	301.8	232.4	92.7	224.2
Total Carbohydrate (%)	50.0	9.5	49.9	49.7	9.5	49.5
Sugar (g)	147.2	86.7	127.8	110.3	58.7	102.4
Sugar (%)	21.9	8.4	21.6	22.8	9.0	22.9
Total Fat (g)	99.7	54.1	85.6	73.0	36.1	67.1
Total Fat (%)	32.5	8.0	32.4	33.1	8.3	32.9
Saturated Fat (g)	43.9	4.6	14.5	31.9	17.5	28.6
Saturated Fat (%)	14.3	4.6	14.5	14.4	4.6	14.3
Alcohol (g)	0.5	5.3	0	0	0	0
Alcohol (%)	0.2	1.7	0	0	0	0
Fibre (g)	23.4	12.1	20.8	18.4	9.3	17.2

The mean weight of all macronutrients intakes increased with age, and boys consumed more macronutrients than girls at all ages. Mean protein intake increased from an average of 65g per day in Year 1, to 78g per day in Year 5, and 95g per day in Year 10 (though the difference between males and females in Year 10 was large). This is comparable with the 1995 National Nutrition Survey which reported intakes of 64g per day for children aged 4-7 and 82g per day for children aged 8-11, and 101g per day for boys aged 16-18 and 80g per day for girls aged 16-18. Carbohydrate and fat intake followed similar patterns of increase.

Boys and girls at all Year levels consumed approximately 50% of their energy intake from carbohydrate. This is comparable with the 1995 National Nutrition Survey data, which reported carbohydrate intakes of 52%, 50% and 49% for children aged 4-7, 8-11 and 16-18 respectively. The percentage of energy intake from sugar, which decreased from 25% to 22% from Year 1 to Year 10 was slightly lower than the 1995 National Nutrition Survey findings, which reported intakes of 28% for children aged 4-7, 25% for children aged 8-11and 25% for children aged 16-18.

The mean intake of fat, expressed as a percentage of energy intake, ranged from 32% to 33% across all ages. The mean intake for percentage of energy intake from saturated fat ranged from 14% to 15% across the Year groups.

KEY POINTS

- The mean reported daily energy intake was within the expected levels for boys and girls in years 1 and 5, and boys in Year 10.
- The mean reported daily energy intake was about 15% lower than the expected level in Year 10 girls, which suggests a greater degree of under-reporting in this group.
- On average, Queensland children aged 5-17 consumed significantly more protein than current recommended dietary intakes, but consumption was comparable to the 1995 National Nutrition Survey data.
- On average, Queensland children aged 5-17 consumed diets in which 50% of the energy intake was derived from carbohydrate. Nearly half of this (22-25% of energy) was derived from sugars.
- On average, Queensland children aged 5-17, consumed diets in which 32.5% of the energy intake was derived from fat, and 14.5% was derived from saturated fat. This compares to current NHMRC dietary guidelines recommending approximately 30% of energy intake as fat and no more than 10% coming from saturated fat as being desirable.

4.2 Micronutrients

Tables 19-21 show the average daily intakes of various micronutrients by Year level and sex.

Table 19 Average daily micronutrient intakes of children in year 1 by sex

	Male (n = 113)			Female (n = 121)		
	Mean	SD	Median	Mean	SD	Median
Thiamin (mg)	1.6	0.9	1.5	1.6	0.9	1.4
Riboflavin (mg)	2.2	1.0	2.1	2.0	1.2	1.7
Niacin (mg)	16.6	6.7	15.9	16.1	7.8	14.5
Niacin equivalents (mg)	30.2	9.8	28.6	28.5	10.9	26.4
Vitamin C (mg)	87.6	62.4	74.0	83.9	71.0	57.2
Calcium (mg)	909	414	911	779	352	758
Iron (mg)	10.2	3.9	9.6	9.0	3.1	8.7
Zinc (mg)	9.2	3.4	8.5	8.2	3.3	7.4
Potassium (mg)	2,491	892	2421	2,161	823	2,112

Table 20 Average daily micronutrient intakes of children in year 5 by sex

	Male (n = 648)			Female (n = 746)		
	Mean	SD	Median	Mean	SD	Median
Thiamin (mg)	1.8	0.9	1.6	1.7	1.3	1.4
Riboflavin (mg)	2.4	1.2	2.2	2.1	1.5	1.9
Niacin (mg)	20.1	9.3	18.9	18.5	10.6	16.5
Niacin equivalents (mg)	36.2	15.1	34.5	33.3	15.4	30.7
Vitamin C (mg)	100.5	88.3	77.7	104.4	97.8	74.0
Calcium (mg)	916	457	858	815	437	735
Iron (mg)	12.1	4.9	11.4	10.7	4.4	10.1
Zinc (mg)	10.7	5.2	9.8	9.8	4.8	9.0
Potassium (mg)	2,669	1,066	2,624	2,483	1,026	2,330

Table 21 Average daily micronutrient intakes of children in year 10 by sex

	Male (n = 404)			Female (n = 526)		
	Mean	SD	Median	Mean	SD	Median
Thiamin (mg)	2.4	1.6	2.1	1.6	0.9	1.5
Riboflavin (mg)	3.0	1.9	2.6	2.0	1.3	1.8
Niacin (mg)	27.6	15.0	23.4	19.3	11.1	17.5
Niacin equivalents (mg)	50.4	25.0	44.5	35.4	17.5	32.5
Vitamin C (mg)	120.5	130.0	83.0	111.8	108.5	82.9
Calcium (mg)	1135	716	997	838	491	782
Iron (mg)	16.5	8.0	15.1	11.4	5.2	10.7
Zinc (mg)	15.1	8.3	13.5	10.5	5.3	9.7
Potassium (mg)	3,468	1,723	3,050	2,668	1,206	2,509

Micronutrient intakes were compared with the Estimated Average Requirement (EAR) recommended for each micronutrient.[39] The EAR is the daily nutrient level estimated to meet the requirements of half of healthy individuals in a particular age, stage or sex. The EAR is used to estimate the prevalence of inadequate intakes within a group or population. Table 22 shows the percentage of the study sample that failed to meet the micronutrient EAR for children of that age.

Higher proportions of inadequate micronutrient intakes were observed in Year 10 girls. These lower reported intakes by Year 10 girls might reflect a greater degree of under-reporting, as previously described.

Table 22 Percentage of children failing to meet the micronutrient EAR by year and sex								
	Thiamin	Riboflavin	Niacin	Vitamin C	Calcium	Iron	Zinc	Potassium
Year 1								
Male	1.8	0	2.7	12.4	17.7	2.7	1.8	43.4
Female	2.5	0	6.6	15.7	22.3	4.1	2.5	60.3
Year 5								
Male	4.8	5.6	7.4	19.9	46.3	7.7	7.4	66.0
Female	6.7	8.7	9.0	15.5	55.3	8.6	9.1	57.8
Year 10								
Male	9.9	8.9	7.7	16.1	54.7	9.2	35.6	65.1
Female	20.7	17.9	17.5	14.3	73.0	28.1	15.6	51.0

These data have been calculated on unadjusted food intake values which does not take in to account the fact that the data were from one day food records. Figures based on adjusted data are available in the full report.

- Values are the percentage of children not achieving the EAR for each vitamin or mineral according to age and sex.

KEY POINTS

On the day of the survey:

- One in six children had diets inadequate in vitamin C.
- Almost one in ten Year 5 girls and more than one in four Year 10 girls had diets inadequate in iron.
- About one in five Year 1 boys and girls, about half of all children in Year 5 and more than half in Year 10 had diets inadequate in calcium.
- Diets inadequate in calcium were more common amongst girls than boys. Almost one-quarter of Year 1 girls, over a half of Year 5 girls and almost three-quarters of Year 10 girls had inadequate calcium intake.
- More than half of all children had inadequate potassium intake.
- Higher proportions of inadequate micronutrient intakes were observed in Year 10 girls. These lower reported intakes by Year 10 girls might reflect a greater degree of under-reporting, as previously described.

4.3 Food categories

Consumption of the major food categories, such as cereals and cereal products, meat products, egg products etc., used in the 1995 National Nutrition Survey [36] were also identified from the 24- hour food record. Table 23 shows the percentage of children who consumed foods from 18 food categories during the study. Details explaining the food categories are in Appendix A.

Table 23 Percentage (%) of males and females consuming foods of selected major food categories by year group and sex

	Year 1		Year 5		Year 10	
n=	Male (113)	Female (121)	Male (648)	Female (746)	Male (404)	Female (526)
Non-alcoholic beverages	64	72	62	63	70	66
Cereals and cereal products	100	100	98	98	99	95
Cereal-based products and dishes	82	74	77	79	73	72
Fats and oils	72	73	53	53	42	44
Fish and seafood products and dishes	14	12	10	10	6	8
Fruit products and dishes	79	84	63	70	55	61
Egg products	15	13	9	9	13	13
Meat, poultry and game products and dishes	80	83	77	79	80	78
Milk products and dishes	98	96	95	94	90	88
Soups	3	4	4	4	6	4
Seed and nut products and dishes	17	19	16	12	11	11
Savoury sauces and condiments	35	31	33	34	38	37
Vegetable products and dishes	71	75	70	74	67	81
Legume and pulse products and dishes	3	4	3	3	5	4
Snack foods	38	27	28	31	27	26
Sugar products and dishes	61	53	52	53	46	38
Confectionery and health bars	46	36	43	47	41	50
Miscellaneous	48	47	39	39	30	39

Table 24 Mean daily intake (g) of selected major food categories of males and females for those who consumed each food group, by year and sex

	Year 1		Year 5		Year 10	
n=	Male (113)	Female (121)	Male (648)	Female (746)	Male (404)	Female (526)
Non-alcoholic beverages	397	367	470	425	731	529
Cereals and cereal products	172	173	196	185	261	180
Cereal-based products and dishes	124	113	163	146	223	153
Fats and oils	8	8	8	7	11	9
Fish and seafood products and dishes	112	122	158	127	202	148
Fruit products and dishes	221	190	201	187	240	217
Egg products	48	79	76	60	72	86
Meat, poultry and game products and dishes	127	107	177	165	264	187
Milk products and dishes	443	374	451	381	570	386
Soups	238	224	444	375	510	469
Seed and nut products and dishes	24	32	25	22	53	31
Savoury sauces and condiments	37	24	41	50	62	45
Vegetable products and dishes	163	135	195	195	268	226
Legume and pulse products and dishes	33	95	172	97	183	138
Snack foods	26	31	49	36	55	43
Sugar products and dishes	32	28	36	33	28	28
Confectionery and health bars	34	29	40	33	51	41
Miscellaneous	7	7	8	8	12	9

Nearly half of the boys in Year 10 did not consume fruit products and dishes, and one in three did not consume vegetable products or dishes on the day of the survey. Reported intakes for Year 10 girls were similar, with four out of 10 not consuming fruit products or dishes, and one in 5 not consuming vegetable dishes or products on day of the survey. This contrasts with reported intakes for Year 1 in which approximately three-quarters of boys and girls consumed vegetable products and dishes and four out of five consumed fruit products and dishes on the day of the survey.

Dairy products and cereals were consumed by nine out of every 10 children.

Tables 24 and 25 show the mean weight (g) and median weight (g) of consumption of these food categories for males and females. It should be noted that these data are the mean intake of only those children who consumed food in these categories during the 24-hour recording period. These data should be considered in the context of data presented in Table 23. For example, for girls in Year 5 the mean consumption of soup was 375 g. However, only 4% of the girls in Year 5 consumed soup during the measurement period.

Table 25 Median daily intake (g) of selected major food categories of males and females for those who consumed each food group, by year and sex

	Year 1		Year 5		Year 10	
n=	Male (113)	Female (121)	Male (648)	Female (746)	Male (404)	Female (526)
Non-alcoholic beverages	263	263	391	314	624	420
Cereals and cereal products	145	133	143	132	195	138
Cereal-based products and dishes	92	77	119	105	162	102
Fats and oils	5	5	5	5	10	5
Fish and seafood products and dishes	120	105	102	95	90	112
Fruit products and dishes	160	171	166	166	166	168
Egg products	50	64	50	50	50	60
Meat, poultry and game products and dishes	88	88	141	125	190	144
Milk products and dishes	407	341	396	322	490	297
Soups	167	252	505	379	500	379
Seed and nut products and dishes	19	20	18	13	25	13
Savoury sauces and condiments	21	20	23	21	23	21
Vegetable products and dishes	142	95	167	165	213	180
Legume and pulse products and dishes	47	44	138	70	127	138
Snack foods	22	25	20	25	30	29
Sugar products and dishes	13	8	14	13	17	11
Confectionery and health bars	32	29	31	30	37	35
Miscellaneous	6	5	6	6	8	6

Table 26 shows the mean consumption of the various food categories across the entire sample, so for example, the mean consumption of soup across the entire sample of the 746 girls in Year 5 was 15.0g.

For comparison with the recommended intakes from core food groups[38] (page 31), an approximate estimate can be derived using the following assumptions:

- an average serve of fruit weighs 150g and that the food group 'fruit products and dishes' is predominantly fruit
- an average serve of vegetables weighs 75g and that the 'vegetable products and dishes' food group is predominantly vegetables
- One serve of milk approximates 250g, one serve of yoghurt 200g and one serve of cheese 40g and therefore it is difficult to estimate the number of dairy serves that children were consuming. Estimates are based on a conservative serve size of 200g,

Table 26 Mean daily intake (g) of selected major food categories across the entire sample by year and sex						
	Year 1		Year 5		Year 10	
n=	Male (113)	Female (121)	Male (648)	Female (746)	Male (404)	Female (526)
Non-alcoholic beverages	254	264	291	268	512	349
Cereals and cereal products	172	173	192	181	258	171
Cereal-based products and dishes	102	84	126	115	163	110
Fats and oils	6	6	4	4	5	4
Fish and seafood products and dishes	16	15	16	13	12	12
Fruit products and dishes	175	160	127	131	132	132
Egg products	7	10	7	5	9	11
Meat, poultry and game products and dishes	102	89	136	130	211	146
Milk products and dishes	434	359	428	358	513	340
Soups	7	9	18	15	31	19
Seed and nut products and dishes	4	6	4	3	6	3
Savoury sauces and condiments	13	7	14	17	24	17
Vegetable products and dishes	116	101	137	144	180	183
Legume and pulse products and dishes	1	4	5	3	9	6
Snack foods	10	8	14	11	15	11
Sugar products and dishes	20	15	19	17	13	11
Confectionery and health bars	16	10	17	16	21	21
Miscellaneous	3	3	3	3	4	4

For the sample population as a whole, reported consumption of fruit products and dishes decreased with age. Using the assumptions stated earlier relating to weights of average serves, mean intakes approximated to just over one serve of fruit per day for Year 1 children and just under one serve a day for years 5 and 10 children. Likewise, for reported consumption of vegetable products and dishes, mean intakes approximated to one and a half serves in Year 1 children, nearly 2 serves in Year 5 children and just under two and a half serves in Year 10 children. Consumption of legume and pulse product and dishes was negligible.

Consumption of milk and milk products, for the sample population as a whole, increased with age in boys, but not for girls. A proxy of 200g for a serve, would suggest that whilst the average Year 1 and Year 5 boy is eating the recommended dairy serves, the average Year 10 boy and the average Year 1, Year 5 and Year 10 girl is eating insufficient milk products.

Non alcoholic beverages (fruit drinks, soft drink, cordial, coffee and tea) were also prominent in the reported intakes across the sample population. On average Year 1 children consumed 250ml, and this increased to 350ml in Year 10 girls and 500ml in Year 10 boys.

KEY POINTS

On the day of the survey:

- on average, Year 1 children met and Year 5 children were close to meeting, the recommended fruit intake of one serve per day
- on average, Year 10 children consumed less than a third of the recommended intake of three serves of fruit per day
- on average, Year 1 children ate less than a half, Year 5 children ate less than two thirds and Year 10 children ate less than three quarters of the serves of vegetables recommended for their age groups
- These insufficient intakes of fruit and vegetables are reflected by the one in six children with inadequate Vitamin C intake, and half of all children whose intake of potassium was inadequate.
- On average, Year 10 girls only consumed just over half the recommended intake of milk and milk products.
- Low intakes of milk products are reflected by the large proportion of children, particularly Year 10 girls, with inadequate calcium intakes.

4.4 Consumption of foods of interest from the 24-hour food record

From the 24-hour food record, consumption of one serve or more of fruit, one serve or more of vegetables, take-away food*, dietary supplements and various types of beverages were extracted. Tables 27 and 28 present data on the consumption of these foods and beverages.

Table 27 Percentage of study population consuming one serve or more of fruit and vegetables, take-away food and dietary supplements on the day of the food record

	n	One or more serve of fruit	One or more serve of vegetables	Take-away food*	Supplements
Year 1					
Male	113	70.5	49.5	20.3	5.1
Female	121	65.7	39.6	13.6	9.8
Year 5					
Male	648	55.7	46.0	21.1	4.4
Female	746	59.3	51.5	19.3	3.3
Year 10					
Male	404	46.7	48.0	26.3	3.2
Female	526	56.2	58.6	22.8	1.9

* For the 24-hour food record, take-away food was defined as meals or snacks such as burgers, pizza, chicken or chips from places like McDonalds, Hungry Jacks, KFC, Pizza Hut, Red Rooster or local take away food places. It also included pies, sausage rolls, and fish and chips, as well as items bought hot from supermarkets etc. It did not include sushi, take away Asian foods or salads, sandwiches or rolls.

Overall, 40% of the participants consumed less than one serve of fruit on the day of the 24-hour food record. Comparison with recommended fruit intake (page 24) indicates that only two-thirds of Year 1 and just over half of Year 5 boys and girls met the recommended intake of at least one serve of fruit per day. Year 10 fruit consumption, as recorded above, cannot be compared with recommendations (since requirements for Year 10 children are three serves per day).

Approximately half of all children consumed less than one serve of vegetables on the day of the survey.

Take-away food was consumed by about 20% of all participants and was highest in Year 10 children, with almost one-quarter consuming take-away food on the day of the survey.

Almost 10% of Year 1 girls and 5% of Year 1 boys consumed dietary supplements on the day of the survey. Use of supplements declined with age.

Table 28 presents the percentage of children recording consumption of each specified beverage.

Consumption of both non-diet and diet soft drinks increased with age, and more boys than girls consumed non-diet soft drinks on the day of the survey. Soft drinks (non diet and diet) were consumed by a third of Year 10 boys and a quarter of Year 10 girls.

Table 28 Percentage of study population consuming soft drinks and sports and energy drinks on the day of the food record

	n	Non-diet soft drinks	Diet soft drinks	Sports drinks	Energy drinks
Year 1					
Male	113	10.5	1.0	0	0
Female	121	11.5	3.9	0.9	0
Year 5					
Male	648	16.9	3.4	1.5	0.2
Female	746	13.0	3.8	0.4	0.1
Year 10					
Male	404	28.4	6.3	7.0	0.4
Female	526	19.2	5.1	2.2	1.1

Whilst consumption of sports and energy drinks was generally low, one in 13 Year 10 boys drank a sports drink on the day of the survey.

Alcohol intake was also recorded. The only recorded consumption was in Year 10 boys, of whom 1.6% reported drinking alcohol on the day of the survey.

KEY POINTS

On the day of the survey:

- approximately two-thirds of Year 1 and just over half of Year 5 boys and girls met recommendations for fruit consumption
- half of Queensland 5-17-year-olds had less than one serve of vegetables
- approximately 1 in 5 of Queensland 5-17-year-olds had take-away food
- one in 10 Year 1 boys and one in six Year 1 girls consumed soft drink and this increased to one in three Year 10 boys and one in four Year 10 girls.

4.5 Food habits

From the food frequency questionnaire, key dietary habits and frequency of consumption of specific meals and foods of interest consumed over the previous 12 months, were assessed. These included:

- fruit and vegetable
- breakfast
- evening meal with parents
- evening meal while watching television
- fast food
- milk
- soft drinks (diet and non-diet)
- energy drinks
- sports drinks.

4.5.1 Fruit and vegetables

Self-reported usual intake of fruit and vegetables over the year before the survey was assessed by two short questions. A serve of fruit was described as a medium piece of fruit, two small pieces of fruit or one cup of diced pieces. A serve of vegetables was described as half a cup of cooked vegetables or one cup of salad vegetables. Table 29 gives the frequency of consumption of fruits and Table 30 the frequency of consumption of vegetables.

Table 29 Frequency of reported fruit consumption in the previous 12 months

	n	Don't eat fruit	1 serve or less per day	2 serves per day	3 serves per day	4 serves or more per day
Year 1						
Male	471	1.8	36.8	44.4	14.3	2.7
Female	466	1.6	39.0	43.7	11.9	3.8
Year 5						
Male	612	3.0	47.1	35.4	9.8	4.7
Female	703	1.2	38.7	43.6	11.7	4.8
Year 10						
Male	412	4.7	44.0	33.6	12.8	4.9
Female	526	3.4	40.4	39.1	13.7	3.4

Values are the percentage of children in each category according to year level and sex.

Table 30 Frequency of reported vegetable consumption in the previous 12 months								
	n	Don't eat vegetables	1 serve or less per day	2 serves per day	3 serves per day	4 serves per day	5 serves per day	6 serves or more per day
Year 1								
Male	470	3.1	46.6	26.6	15.9	6.6	1.0	0.3
Female	466	2.1	46.0	34.2	11.6	5.4	0.6	0
Year 5								
Male	611	2.4	32.2	29.2	22.3	9.6	2.9	1.3
Female	703	1.4	33.7	31.6	19.7	7.6	4.1	1.9
Year 10								
Male	413	1.7	25.3	26.0	23.5	15.1	5.6	2.8
Female	526	0.7	26.3	28.7	21.9	15.6	5.0	1.7

Values are the percentage of children who ate vegetables in each frequency category according to year level and sex.

The data was compared to the national recommendations shown on page 31. On average, 60% of Year 1 and Year 5 children reported regularly consuming two pieces of fruit or more per day, thus exceeding the minimum recommendations for fruit consumption. In contrast, only 1 in 6 Year 10 boys and girls reported regularly consuming the recommended amount of fruit (three serves/day).

The percentage of children regularly consuming the recommended amount of vegetables for their age declined with age. Just over half of Year 1 children reported regularly consuming the recommended amount of vegetables or more (at least two serves/day) for their age group. In Year 5 children, just over a third reported regularly consuming the recommended amount of vegetables or more (three serves/day). In Year 10, only 23.5% of boys and 22.3% of girls reported regularly consuming the recommended amount of vegetables (a minimum of four 4 serves/day).

4.5.2 Meal habits

Breakfast

The children were asked to record how often they ate breakfast over the past Year.

A high percentage of children in Years 1 and 5 reported eating breakfast every day. The proportion who ate breakfast daily declined steadily with age from more than nine in ten children in Year 1, just under nine in ten children in Year 5, and on average six in ten children in Year 10. Girls in Year 10 reported eating breakfast the least: only just over half of them had breakfast every day and more than one in 10 had breakfast rarely or never.

Table 31 Reported breakfast consumption in the previous 12 months						
	n	Rarely or Never	1-2 days per week	3-4 days per week	5-6 days per week	Every day
Year 1						
Male	471	0	0.4	0.6	4.2	94.8
Female	464	0.1	0.9	1.6	6.5	90.9
Year 5						
Male	611	1.0	0.6	3.3	3.8	91.2
Female	704	1.1	2.3	4.1	5.8	86.6
Year 10						
Male	412	4.8	3.8	5.8	12.6	72.8
Female	525	11.3	8.9	10.6	15.5	53.8

Values are the percentage of children who ate breakfast in each frequency category according to year level and sex.

Evening meal practices

The children were asked to record the frequency with which they ate their evening meal a) while watching the television and b) with the family (at least one parent).

Table 32 Reported frequency of eating evening meal while watching TV in the previous 12 months

	n	Rarely or Never	Irregularly	1-4 times per week	5-7 times per week
Year 1					
Male	469	48.9	5.7	28.4	17.0
Female	464	46.3	5.7	30.6	17.4
Year 5					
Male	610	37.4	8.6	33.8	20.2
Female	701	37.3	9.9	34.6	18.1
Year 10					
Male	414	31.6	4.5	31.3	32.6
Female	523	31.8	6.0	33.7	28.5

Values are the percentage of children who ate the evening meal while watching television in each frequency category according to year level and sex.

Overall, about one-half to two-thirds of all participants ate the evening meal while watching television at least once a week. The percentage of children who ate the evening meal while watching television on most days (5-7 days/week) increased with age from one in six Year 1 children to three in ten Year 10 children. A fairly constant percentage (about one third) of children ate the evening meal while watching television on some days (1-4 days/week).

Table 33 Reported frequency of eating evening meal with family in the previous 12 months

	n	Rarely or Never	Irregularly	1-4 times per week	5-7 times per week	Irregularly
Year 1						
Male	470	0.6	2.8	10.1	85.9	2.8
Female	465	1.2	3.5	10.7	84.5	3.5
Year 5						
Male	611	2.9	4.7	7.9	84.6	4.7
Female	702	3.3	4.5	8.7	83.5	4.5
Year 10						
Male	414	8.4	4.9	16.5	70.2	4.9
Female	523	7.3	4.3	21.4	67.0	4.3

Values are the percentage of children who ate the evening meal with family (including at least one parent) in each frequency category according to year level and sex.

In years 1 and 5, a high percentage of children, on average five out of every six, ate the evening meal with their family five or more times a week. Fewer Year 10 children ate the evening meal with their family five or more times a week; 70.2% of boys and 67.0% of girls. Few Year 1 and 5 children rarely or never ate their evening meal with the family and less than 10% of Year 10 children rarely or never ate the family meal with family.

Consumption of fast food

Fast food was described as meals or snacks from fast-food chains, and several examples of fast-food chains were listed for the children.

Table 34 Reported frequency of consuming 'fast food' in the previous 12 months

	n	Never	Once per fortnight or less	Once per week	2-4 times per week	5-7 times per week
Year 1						
Male	469	3.4	66.3	27.1	3.2	0
Female	464	4.5	57.6	35.3	2.3	0.2
Year 5						
Male	612	6.5	63.5	26.7	3.3	1
Female	703	5.3	61.3	30.8	2.5	0.1
Year 10						
Male	414	4.2	56.2	30.8	6.8	1.9
Female	523	13.7	59.3	21.4	5.2	0.4

Values are the percentage of children who consumed fast food in each frequency category according to year level and sex.

More than one in ten Year 10 girls reported that they never ate fast food. Around three in five children in Year 1 and Year 5 reported eating fast food once per fortnight or less. Overall, about one-third of participants consumed fast food at least once per week, but frequency of consumption was highest in Year 10 boys, with about one in ten reporting fast food 2-4 times a week or more

4.5.3 Beverages

Consumption of milk

Table 35 Type of milk consumed in the previous 12 months

	n	Don't drink milk	Whole milk	Low or reduced-fat milk	Skim milk	Soy milk	Other	More than 1 type
Year 1								
Male	471	1.9	74.2	15.4	1.6	1.5	4.6	0.8
Female	466	2.0	73.5	17.4	1.8	1.4	3.0	1.0
Year 5								
Male	611	0.7	67.6	19.1	5.0	2.1	4.2	1.3
Female	704	3.8	62.1	18.8	6.5	1.4	6.4	1.1
Year 10								
Male	414	2.2	67.6	17.1	6.4	2.1	3.3	1.2
Female	521	6.4	56.3	22.2	10.0	1.0	2.9	1.2

Values are the percentage of children who consumed milk in each frequency category according to year level and sex.

On average, more than 95% of all children drank milk. In Years 5 and 10, more girls than boys reported not drinking any type of milk.

Whilst current guidelines recommend two to three serves of dairy intake, including milk, to promote calcium intake, it is recommended that children over 2 years of age should be encouraged to choose reduced-fat varieties. Whole milk was the predominant milk of choice by most children in this survey, though there was a clear trend for older children to switch to the low or reduced fat milks. Whilst three-quarters of Year 1 children consumed whole milk, this dropped to just over half of Year 10 children and whilst one in six Year 1 children consumed low or reduced-fat milk, this increased to one in five of Year 10 children.

Consumption of soft drinks

Table 36 Frequency of reported non-diet soft drink consumption in the previous 12 months

	n	Never	≤ 1 per month	1 per week	2-4 per week	5-6 per week	1 per day	> 2 per day
Year 1								
Male	449	45.7	23.9	18.6	8.2	1.4	1.5	0.6
Female	456	40.5	21.4	21.5	12.4	1.0	2.5	0.5
Year 5								
Male	600	30.4	28.8	22.3	13.7	1.9	1.8	0.9
Female	693	30.6	25.8	22.8	14.5	2.0	2.9	1.4
Year 10								
Male	410	11.3	17.3	27.7	26.6	7.9	5.2	4.1
Female	521	27.2	24.7	21.4	15.0	4.6	4.3	2.8

Values are the percentage of children who consumed non-diet soft drinks in each frequency category according to year level and sex.

Soft drink consumption increased with age. Three in ten Year 1 children reported drinking soft drink once a week or more and this rose to seven in ten of Year 10 boys and just under half of Year 10 girls. This trend is also reflected in the number of children who reported never drinking soft drink. Whilst two in five Year 1 children never drank soft drink, this dropped to only one in ten of Year 10 boys and just under three in ten Year 10 girls.

Soft drink consumption patterns were in general similar between boys and girls, apart from Year 10. One in four Year 10 girls and two in five Year 10 boys reported consuming soft drink at least 2-4 times a week.

Consumption of diet soft drinks

Table 37 Frequency of reported diet soft drink consumption in the previous 12 months

	n	Never	≤ 1 per month	1 per week	2-4 per week	5-6 per week	1 per day	>2 per day
Year 1								
Male	439	77.9	7.9	7.7	4.9	0.7	0.7	0.3
Female	447	71.1	11.2	9.3	6.7	0.7	0.9	0.2
Year 5								
Male	597	60.1	15.6	11.3	9.6	1.4	1.3	0.5
Female	690	60.1	17.4	10.7	8.2	1.4	1.7	0.4
Year 10								
Male	411	53.8	14.8	16.9	9.6	2.8	1.6	0.7
Female	520	50.5	18.9	17.2	8.5	1.2	2.8	0.9

Values are the percentage of children who consumed diet soft drinks in each frequency category according to year level and sex.

Children reported consuming diet soft drink less frequently than regular soft drink. As with soft drink consumption, consumption of diet soft drink increased with age. One in six Year 1 children reported drinking diet soft drink once a week or more and this rose to approximately one in four of Year 10 children. This trend is also reflected in the number of children who reported never drinking diet soft drink. Just under three quarters of Year 1 children never drank diet soft drink, and this was reduced to just over a half of Year 10 children.

Diet soft drink consumption patterns were similar between boys and girls at all Year levels.

Consumption of energy drinks

Table 38 Frequency of reported energy drink consumption in the previous 12 months

	n	Never	≤ 1 per month	1 per week	2-4 per week	5-6 per week	1 per day	>2 per day
Year 1								
Male	450	98.1	1.4	0.1	0.4	0	0	0
Female	452	99.1	0.9	0	0	0	0	0
Year 5								
Male	599	92.3	6.6	0.8	0.1	0.1	0	0.1
Female	695	91.6	6.2	0.6	0.3	0.6	0.5	0.2
Year 10								
Male	410	48.1	33.6	10.7	5.2	2.0	0.5	0
Female	522	64.6	24.4	6.1	2.4	2.4	0	0.2

Values are the percentage of children who consumed energy drinks in each frequency category according to year level and sex.

As with soft drink consumption, consumption of energy drinks increased with age, and there was a notable step-up in consumption for the older children. Less than 2%, or one in 50, children in years 1 and 5 reported drinking energy drinks once a week or more. However in Year 10, one in six boys and one in eight girls reported drinking energy drinks once a week or more.

This trend is also reflected in the number of children who reported never drinking energy drinks. Over 90% of years 1 and 5 children never drank energy drinks, and this dropped to just over a half of Year 10 children.

Consumption of sports drinks

Table 39 Frequency of reported sports drink consumption in the previous 12 months

	n	Never	≤1 per month	1 per week	2-4 per week	5-6 per week	1 per day	> 2 per day
Year 1								
Male	454	77.8	17.9	2.8	1.5	0	0	0
Female	456	87.1	11.1	1.2	0.4	0	0.1	0
Year 5								
Male	600	47.8	40.0	9.0	2.4	0.6	0	0.1
Female	698	61.5	30.3	5.6	2.0	0.1	0	0.5
Year 10								
Male	411	17.1	39.5	21.1	16.3	3.2	1.5	1.3
Female	523	35.8	41.9	14.3	5.1	2.0	0.7	0.3

Values are the percentage of children who consumed sports drinks in each frequency category according to year level and sex.

Children drank sports drinks more frequently than energy drinks, but not as frequently as soft drinks. As with soft drinks and energy drinks, consumption of sports drinks increased with age and again there was a step-up in consumption for the older children of Year 10. Approximately one in 20 Year 1 children, one in ten Year 5 children and one in three Year 10 children reported consuming sports drinks once a week or more.

Sports drink consumption patterns were higher amongst boys than girls at each Year level. By Year 10, two out of five of boys were consuming sports drinks once a week or more, compared to one in five girls.

KEY POINTS

Fruit and vegetables- over the past year:

- On average, three in five Year 1 and Year 5 children reported consuming two pieces of fruit or more per day, thus exceeding their minimum daily recommendations for fruit consumption.
- Only 17% of Year 10 children reported consuming the recommended amount of fruit for their age (3 serves/day).
- On average a half of Year 1 children, a third of Year 5 children and just over a fifth of Year 10 children reported consuming the recommended amount of vegetables for their age.

Meal habits- over the past year:

- Over 90% of children in years 1 and 5 ate breakfast every day, however this dropped to three quarters of Year 10 boys and just over half of Year 10 girls.
- A high percentage of children, on average five out of every six Year 1 and 5 children and two in three Year 10 children, ate the evening meal with their family five or more times a week.
- Approximately one-half to two-thirds of all children ate their evening meal in front of the television at least once per week. The percentage of children who ate the evening meal while watching television on most days (5-7 days/week) increased with age from one in six Year 1 children to three in ten Year 10 children.
- About one-third of children in all Year levels reported consuming fast food at least once per week.

Beverages- over the past year:

- On average, more than 95% of all children drank milk. Year 10 girls were notable with one in 15 girls not drinking any type of milk.
- In contrast to the recommendation that children aged over 2 years should choose low fat milk, most children drank whole milk. Only one in five of Year 1 children reported drinking low fat milk, and this increased to one in three amongst Year 10 girls.
- Soft drink consumption increased with age. Three in ten Year 1 children reported drinking soft drink once a week or more and this rose to seven in ten of Year 10 boys and just under half of Year 10 girls.
- As with soft drink consumption, consumption of diet soft drink also increased with age. One in six Year 1 children reported drinking diet soft drink once a week or more and this rose to approximately one in four Year 10 children.
- Approximately, one in 20 Year 1 children, one in ten Year 5 children and one in three Year 10 children reported consuming sports drinks once a week or more. Sports drink consumption patterns were higher amongst boys than girls at each Year level
- Energy drinks were consumed less than sports drinks. Less than 2%, or one in 50, children in years 1 and 5 reported drinking energy drinks once a week or more. However in Year 10, one in six boys and one in eight girls reported drinking energy drinks once a week or more.
- Throughout the analyses of children's diets, no consistent differences were observed between children in urban areas and children in rural areas.

5.0 Physical activity

Regular physical activity is an important part of physical, social and psychological development in children. Weight-bearing activity is important to bone health, and moderate-to-vigorous activity is important for preventing diseases or conditions related to a sedentary lifestyle.

The Australian Physical Activity Guidelines for Children and Youth recommend at least one hour of moderate or vigorous physical activity each day and that children limit their use of electronic media for entertainment, such as watching television and videos/DVDs or using computer games or internet, to two hours per day.[44]

Physical activity levels were assessed using a physical activity questionnaire and by a pedometer, standard methods to assess physical activity behaviour at the population level and methods that are similar to those used in the 2003 WA CAPANS Survey.[28]

Physical activity questionnaire

Children (or their parents for Year 1 children) completed a questionnaire about their physical activity during the previous seven days. They were provided with a list of named physical activities (31 for years 1 and 5 children, and 35 for Year 10 children) and asked to indicate the number of times they performed each activity during the week and on the weekend. Questions also asked about participation in physical activity at school, whether the children walked to school, and other leisure pursuits (television, hobbies, etc.). Children also indicated their participation in various activities during the preceding year. In order to assess whether the children were meeting the current physical activity guidelines, the children were asked to report the number of days in the past week on which they had engaged in physical activity or active play that caused their heart rate to rise or caused them to 'huff and puff'. This was taken as an indicator of activity that was of a moderate or vigorous intensity.

Pedometer diary

A pedometer is worn on the waist and measures the number of steps taken. It is used widely in children, adolescents and adults as a quantitative measure of physical activity. Each participant was given a pedometer and instructed on its use. Children were asked to use the pedometer for five consecutive days including both weekdays and weekend days. Participants or their parents recorded the number of steps taken each day, the time the pedometer was worn, and whether the pedometer had been taken off during the day and why.

The overall compliance for the pedometer was good. A day's recording was deemed valid if it had been recorded as worn for at least eight hours per day. More than 90% of all participants who agreed to the pedometer study completed a minimum of two days; 66% of Year 1 children, 75% of Year 5 children and 78% of Year 10 children recorded steps on four days or more.

Throughout the subsequent analyses of children's activity behaviours, no consistent differences were observed between children in urban areas and children in rural areas.

5.1 Physical activity patterns and electronic media for entertainment

The children were asked how many days of the past seven days had they engaged in physical activity or active play that raised their heart rate or caused them to 'huff and puff' for a total of 60 minutes per day. This was used as an indication of time spent in moderate or vigorous physical activity and was compared with the recommendations shown on the previous page. The average number of days which they achieved this recommendation is shown by Year and sex in Table 40.

Table 40	Self reported frequency of the number of days over the past seven days that children engaged in physical activity or active play that raised their heart rate or caused them to huff and puff for a total of 60 minutes or more per day			
	n	Number of days in past week Mean (median)	Percentage of children who reported every day in past 7 days %	Percentage of children who reported 3 days or more in past 7 days %
Year 1				
Male	420	3.0 (3.3)	16.5	53.4
Female	394	2.2 (2.0)	6.3	35.1
Year 5				
Male	605	3.0 (3.0)	11.7	51.7
Female	696	3.0 (3.0)	9.5	53.5
Year 10				
Male	405	3.5 (3.0)	12.5	65.9
Female	505	2.8 (3.0)	4.8	52.6

On average, children reported that they achieved this 60-minute target on three days of the previous week. The number of children who met the daily recommended level of activity decreased with age, and was higher amongst boys at all ages. The percentage of boys who were active for 60 minutes a day over the past week decreased from 16.5 % in Year 1 to 12.5% in Year 10 and in girls, from 6.3% in Year 1 to 4.8% in Year 10.The children were also asked to record how long they had spent on the previous day (or most recent school day) 'watching television, videos, DVDs or playing video or computer games for entertainment' in daylight hours. The mean number of minutes recorded is shown in Table 41, along with the percentage of children who spent more than two hours on these activities. Children in years 1 and 5 recorded slightly more than 80 minutes of screen-based electronic media entertainment, whereas children in Year 10 reported on average just over 100 minutes on the previous day: Year 10 boys recorded an average of two hours.

Table 41	Reported time spent and the percentage of children who spent more than two hours on screen-based electronic media for entertainment, during daylight hours in the previous day			
	n	Mean (SD) number of minutes	Median number of minutes	Percentage of children who reported spending over 2 hours
Year 1				
Male	431	83 (75)	75	16.0
Female	418	84 (64)	60	17.5
Year 5				
Male	588	91 (73)	90	26.6
Female	681	79 (72)	60	19.2
Year 10				
Male	395	123 (103)	120	39.3
Female	498	91 (92)	60	27.0

The percentage of children who exceeded two hours of screen-based electronic media for entertainment on the previous day increased with age from 17% of Year 1 children to 23% of Year 5 children to 33% of children in Year 10. Almost two in five boys in Year 10 spent more than two hours of the previous day on screen-based electronic media for entertainment.

KEY POINTS

Over the week before the survey:

- The percentage of children who self-reported meeting the daily recommendations of 60 minutes of moderate or vigorous physical activity over the past week decreased with age and was higher in boys than girls at all ages.
- One in six Year 1 boys were active for an hour every day and this dropped to one in eight by Year 10. One in 15 Year 1 girls were active for an hour every day and this decreased to one in 20 by Year 10.

On the school day before the survey:

- The average Queensland child, aged 5 to 17, spent 90 minutes per day on screen-based electronic media for entertainment with boys on average spending more time than girls.
- Time spent on screen-based electronic media increased with age. More than two in five boys and one in four Year 10 girls exceeded the current daily recommendations.

5.2 Physical activities and sports

Children were asked about the type of physical activities that they had participated in over the previous week. They were also asked to indicate what physical activities they usually participated in the previous year as a way of finding out about participation in seasonal-based activities and sports not undertaken at the time of the survey. Year 1 and 5 children were provided with a list of 31 activities and sports, and Year 10 children were provided with a list of 35 activities and sports. There was also space on the survey for the children to include any activity or sport not already on the list. The top 20 most cited activities for both the previous week and the previous year are shown in Tables 42-47.

Table 42 Participation in physical activities* over the previous week for Year 1 males and females

Male	%	Female	%
Playing outside	89.7	Playing outside	89.9
Playing on playground equipment	86.3	Playing on playground equipment	86.5
Sports/PE at school	81.0	Sports/PE at school	85.7
Chores	73.0	Chores	71.0
Bike riding	71.9	Bike riding	68.0
Trampolining	58.8	Trampolining	58.7
Running/jogging	42.8	Skipping with a rope	53.2
Soccer	37.9	Dance	44.5
Walking	32.7	Running/jogging	38.7
Swimming (at a pool)	29.9	Walking	37.8
Skateboarding/rollerblading	27.6	Swimming (at a pool)	28.4
Athletics	22.1	Skateboarding/rollerblading	24.3
Skipping with a rope	19.9	Walking the dog	18.3
Handball/4 square	18.6	Athletics	19.1
Dance	14.5	Gymnastics	11.3
Walking the dog	14.0	Soccer	9.9
Rugby league	11.6	Handball/4 square	8.3
Tennis	11.0	Tennis	6.8
Cricket	10.5	Basketball	5.3
Australian rules football	8.7	Martial arts	3.9

* There were 31 listed physical activities to choose from and space for others, not listed, to be added

Table 43	Physical activities* that Year 1 males and females had 'usually' participated in over the previous year		
Male	**%**	**Female**	**%**
Playing outside	74.3	Playing outside	76.9
Playing on playground equipment	75.0	Bike riding	71.4
Bike riding	67.5	Playing on playground equipment	71.3
Trampolining	61.7	Trampolining	63.2
Swimming (at a pool)	59.9	Swimming (at a pool)	61.3
Chores	58.6	Sports/PE at school	58.0
Sports/PE at school	57.9	Chores	57.5
Running/jogging	35.2	Skipping with a rope	49.8
Walking	34.7	Dance	39.0
Soccer	34.2	Walking	35.3
Skateboarding/rollerblading	29.6	Running/jogging	35.2
Athletics	23.1	Skateboarding/rollerblading	26.3
Skipping with a rope	21.8	Walking the dog	22.2
Cricket	18.5	Athletics	19.4
Walking the dog	17.1	Gymnastics	12.4
Handball/4 square	15.4	Soccer	8.0
Dance	14.0	Handball/4 square	7.8
Tennis	13.5	Tennis	6.9
Australian rules football	13.4	Basketball	4.9
Rugby league	10.8	Cricket	4.6

* There were 31 listed physical activities to chose from and space for others, not listed, to be added

For Year 1 children, common physical activities included general activities such as bike riding, playing outside, trampolining, skipping and swimming. The most played sports were soccer, athletics, handball and cricket for boys and gymnastics, soccer and athletics for girls.

Table 44	Participation in physical activities* over the previous week for Year 5 males and females		
Male	**%**	**Female**	**%**
Sports/PE at school	87.7	Sports/PE at school	91.7
Playing outside	84.3	Playing outside	89.9
Chores	64.8	Chores	79.2
Running/jogging	63.5	Running/jogging	69.5
Bike riding	66.4	Bike riding	64.5
Handball/4 square	55.3	Walking	61.4
Soccer	52.7	Playing on playground equipment	60.6
Playing on playground equipment	49.1	Skipping with a rope	57.7
Walking	43.9	Trampolining	50.3
Skateboarding/rollerblading	42.5	Handball/4 square	47.3
Trampolining	42.4	Skateboarding/rollerblading	42.8
Athletics	35.5	Soccer	40.7
Rugby league	30.0	Dance	39.4
Swimming (at a pool)	26.1	Walking the dog	35.8
Walking the dog	25.9	Netball	35.6
Skipping with a rope	23.8	Athletics	36.8
Tennis	22.5	Swimming (at a pool)	33.3
Cricket	20.5	Basketball	22.9
AFL	19.0	Tennis	19.9
Basketball	17.9	Baseball/softball	16.3

* There were 31 listed physical activities to chose from and space for others, not listed, to be added

Table 45	Physical activities* that Year 5 males and females had 'usually' participated in over the previous year		
Male	**%**	**Female**	**%**
Playing outside	79.7	Playing outside	81.7
Sports/PE at school	74.7	Sports/PE at school	77.0
Bike riding	73.0	Bike riding	72.7
Swimming (at a pool)	62.0	Chores	71.5
Chores	59.0	Swimming (at a pool)	66.3
Running/jogging	57.9	Running/jogging	65.3
Handball/4 square	53.6	Playing on playground equipment	64.5
Playing on playground equipment	51.6	Skipping with a rope	64.0
Soccer	50.2	Walking	61.5
Trampolining	49.2	Trampolining	58.5
Athletics	47.2	Skateboarding/rollerblading	48.8
Skateboarding/rollerblading	46.9	Handball/4 square	47.9
Walking	44.7	Athletics	42.9
Walking the dog	34.4	Dance	42.6
Cricket	33.0	Walking the dog	40.6
Rugby league	29.8	Soccer	40.3
Skipping with a rope	29.4	Netball	40.3
Tennis	27.7	Tennis	24.8
AFL	23.0	Basketball	24.2
Basketball	18.3	Baseball/softball	22.6

* There were 31 listed physical activities to chose from and space for others, not listed, to be added

For Year 5 children, common physical activities included general activities such as bike riding, playing outside, skipping and swimming. The most played sports were soccer, handball and athletics for boys and handball, soccer and athletics for girls.

Table 46	Participation in physical activities* over the previous week for Year 10 males and females		
Male	**%**	**Female**	**%**
Sports/PE at school	77.6	Chores	77.1
Chores	60.5	Sports/PE at school	68.5
Running/jogging	40.3	Walking	49.9
Bike riding	38.1	Running/jogging	41.0
Soccer	31.6	Dance	31.9
Touch football	29.6	Walking the dog	27.3
Rugby league	29.3	Athletics	24.8
Athletics	27.3	Touch football	23.4
Walking	22.9	Netball	22.3
Basketball	22.7	Basketball	19.4
Walking the dog	20.6	Soccer	19.3
Tennis	19.7	Tennis	16.1
Handball/4 square	15.4	Swimming (at a pool)	15.4
Swimming (at a pool)	12.8	Bike riding	14.9
AFL	11.8	Volleyball	11.3
Rugby union	11.1	Aerobics	8.5
Skateboarding/rollerblading	9.0	Handball/4 square	7.2
Volleyball	8.7	Cricket	4.6
Surfing	8.2	Scooter	4.4
Cricket	8.1	Hockey	4.2

* There were 35 listed physical activities to choose from and space for others, not listed, to be added

Table 47	Physical activities* that Year 10 males and females had 'usually' participated in over the previous year		
Male	**%**	**Female**	**%**
Sports/PE at school	71.0	Chores	72.9
Chores	61.2	Sports/PE at school	65.9
Bike riding	53.2	Walking	59.8
Swimming (at a pool)	48.3	Swimming (at a pool)	57.1
Running/jogging	47.7	Running/jogging	50.0
Soccer	42.8	Athletics	44.2
Touch football	41.4	Dance	37.8
Athletics	41.8	Walking the dog	36.2
Rugby league	39.4	Touch football	33.3
Walking	34.8	Soccer	33.1
Basketball	34.3	Netball	30.5
Cricket	33.1	Tennis	28.0
Walking the dog	30.8	Bike riding	26.9
Tennis	29.7	Basketball	25.5
Handball/4 square	28.6	Volleyball	21.7
Rugby union	24.7	Handball/4 square	17.4
Golf	22.6	Cricket	16.8
Skateboarding/rollerblading	18.0	Baseball/softball	14.3
Volleyball	17.2	Aerobics	14.2
AFL	17.0	Rollerblading	13.6

* There were 35 listed physical activities to choose from and space for others, not listed, to be added

For Year 10 children, common physical activities included general activities such as bike riding, running, walking and swimming. The most played 'sports' were soccer, touch football, rugby league and athletics for boys and athletics, touch football, soccer and netball for girls.

KEY POINTS

- The most recorded physical activity for Year 1 children was playing outside, either as simple playing, skipping and trampolining, or playing on playground equipment.
- Bike riding was also a popular physical activity for children of all ages, apart from Year 10 girls.
- Common sports across all ages were soccer and athletics, with handball being popular among the younger children and touch football popular amongst the children in Year 10.
- School-based sports and physical education (PE) provided a significant opportunity for physical activity, listed as first or second activity for both boys and girls in Years 5 and 10.

5.3 Active transport

Children recorded the number of times they had walked and the number of times they had cycled to or from school in the previous week. Table 48 shows the percentage of children who had walked or cycled between home and school at least once in the past week, and those that had done so every day.

The number of children who had walked or cycled to school in the previous week increased with age; 22% of Year 1 children, 36% of Year 5 children and 42% of Year 10 children had walked or cycled at least once in the past week.

Table 48 Percentage of children engaging in 'active transport' to or from school over the previous week

	n	Percentage who had not walked or cycled in previous week (%)	Percentage who had walked at least once (%)	Percentage who had walked every day (%)	Percentage who had cycled at least once (%)	Percentage who had cycled every day (%)
Year 1						
Male	479	79.2	16.1	4.4	4.3	0.6
Female	475	74.1	22.1	5.4	2.3	0.3
Year 5						
Male	647	68.0	22.1	6.0	12.1	1.9
Female	742	62.5	27.0	5.1	7.8	0.7
Year 10						
Male	415	58.7	34.9	11.5	13.0	3.3
Female	527	57.2	42.1	13.8	1.8	0.1

Children were also asked how they had got to school on the day of the survey and how they had got home from school on the day before the survey. Similar to the findings shown in Table 48 about the previous week, the percentage of children who had either walked or cycled (all of the way or part of the way) to school on the day of the survey increased with age, with 14.2% and 13.2% of Year 1 boys and girls, 22.9% and 23.2% of Year 5 boys and girls and 36.9 and 35.1% of Year 10 boys and girls respectively reporting active transport.

Getting home from school followed a similar pattern; 16.7% and 15.5 % of Year 1 boys and girls, 26.7% and 27.6% of Year 5 boys and girls and 41.1% and 45.4% of Year 10 boys and girls respectively either walked or cycled all or part of the way home from school.

Table 49 and 50 shows the percentage of children who had used either a car or public transport to get to school on the day of the survey or from school on the day before the survey.

Table 49 Percentage of children who used a car or public transport to get to school on the day of the survey

	n	Percentage who travelled by car*	Percentage who travelled by bus*	Percentage who travelled by train/ ferry *	Percentage who walked to bus, train or ferry	Percentage who cycled to bus, train or ferry
Year 1						
Male	460	77.7	5.6	0.0	1.5	0.1
Female	459	77.8	5.4	0.0	2.3	0.0
Year 5						
Male	623	63.2	8.8	0.6	3.1	0.5
Female	717	66.5	9.1	0.3	2.4	0.1
Year 10						
Male	416	38.8	28.0	3.3	13.4	0.6
Female	522	49.1	20.0	2.1	18.3	0.0

* these are not mutually exclusive i.e. some children may have been driven part of the way and then taken a bus

Table 50	Percentage of children who used a car or public transport to get home from school on the day before the survey						
		n	Percentage who travelled by car*	Percentage who travelled by bus*	Percentage who travelled by train/ ferry *	Percentage who walked or cycled to bus	Percentage who walked or cycled to train/ ferry
Year 1							
	Male	460	75.2	5.5	0.0	1.9	0.0
	Female	458	74.4	5.6	0.0	2.7	0.0
Year 5							
	Male	620	54.6	13.9	0.0	4.4	0.5
	Female	717	60.8	10.2	0.0	3.9	0.1
Year 10							
	Male	416	32.5	30.6	3.3	15.7	1.0
	Female	523	34.0	23.3	2.0	22.4	0.0

* these are not mutually exclusive i.e. some children may have been driven part of the way and then taken a bus

Being driven to and from school by car was the mode of transport for just over three-quarters of Year 1 children. Half of Year 5 children and about a third of Year 10 children were driven to and from school. Use of public transport increased with age, with approximately one in four Year 10 children using the bus to get to and from school, and more than one in three using some form of public transport on their route to and from school. Children, at all ages, were more likely to use public transport to get home from school than to get to school from home.

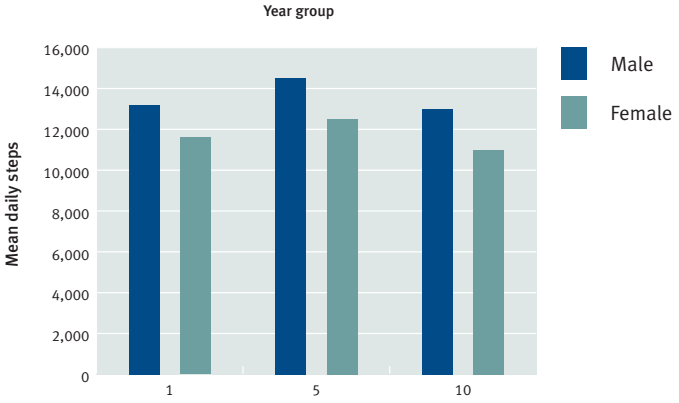
KEY POINTS

- 5% of Years 1 and 5 children engaged in active transport to and from school on a daily basis.
- 20% of Years 1 and 5 children engaged in active transport to or from school at least once a week.
- 75% of Year 1 children reported no participation in active transport to or from school in the previous week.
- Participation in active transport increased with age; more than one-third of Year 10 children participated in active transport at least once a week and over 10% either cycled or walked to and from school daily.
- On the day of the survey, over 75% of Year 1 children had been driven to school by car.
- On the day of the survey, use of public transport to get to school increased with age, with more than one in three Year 10 children using some form of public transport on the route to or from school.

5.4 Pedometer steps

The data in Figure 6 show the mean number of daily steps, defined as the mean number of steps per day for each participant who wore the pedometer for eight hours or more, on four or five days during the study period.

Figure 6 Mean number of steps per day, measured with a pedometer, by Year and sex



The same records were used to explore the difference in steps taken on a weekday compared with a weekend day.

Table 51 shows the mean number of daily steps and the corresponding mean number for type of day (weekday or weekend).

Table 51 Mean number of steps per day, per weekday and per weekend day, measured with a pedometer, by year and sex

Steps		n	Mean daily steps (SD)	Weekday steps	Weekend steps
Year 1	Male	306	13,184 (3,033)	12,956	13,798
	Female	297	11,495 (3,082)	11,269	11,909
Year 5	Male	438	14,555 (4,216)	15,395	12,873
	Female	566	12,518 (3,443)	12,869	11,702
Year 10	Male	265	12,966 (4,074)	13,847	11,747
	Female	398	10,870 (3,254)	11,334	9844

In each age group, boys accumulated more mean daily steps and more steps per day than girls on both weekdays and weekends. The difference between boys and girls by Year 10 was over 2,000 steps.

Year 1 children took more steps on weekends than on weekdays, but this was reversed in Year 5 and 10 children, who were more active on weekdays than on weekends. This trend was similar in boys and girls.

Whilst there are no current national step guidelines for children, there has been a suggestion in the international literature [45] that to maintain a healthy weight, girls aged 6-12 should aim for a target of 12000 steps, and boys of the same age, 15000 steps per day. No recommendations for older children exist. Using these targets, 27% of the boys in Year 1 and 42% of the girls in Year 1 achieved adequate steps. This increased to 40% of boys, and 53% of girls, in Year 5.

KEY POINTS

- Boys on average took more steps than girls at all ages, and this difference was greatest (more than 2,000 steps) in Year 10 children.
- In terms of steps taken, Year 5 children were the most active and Year 10 children the least active.
- Year 1 children are more active on weekends than during the week.
- Year 5 and 10 children are more active during the week than on weekends.
- Using suggested international targets for daily steps, approximately only three in ten Year 1 boys and four in ten Year 1 girls met physical activity targets. This increased to four in ten of Year 5 boys and just over half of Year 5 girls.
- Throughout the analyses of children's physical activity behaviours, no consistent differences were observed between children in urban areas and children in rural areas.

6.0 Concluding comments

This data set was collected over a six-month period in 2006 by five field teams comprising 4-6 research assistants. We are grateful to the school systems, schools, teachers, students and their families who so enthusiastically embraced this project. Their cooperation was essential to the success of the Survey.

The data in this Summary Report give a snapshot of key patterns of BMI, nutrition, food habits and physical activity for Queensland children aged 5-17 years. Where appropriate, comparisons were made with comparable data from the 1985 ACHPER Survey [35] and the more recent surveys in Western Australia [28] and New South Wales. [27] A summary of the findings is given in the Executive Summary on pages 1-3. This report will be complemented with a more detailed full report later in 2007.

This Healthy Kids Queensland Survey provides data that will be used to inform health policies for the benefit of all Queenslanders. Ideally this cross-sectional project will be repeated in subsequent years to provide Queensland with a thorough, longitudinal database of patterns of physical activity and nutrition in Queensland children.

7.0 References

1. World Health Organisation. Child and Adolescent Health and Development – Nutrition homepage, Accessed 5 March 2007. Available from http://www.who.int/child-adolescent-health/nut.htm.
2. Biddle S, Sallis J, Cavill N. Young and Active? Young People and Health-enhancing Physical Activity – Evidence and Implications. London: Health Education Authority, 1998.
3. Queensland Health. Eat well, be active: healthy kids for life. The Queensland Government's first action plan 2005-2008. Brisbane: Queensland health, 2005.
4. World Health Organization. Global strategy on diet, physical activity and health. Geneva: World Health Organization, 2004.
5. Kelder SH, Perry CL, Klepp KI, Lytle LL. Longitudinal tracking of adolescent smoking, physical activity, and food choice behaviors. *Am J Public Health* 1994;84:1121-1126.
6. Ebbeling CB, Pawlak DB, Ludwig DS. Childhood obesity: public-health crisis, common sense cure. *Lancet* 2002;360(9331):473-82.
7. Norton K, Dollman J, Martin M, Harten N. Descriptive epidemiology of childhood overweight and obesity in Australia: 1901-2003. *Int J Pediatric Obesity* 2006;1(4):232-238.
8. Booth ML, Dobbins T, Okely AD, Denney-Wilson E, Hardy LL. Trends in the Prevalence of Overweight and Obesity among Young Australians, 1985, 1997, and 2004. *Obesity* 2007;15(5):1089-1095.
9. Magarey AM, Daniels LA, Boulton TJ. Prevalence of overweight and obesity in Australian children and adolescents: reassessment of 1985 and 1995 data against new standard international definitions. *Med J Aust* 2001;174(11):561-4.
10. Australian Institute of Health and Welfare (AIHW) and National Heart Foundation of Australia. The relationship between overweight, obesity and cardiovascular disease. AIHW Cat. No. CVD 29. *Cardiovascular Disease Series No.23*. Canberra: AIHW, 2004.
11. Daniels S. The consequences of childhood overweight and obesity. *Future Child* 2006;16:47-67.
12. Rolland-Cachera MF, Deheeger M, Guilloud-Battaille M, Avorns P, Patois E, Sempe M. Tracking the development of adiposity from one month of age to adulthood. *Ann Hum Biol* 1987;14:219-229.
13. Access Economics. The economic costs of obesity. Canberra: Diabetes Australia, 2006.
14. Royal College of Physicians. Medical aspects of exercise: benefits and risks. Summary of a report of the Royal College of Physicians. *J R Coll Physicians Lond* 1991;25(193-196).
15. Anderssen N, Jacobs DRJ, Sidney S, Bild DE, Sternfeld B, Slattery ML, et al. Change and secular trends in physical activity patterns in young adults: a seven year longitudinal follow-up in the Coronary Artery Risk Development in Young Adults Study (CARDIA). *Am J Epidemiol* 1996;143(351-362).
16. Raitakari O, Porkka K, Taimela S, Telama R, Rasanen L, Viikari J. Effects of persistent physical activity and inactivity on coronary risk factors in children and young adults. The cardiovascular risk in young Finns study. *Am J Epidemiol* 1994;140(195-205).
17. Berkey CS, Rockett HR, Gillman MW, Colditz GA. One-year changes in activity and in inactivity among 10- to 15-year old boys and girls: relationship to change in body mass index. *Pediatrics* 2003;111:836-843.
18. Moore LL, Nguyen UDT, Rothman KJ, Cupples LA, Ellison RC. Preschool physical activity level and change in body fatness in young children. *J Pediatr* 1995;118:215-219.
19. Bailey D, McKay HA, L MR, Crocker PR, Faulkner RA. A six-year longitudinal study of the relationship of physical activity to bone mineral accrual in growing children: The University of Saskatchewan bone mineral accrual study. *J Bone Miner Res* 1999;14(1672-1679).
20. Alfermann D, Stoll O. Effects of physical exercise on self-concept and well-being. *Int J Sport Psychol* 2000;31:47-65.
21. Behets D. Comparison of more and less effective teaching behaviors in secondary physical education. *Teach and Teach Educ* 1997;13:215-224.
22. Blanksby B, Parker H, Bradley S, Ong V. Children's readiness for learning front crawl swimming. *Aust J Sci Med Sport* 1995;27:34-37.
23. National Health & Medical Research Council. Dietary Guidelines for Children and Adolescents in Australia. Canberra: NHMRC, 2003.
24. Bonjour JP, Carrie A, Ferrari S, Clavien H, Slosman D, Theintz G, et al. Calcium-enriched foods and bone mass in pre-pubertal girls. *J Clin Invest* 1997;99:1287-1294.
25. Australian Institute of Health and Welfare. Rural, regional and remote health: a guide to remoteness classifications. AIHW cat. no. PHE 53. Canberra: AIHW, 2004.
26. Lohr SL. Sampling: Design and Analysis (Chap 7). Pacific Grove, CA: Duxbury Press, 1999:221-253.

27. Booth M, Okely AD, Denney-Wilson E, Hardy L, Yang B, Dobbins T. NSW Schools Physical Activity and Nutrition Survey (SPANS) 2004: Summary Report. Sydney: NSW Department of Health, 2006.
28. Hands B, Parker H, Glasson C, Brinkman S, Read H. Physical Activity and Nutrition Levels in Western Australian Children and Adolescents Report. Perth, Western Australia: Western Australian Government, 2004.
29. Davies PSW, Roodveldt R, Marks G. Standard methods for the collection and collation of anthropometric data in children. Canberra: Commonwealth Department of Health and Aged Care, 2001.
30. WHO Expert Committee on Physical Status. The use and interpretation of anthropometry. Report of a WHO Expert Committee. Geneva: World Health Organization, 1995.
31. Cole TJ, Bellizzi MC, Flegal KM, Dietz WH. Establishing a standard definition for child overweight and obesity worldwide: international survey. *BMJ* 2000;320(7244):1240-.
32. Centers for Disease Control and Prevention. CDC Growth charts, Accessed 9 Mar 2007. Available from http://www.cdc.gov/nchs/about/major/nhanes/growthcharts/datafiles.htm.
33. Cole TJ. The LMS method for constructing normalised growth standards. *Eur J Clin Nutr* 1990;44:45-60.
34. Wake M, Hardy P, Canterford L, Sawyer M, Carlin JB. Overweight, obesity and girth of Australian preschoolers: prevalence and socio-economic correlates. *Int J Obes (Lond)* 2006;Dec 5; [Epub ahead of print].
35. The Australian Council for Health Physical Education and Recreation. Australian health and fitness survey 1985. Parkside, South Australia: ACHPER, 1985.
36. Australian Bureau of Statistics. National Nutrition Survey: Nutrient intakes and Physical Measurements: Australia, 1995. Canberra: Australian Bureau of Statistics, 1998.
37. Goran MI, Gower BA, Treuth M, Nagy T. Prediction of intra-abdominal adipose tissue in healthy pre-pubertal children. *Int J Obes (Lond)* 1998;22:549-558.
38. Department of Health and Aged Care. Australian Guide to Healthy Eating. Canberra: Department of Health and Aged Care, 1998.
39. National Health and Medical Research Council. Nutrient Reference Values for Australia and New Zealand including Recommended Dietary Intakes. Canberra: NHMRC, 2006.
40. Goldberg GR, Black AE, Jebb SA, Cole TJ, Murgatroyd PR, Coward WA, et al. Critical evaluation of energy intake data using fundamental principles of energy physiology: 1. Derivation of cut off limits to identify under recording. *Eur J Clin Nutr.* 1991;45:569-581.
41. Black AE. Critical evaluation of energy intake using the Goldberg cut off for energy intake: basal metabolic rate. A practical guide to its calculation, use and limitations. *Int J Obes.* 2000(24):1119-1130.
42. Hill RJ, Davies PS. The validity of self-reported energy intake as determined using the doubly labelled water technique. *Br J Nutr* 2001;85(4):415-430.
43. Cook T, Rutishauser IHE, Seelig M. Comparable data on food and nutrient intake and physical measurements from the 1983, 1985 and 1995 national nutrition surveys. Canberra: Commonwealth Department of Health and Aged Care, 2001.
44. Department of Health and Aging. Australia's physical activity recommendations for children and young people, 2005.
45. Tudor-Locke C, Pangrazi R, Corbin C, Rutherford WJ, Vincent S, Raustorp A, et al. BMI referenced standards for recommended pedometer-determined steps/day in children. *Prev Med* 2004;38:857-864.

APPENDIX Classification of Food Groups

Foods and beverages from the 24-hour food record were classified into major food categories according to the classification system used in the 1995 National Nutrition Survey.[36]

Major Food Category	Sub-Major Food Category	Example
Non-alcoholic beverages	Tea	Black tea, white tea, herbal tea
	Coffee and coffee substitutes	Black coffee, white coffee, coffee substitutes
	Fruit and vegetable juices and drinks	Apple juice, pineapple fruit drink, cordial
	Soft drinks, flavoured mineral waters and electrolyte drinks	Lemonade, tonic water, fruit-flavoured mineral water, sports drinks
	Mineral waters and water	Natural mineral water, bottled water, tap water
	Water with other additions as a beverage	Drinking chocolate (and other beverage flavours) made with water
Cereals and cereal products	Flours and other cereal grains and starches	Cornmeal, couscous, bulgar
	Regular breads and rolls	Bread, bread roll, bagel
	Breakfast cereals, plain, single source	Bran, wheat breakfast biscuits, puffed rice, corn flakes
	Fancy breads, flat breads, English style muffins and crumpets	Lavash bread, cheese-topped bread, focaccia, fruit bread, tortilla
	Pasta and pasta products	Ravioli, wholemeal pasta, rice noodles
	Rice and rice products	Rice, rice cake, flavoured rice
	Breakfast cereals, mixed sources	Muesli, wheat flakes with added fruit and nuts, breakfast bar
	Breakfast cereal, hot porridge type	Regular oats, oats with honey, cooked semolina
Cereal-based products and dishes	Sweet biscuits	Shortbread, chocolate biscuits, homemade chocolate chip biscuits
	Savoury biscuits	Water cracker, crispbread
	Cakes, buns, muffins, scones, cake-type desserts	Cake, sweet bun, brioche, pudding, slice, savoury, dumpling, sweet dumpling
	Pastries	Croissant, apple pie, danish pastry, quiche, meat pie, spinach and cheese triangle
	Mixed dishes where cereal is the major ingredient	Pizza, commercial hamburger, burrito, spring roll, packet pasta and sauce, lasagne, fried rice
	Batter-based products	Pancakes, waffle, apple fritter, doughnut
Fats and oils	Dairy fats	Butter, ghee, dairy blend
	Margarine	Margarine
	Vegetable oil	Vegetable oil, sesame oil, olive oil
	Other fats	Dripping, lard, copha, solid frying fat
	Unspecified fats	Unspecified spreads
Fish and seafood products and dishes	Fin fish (excluding canned)	Fried flathead, poached bream, baked ling, smoked salmon
	Crustacea and molluscs (excluding canned)	Abalone, calamari, mussel, oyster, snail
	Other sea and freshwater foods	Roe, eel
	Packed (canned and bottled) fish and seafood	Canned anchovy, canned salmon
	Fish and seafood products	Battered and crumbed fish, salmon patty, fish stick
	Mixed dishes with fish or seafood as the major component	Tuna mornay, kedgeree, prawn toast, fish casserole, paella with seafood

Major Food Category	Sub-Major Food Category	Example
Fruit products and dishes	Pome fruit	Fresh pear, canned apple, stewed quince
	Stone fruit	Apricot, cherry, peach, plum
	Tropical fruit	Banana, pineapple, mango, pawpaw
	Other fruit	Date, fig, grape, melon, passionfruit
	Mixtures of two or more groups of fruit	Fruit salad, canned two fruits
	Dried fruit, preserved fruit	Sultana, banana chip, dried peach
	Mixed dishes where fruit is the major component	Glace fruit, toffee apple, fruit crumble
Egg products and dishes	Eggs	Fried egg, poached egg, quail egg
	Dishes where egg is the major ingredient	Scrambled egg, omelette, souffle
	Egg substitutes and dishes	Egg substitute
Meat, poultry and game products and dishes	Muscle meat	Beef, corned beef, lamb, pork, bacon, ham, veal
	Game and other carcase meat	Kangaroo, rabbit, venison
	Poultry and feathered game	Chicken, turkey, duck, quail, emu
	Organ meats and offal products and dishes	Liver, kidney, tongue, brain, black pudding, pate
	Sausages, frankfurters and saveloys	Beef sausage, frankfurt
	Processed meat	Processed delicatessen meats, ham paste, canned corned beef
	Mixed dishes where beef or veal is the major component	Beef curry, veal casserole, hamburger patty, pork and veal meatballs
	Mixed dishes where lamb, pork, bacon, ham is the major component	Lamb meatballs, pork stir-fry, pork sausage
	Mixed dishes where poultry or game is the major component	Chicken curry, rabbit stew, satay chicken
Milk products and dishes	Dairy milk	Milk, goats milk, evaporated milk, powdered milk
	Yoghurt	Yoghurt, yoghurt dip, buttermilk
	Cream	Cream, sour cream, mock cream, sour cream-based dip
	Cheese	Cottage cheese, camembert cheese, cheese fondue
	Frozen milk products	Ice cream, thickshake, frozen yoghurt
	Other dishes where milk or a milk product is the major component	Creme caramel, custard, baked rice custard, cheesecake, mousse
	Milk substitutes	Soy beverages, tofu-based ice confection, soy cheese
	Flavoured milks	Egg flip, milkshake, flavoured milk, smoothie
Soups	Soup	Homemade broth, reconstituted vegetable soup
	Dry soup mix	Tomato soup mix, chicken and noodle instant dry mix
	Canned condensed soup	Condensed minestrone soup
Seed and nut product and dishes	Seed and seed products	Pumpkin seed, sesame seed, tahini
	Nut and nut products	Cashew nuts, peanut butter, coconut cream
Savoury sauces and condiments	Gravies and savoury sauces	Fish stock, gravy, black bean sauce, tomato sauce, white sauce, simmer sauce, commercial pasta sauce
	Pickles, chutneys and relishes	Apple sauce, mustard, mint jelly, olives, pickles
	Salad dressings	Mayonnaise, salad dressing, vinegar
	Stuffings	Commercial stuffing, rice and nut stuffing

Major Food Category	Sub-Major Food Category	Example
Vegetable products and dishes	Potatoes	Cooked potato, canned potato, hot potato chips, mashed potato, potato patty, potato salad
	Cabbage, cauliflower and similar brassica vegetables	Broccoli, cabbage, cauliflower, sauerkraut
	Carrot and similar root vegetables	Beetroot, carrot, parsnip, radish, sweet potato
	Leaf and stalk vegetables	Alfalfa, bean sprout, chives, lettuce, parsley, spinach
	Peas and beans	Green beans, peas, snow peas
	Tomato and tomato products	Raw tomato, sun-dried tomato, tomato paste
	Other fruiting vegetables	Pumpkin, zucchini, avocado, cucumber, eggplant, okra
	Other vegetable and vegetable combinations	Corn, mushrooms, seaweed, garlic, onion, shallot, mixed vegetables, Caesar salad, coleslaw
	Dishes where vegetable is the major component	Cauliflower in cheese sauce, vegetables in Thai sauce, ratatouille, stuffed zucchini
Legumes and pulse products and dishes	Mature legumes and pulses	Kidney beans, chick peas, lentils
	Mature legume and pulse products and dishes	Pappadum, baked beans, tofu, vegetarian sausages
Snack foods	Potato snacks	Potato crisps, potato straw
	Corn snacks	Corn chips, popcorn
	Extruded snacks	Pork rind snack, prawn crackers, cheese flavour extruded snacks
	Pretzels and other snacks	Pretzels, oriental snack mix
Sugar products and dishes	Sugar, honey and syrups	Glace icing, white sugar, fairy floss, honey, golden syrup, chocolate topping
	Jams and lemon spreads, chocolate spreads	Jam, marmalade, lemon butter
	Dishes and products other than confectionery where sugar is the major component	Meringue, sorbet, icing with added fat
Confectionary and health bars	Chocolate and chocolate-based confectionery	Chocolate, chocolate bars, liqueur-filled chocolates, peanut brittle
	Cereal-, fruit-, nut- and seed-bars	Muesli-bar, fruit leather, sesame seed-bar
	Other confectionery	Coconut ice, fudge, licorice, hundreds and thousands, boiled lollies, turkish delight, chewing gum
Miscellaneous	Beverage flavourings	Dry beverage flavourings, cocoa, malted milk powder
	Yeast; yeast, vegetable and meat extracts	Compressed yeast, beef extract, yeast extract spread
	Artificial sweetening agents	Saccharine artificial sweetener, aspartame artificial sweetener tablet
	Herbs, spices, seasonings and stock cubes	Chilli powder, curry paste, mint, pepper, bacon chips
	Chemical-raising agents and cooking ingredients	Baking powder, baking soda, gelatine