Skipping breakfast among Australian children and adolescents; findings from the 2011–12 National Nutrition and Physical Activity Survey

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Abstract

Objective: Skipping breakfast has been linked with poor diet quality, higher BMI and adverse cardiometabolic outcomes. This study aimed to determine the prevalence and correlates of skipping breakfast among Australian children and adolescents.

Methods: A total of 1,592 2–17-year-olds completed two 24-hour recalls, collected via face-to-face and telephone interview, in the 2011–12 National Nutrition and Physical Activity Survey. Breakfast was an eating occasion of ≥210kJ named as 'breakfast' by the participant. Child, household and adult correlates of skipping breakfast were reported. Odds ratios were calculated using ordinal regression. Linear regression was used to examine differences in dietary intake. Survey weights were applied to give nationally representative estimates.

Results: Most (86.8% of boys, 81.4% of girls) ate breakfast on both days, 11.8% of boys and 14.8% girls skipped on one day and 1.4% boys and 3.8% girls skipped on both days. Characteristics associated with skipping breakfast were being female, being older, being underweight or overweight/obese, poorer diet, lower physical activity, inadequate sleep, lower household income, greater socioeconomic disadvantage, and being from a single-parent home.

Conclusion: Skipping breakfast was common among Australian adolescents but few consistently skipped.

Implications for public health: Interventions to increase breakfast should target adolescents, particularly girls, and low SEP households.

Key words: skipping breakfast, children, adolescents, Australia, National Nutrition and Physical Activity Survey, prevalence, correlates

Skipping breakfast may have a negative impact on health. Systematic reviews and a meta-analysis have reported children and adolescents who skip breakfast tend to have poorer diet quality,[1] and higher BMI,[2,3] than breakfast consumers. There is also evidence breakfast skippers may have higher cardiometabolic risk factors.[4-6] Regular breakfast consumption in adolescents has been shown to predict breakfast consumption in young adulthood.[7] Young adults who skipped breakfast in both childhood and adulthood have been shown to have poorer diet quality, higher waist circumference and higher cardiometabolic risk factors than those who ate breakfast at both time points.[8] Establishing regular breakfast habits in children and adolescents may improve long-term health.

Despite the potential health implications, little is known about the prevalence of skipping breakfast in Australian children and adolescents. Data from the 2007 Australian National Children's Nutrition and Physical Activity Survey indicated that 20% of 12–16-year-old boys did not eat breakfast the previous day.[9] Unfortunately, the authors did not report the prevalence of skipping breakfast among girls. Another paper using the 2007 survey data reported 4% of Australian children and adolescents skipped breakfast on both days the 24-hour recalls were collected.[10] However, the prevalence of skipping was not stratified by age and those who skipped on one of the two days were classified as breakfast consumers. Prior to the 2007 survey, the most recent published national Australian data on skipping breakfast were from the 1995 National Nutrition Survey. Skipping breakfast three or more times per week was reported by 7% of 2–11-year-olds and increased to 21% for 12–15-year-olds.[11] Data from the US and Germany suggest the prevalence of skipping breakfast has increased over time.[12,13] However, in the study from the US the increased prevalence may be due to the different methods used to define breakfast over time.

Previous studies in Australia, Europe and the US have shown that skipping breakfast is more common among girls than boys;[1,14-19] older than younger children;[16,20] and those with greater socioeconomic disadvantage.[14,16,18] Skipping breakfast has also been reported to cluster with other unhealthy behaviours including smoking, lower levels of physical activity and poorer diet quality.[1,10,14] It is important to examine whether these factors are associated with skipping breakfast in a contemporary cohort

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Submitted: October 2016; Revision requested: February 2017; Accepted: July 2017
The authors have stated they have no conflict of interest.

Aust NZ J Public Health. 2017; 41:572-8; doi: 10.1111/1753-6405.12715

of Australian children and adolescents so that interventions to reduce breakfast skipping can be better targeted.

Using data from the 2011–12 Australian National Nutrition and Physical Activity Survey (NNPAS), this study aimed to determine the prevalence and correlates of skipping breakfast among Australian children and adolescents. We hypothesised that skipping breakfast would be higher among girls than boys, would increase with age and be associated with socioeconomic disadvantage and poorer diet quality.

Methods

The NNPAS was conducted during May 2011 to June 2012 and is described in detail elsewhere.[21] A stratified multistage area design was used to sample private dwellings in each state and territory of Australia, to ensure a nationally representative sample. Very remote and Indigenous communities were excluded from the sampling frame. At each selected dwelling, the names of all persons living in the household were entered into a computer. One adult (aged 18 years or older) and one child (aged 2–17 years) were randomly selected using a random number generator. If the selected person declined, a replacement person was not chosen.

A computer assisted face-to-face interview was conducted by trained Australian Bureau of Statistics (ABS) staff to collect information on socio-demographics, health and lifestyle factors. For children aged 2–5 years the interviews were completed by an adult; for 6–8-year-olds an adult was interviewed with help from the child; 9–11-year-old children were interviewed directly with assistance from an adult; 12–17-year-olds were interviewed directly, with the adult remaining in the room for those aged 12–14 years. A pilot study found these interview methods worked well. Children aged 8–10 years have been shown to report their food intake as reliably as their parents, but parental input is needed for providing details of the food and amounts consumed.[22]

Diet assessment

Participants completed two 24-hour recalls, reporting all food and beverages consumed from midnight to midnight the previous day. The Automated Multiple-Pass method, developed by the Agricultural Research Service of the United States Department of Agriculture (USDA), has been validated in adults[23] and was adapted with the help from Food Standards Australia New Zealand (FSANZ) to reflect the Australian food supply. The Automated Multiple-Pass Method has been used for children and adolescents in large national surveys including the NHANES study from the USA. Participants reported the time of consumption, name of the eating occasion, a detailed description of the food, and the amount consumed. The first recall was collected during the face-to-face interview. The second recall was collected via telephone at least eight days after the first interview, preferably on a different day of the week. A food model booklet was used to help the participant estimate serving sizes. Interviews were only conducted on Sundays when specifically requested by the participant. The 24-recall data were coded by the ABS using the USDA Dietary Intake Data System. Foods were given an eight-digit food code and classified into food classification groups using the AUSNUT 2011–13 database. Food and beverages were classified into the five core food groups (vegetables, fruit, grains, lean meat and alternatives, dairy) or discretionary choices (not an essential part of the diet[24]) as defined by the Australian Dietary Guidelines[24] and ABS. Mean intake over the two days was calculated. Each item was also coded as a food or beverage.

Breakfast assessment

Participants were classified as breakfast consumers if they defined an eating occasion as 'breakfast' and the energy intake for that eating occasion was at least 210kJ. This cut point was chosen to exclude those who only consumed a very low or no energy food or beverage, for example a cup of tea with milk or a glass of water. If two breakfast meals were consumed within 15 minutes, they were combined and counted as the same meal. Using the criterion of 210kJ and a time interval between meals of at least 15 minutes has been shown to be the most appropriate method for defining an eating occasion.[25] If two eating occasions identified as breakfast were consumed more than 15 minutes apart, the meal with the highest energy intake was used to calculate the percentage of daily energy provided by breakfast.

Child correlates

The state/territory the participant lived in was recorded by the ABS, when the household was selected for the survey. Weight was measured to the nearest 0.1kg using a digital scale and height was measured to the nearest 0.1cm using a stadiometer. Participants were encouraged to remove shoes and heavy clothing. Body mass index (BMI) was calculated (kg/m^2). Weight status (underweight, healthy weight, overweight, obese) was defined using the sex and age specific cut points defined by Cole et al.[26,27]

Physical activity over the previous seven days was compared to the physical activity guidelines, which recommend at least 3 hours/day of physical activity, with no specified intensity level for 2–4-year-olds,[28] and at least 60 minutes/day of moderate to vigorous activity for 5–18-year-olds.[29] For 2–4-year-old children, the amount of time the child spent in active play or physical activity, indoors and outdoors was reported. For 5–17-year-olds, the amount of time spent on active commuting, moderate to vigorous physical activity and organised moderate/vigorous physical activity was reported. The number of days the participant met the physical activity guidelines was calculated (0, 1–2, 3–5, 6–7 days).

Sleep duration for the previous night was calculated from the time the child went to bed and the lights were turned off until the last time they woke up. Sleep duration was divided by the age-specific guidelines from the Millpond Children's sleep clinic[30] to calculate the ratio of actual to adequate sleep. The participant's sleep was classified as adequate (≥0.9), somewhat adequate (≥0.75–<0.9), or very inadequate (<0.75).[30] Sleep data were only available for those 5 years or older (n=1,181).

Household correlates

The adult respondent answered questions relating to the household. Weekly household income from all sources was calculated and reported in deciles and categorised as 0–30 (lowest income), 31–70, 71–100 (highest income). Food insecurity was assessed using the question: 'In the past 12 months was there any time when you (or members of your household) ran out of food and couldn't afford to buy more?' Household types were defined as a couple family with children, one parent family, or other.

The Socioeconomic Indexes for Areas (SEIFA) index of Relative Socioeconomic Disadvantage was used as a measure of social and economic disadvantage for the area where the participant lived (categorised as 0–20 (most disadvantaged), 21–40,

41–60, 61–80, 81–100 (least disadvantaged). Remoteness was defined using the Accessibility/Remoteness Index of Australia (ARIA) classified as major city, inner regional, outer regional, remote, and very remote.

Adult correlates

The adult respondent reported their highest level of education (classified as high school or less, vocational or university), smoking status (current daily, current weekly, ex-smoker or never smoked) and rated their health (excellent, very good, good, fair, poor). Breakfast consumption was defined using the same method as for children and adolescents. The relationship of the child to the adult respondent (e.g. parent, older sibling) was not reported in the dataset.

Statistical analysis

To calculate population estimates for the prevalence of skipping breakfast, weights supplied by the Australian Bureau of Statistics were applied within the survey program of Stata.[31] Confidence intervals were estimated by the program using jack-knife replicate weights that take into account clustering present in area-based samples. In a small number of cases the intervals contained negative lower bounds, and when this occurred the lower boundary was truncated at zero.

To examine the correlates of skipping breakfast, adjacent category logit-link ordinal regression models were used.[32] Point estimates were calculated using person weights and jack-knife replicate weights were used to compute standard errors. The person weights were multiplied by the probability that a participant completed the second recall, with the probability estimated from child age, household type, household income, and the adult data for education, occupation, physical activity and self-rated health. Applying the constraints necessary for an adjacent categories model did not result in significant loss of model fit. When the independent variable was ordinal, *P*-values for trend were obtained by treating the variable as a linear regressor. For non-ordinal variables, *P*-values were calculated using a likelihood ratio test, comparing the log-likelihood of the model with and without that covariate and applying the chi-square distribution.

To examine whether breakfast skippers had a poorer diet than breakfast consumers, the mean number of daily serves from the five core food groups and discretionary choices were calculated. Mean intake of each food group for those who skipped on one or two days was compared to those who ate breakfast on both days using linear regression. The differences in mean energy intake, percentage of total energy from added sugars and discretionary choices were also compared.

Boys and girls were analysed together, because the associations between skipping breakfast and the correlates were in the same direction and no sex interactions were observed. The age group categories (2–3, 4–8, 9–11, 12–13, 14–17 years) were chosen to be consistent with the dietary guidelines. Eighteen-year-olds were not included in this analysis as they were considered adults in the NNPAS. Adjustments were made for age (continuous), sex and socioeconomic position (SEP). These covariates were chosen as previous studies have shown skipping breakfast is higher among girls than boys, increases with age and is higher among those with lower SEP.[16,33,34] The SEIFA index was used as the measure of SEP because it was strongly associated with skipping breakfast in the univariable analysis and there were no missing data. Models for household income, remoteness index, food security, adult education and household type were not adjusted for SEP due to collinearity. For the nutrition analysis additional adjustments were also made for child, household and adult correlates that were found to be associated with skipping in the correlates analysis. Energy intake was also added to the final model for the food group analysis. We do not include energy in the models where the outcomes were percentage of energy from added sugar or discretionary food, as energy intake was used to calculate these variables. Stata SE 13.1 (2014, StataCorp, College Station, TX USA) was used for all analyses.

A sensitivity analysis was conducted to examine whether day of the week was associated with skipping breakfast. Participants were classified into one of three groups, depending on the days that the 24-hour recalls referred to: two weekdays (n=959), one weekday and one weekend day (n=553), or two weekend days (n=80). The percentage of skipping breakfast was compared across the three groups using chi-squared tests.

We also examined whether skipping breakfast was associated with under-reporting of dietary intake (low-energy responders). Low-energy responders were defined using the Goldberg cut-offs[35] and participants were classified into one of three groups based on the number of days that they were classified as low-energy responders (0, 1, 2 days). Chi-squared tests were used to compare the percentage of participants who were skipping breakfast across the three groups. Only those aged 10 years or older (n=770) were included in this sensitivity analysis as the Goldberg cut point is not appropriate for younger children.[36] Chi-squared tests were also used to compare the characteristics of the participants who were included in the analysis with those who were excluded.

Results

Of the 2,718 participants aged 2–17 years who completed the first 24-hour recall, 1,621 (60%) completed the second recall via telephone interview. Twenty-nine participants were excluded from the analysis examining correlates of breakfast skipping because data needed to calculate the weights had not been collected for the adult in the household, leaving 1,592 for the analysis.

Mean energy intake at breakfast was 1,345kJ (SD 827kJ), 18% of average energy intake for that day. Thirty-six children or adolescents (2.2% of breakfast consumers) reported consuming only a beverage for breakfast on one day and five (0.3%) consumed only a beverage on both days.

The percentage of children and adolescents who skipped breakfast on 0, 1 or 2 days, stratified by age and state/territory, are reported in Table 1 for boys and Table 2 for girls. We present the actual numbers from the study sample as well as the weighted percentages, which give national estimates. Most (86.8% boys, 81.4% girls) children and adolescents ate breakfast on both days; 11.8% of boys and 14.8% of girls skipped breakfast on one day; and 1.4% of boys and 3.8% of girls skipped on both days (Tables 1 and 2). The prevalence of skipping breakfast on at least one day increased with age among boys from 5.2% of 2–3-year-olds to 25.6% of 14–17-year-olds (Table 1) and also among girls from 11.1% of 2–3-year-olds to 36% of 14–17-year-olds (Table 2). When examining the prevalence of skipping breakfast (one day or both days) by state/territory, the prevalence ranged from 6% in the Australian Capital Territory to 17% in the Northern Territory among boys, and 8% in the Northern Territory and Tasmania to 24% in Queensland for girls.

Child correlates of skipping breakfast

The correlates of skipping breakfast are reported in Supplemental Table 1. In the adjusted analysis, the odds of skipping breakfast were 48% higher among girls than boys. Skipping breakfast increased with age, with the odds of being in a higher category of skipping breakfast being 4.1 times higher among the adolescents than the younger children. The odds of skipping breakfast were progressively higher with increasing BMI category and also among those who were underweight.

The odds of moving to a higher skipping breakfast category progressively increased as the number of days the child met the physical activity guidelines decreased. Those who did not meet the recommendation on any of the previous seven days were 2.2 times more likely to be in a higher category of skipping breakfast in the unadjusted model. However, this association was attenuated and no longer statistically significant in the adjusted model, mostly due to the adjustment for age. Children who had inadequate sleep were more likely to skip breakfast in the adjusted analysis. However, there were only 29 participants who were classified as having very inadequate sleep and the confidence intervals were wide.

Table 1: Weighted percentage for Australian boys who skip breakfast by age and state.

Characteristic	Sample *N*[b]	Skipped breakfast[a] 0/2 days		Skipped breakfast[a] 1/2 days		Skipped breakfast[a] 2/2 days	
		Sample *n*[b]	Weighted %[c]	Sample *n*[b]	Weighted %[c]	Sample *n*[b]	Weighted %[c]
Overall	824	713	86.8 (83.7, 90.0)	93	11.8 (8.9, 14.7)	18	1.4 (0.5, 2.2)
Age							
2-3 years	139	130	94.8 (90.7, 99.1)	8	4.1 (0.3, 7.8)	1	1.0 (0.0, 3.1)
4-8 years	239	222	92.2 (87.6, 96.8)	16	7.7 (3.1, 12.3)	1	0.1 (0.0, 0.2)
9-11 years	130	114	85.8 (77.2, 94.3)	15	13.9 (5.3, 22.4)	1	0.3 (0.0, 1.1)
12-13 years	103	89	88.2 (78.9, 97.4)	13	11.6 (2.4, 20.9)	1	0.2 (0.0, 0.6)
14-17 years	213	158	74.5 (66.0, 82.9)	41	20.6 (12.4, 28.8)	14	5.0 (1.3, 8.6)
State/Territory							
ACT	84	79	94.0 (88.4, 99.6)	2	1.6 (0.0, 4.0)	3	4.4 (0.0, 9.4)
QLD	116	100	87.8 (81.4, 94.2)	14	11.5 (5.2, 17.7)	2	0.7 (0.0, 2.2)
NSW	141	122	86.6 (80.2, 93.0)	16	11.4 (5.8, 16.9)	3	2.1 (0.0, 4.3)
NT	56	45	83.0 (73.2, 92.9)	9	14.5 (4.6, 24.4)	2	2.5 (0.0, 6.0)
SA	96	81	85.6 (78.4, 92.7)	13	13.6 (6.6, 20.6)	2	0.8 (0.0, 2.0)
TAS	88	73	85.6 (75.7, 95.4)	10	5.3 (1.5, 9.1)	5	9.1 (0.2, 18.1)
VIC	113	97	86.0 (78.8, 93.2)	15	13.4 (6.5, 20.2)	1	0.6 (0.0, 1.8)
WA	130	116	87.8 (81.6, 94.0)	14	12.2 (6.0, 18.4)	0	0.0 (0.0, 0.0)

Abbreviations: ACT Australian Capital Territory; QLD Queensland; NSW New South Wales; NT Northern Territory; SA South Australia; TAS Tasmania; VIC Victoria; WA Western Australia.

a: Participants were classified as breakfast skippers if they did not define an eating occasion as 'breakfast' in the 24-hour recall or the energy intake for the 'breakfast' occasion was <210kJ.

b: Sample n and N are the actual numbers from the study sample.

c: Percentage and confidence intervals are the weighted national percentages for 2-17 year Australian children and adolescents.

Table 2: Weighted percentage for Australian girls who skip breakfast by age and state.

Characteristic	Sample *N*[b]	Skipped breakfast[a] 0/2 days		Skipped breakfast[a] 1/2 days		Skipped breakfast[a] 2/2 days	
		Sample *n*[b]	Weighted %[c]	Sample *n*[b]	Weighted %[c]	Sample *n*[b]	Weighted %[c]
Overall	797	670	81.4 (77.7, 85.2)	104	14.8 (11.4, 18.2)	23	3.8 (1.5, 6.0)
Age							
2-3 years	157	145	88.9 (81.7, 96.1)	11	10.7 (3.5, 18.0)	1	0.3 (0.0, 1.0)
4-8 years	215	195	91.4 (85.9, 96.9)	19	7.3 (2.2, 12.5)	1	1.3 (0.0, 3.9)
9-11 years	133	117	87.3 (78.8, 95.7)	11	7.7 (1.4, 14.0)	5	5.0 (0.0, 10.9)
12-13 years	97	79	76.7 (64.4, 89.0)	15	18.2 (7.2, 29.2)	3	5.1 (0.0, 13.9)
14-17 years	195	134	64.0 (54.5, 73.4)	48	29.2 (19.7, 38.8)	13	6.8 (2.0, 11.6)
State/Territory							
ACT	83	72	83.4 (73.3, 93.6)	10	15.4 (5.2, 25.6)	1	1.1 (0.0, 3.5)
QLD	115	90	76.1 (66.6, 85.7)	21	21.3 (12.1, 30.4)	4	2.6 (0.0, 5.4)
NSW	147	120	78.1 (70.9, 85.4)	22	16.5 (9.5, 23.5)	5	5.4 (0.0, 10.7)
NT	59	51	91.4 (84.1, 98.7)	7	7.3 (0.7, 13.9)	1	1.3 (0.0, 4.0)
SA	89	72	77.9 (65.0, 90.9)	11	14.5 (4.9, 24.0)	6	7.6 (0.1, 15.0)
TAS	85	76	91.7 (85.7, 97.8)	8	7.5 (1.4, 13.6)	1	0.8 (0.0, 2.5)
VIC	94	82	88.3 (81.2, 95.3)	9	8.3 (2.3, 14.3)	3	3.5 (0.0, 7.7)
WA	125	107	84.6 (74.7, 94.4)	16	14.5 (4.4, 24.6)	2	0.9 (0.0, 2.5)

Abbreviations: ACT Australian Capital Territory; QLD Queensland; NSW New South Wales; NT Northern Territory; SA South Australia; TAS Tasmania; VIC Victoria; WA Western Australia.

a: Participants were classified as breakfast skippers if they did not define an eating occasion as 'breakfast' in the 24-hour recall or the energy intake for the 'breakfast' occasion was <210kJ.

b: Sample n and N are the actual numbers from the study sample.

c: Percentage and confidence intervals are the weighted national percentages for 2-17 year Australian children and adolescents.

Household correlates of skipping breakfast

In the adjusted analysis, children and adolescents who were from single-parent homes, lower-income households, more disadvantaged areas and households that reported running out of food in the previous 12 months had greater odds of being in a higher category of skipping breakfast (Supplemental Table 1). The association with food insecurity was not statistically significant, possibly due to the small number in this group (only 15 participants skipped breakfast on at least one day).

Adult correlates

In the unadjusted analyses, the odds of skipping breakfast were higher when the adult in the household skipped breakfast and had poorer self-rated health but the associations were attenuated and no longer statistically significant in the adjusted analysis (Supplemental Table 1). Skipping breakfast was not associated with education level or smoking status of the adult respondent.

Dietary intake

Compared to those who ate breakfast on both days, energy intake was 709kJ lower among those who skipped on one day and 1281kJ lower among those who skipped on both days in the adjusted analysis (Table 3). Those who skipped breakfast on at least one day consumed significantly fewer serves of dairy (skipped one day 0.2 serves lower, skipped both days 0.4 serves lower) in the adjusted analysis than those who ate breakfast on both days. Skippers also had a higher number of serves from discretionary choices (skipped one day 1.1 serves higher, skipped both days 1.3 serves higher) and a higher percentage of energy coming from discretionary choices (skipped one day 5.8 percentage points higher, skipped both days

5.9 percentage points higher), although the associations were only significant for those who skipped on one day.

Sensitivity analysis

The percentage of children and adolescents who ate breakfast on both days was similar among those who completed the 24-hour recall for a weekend day and those who did not. Breakfast was eaten on both days for 87% of those who completed the 24-hour recall for two weekdays, 83% for one weekday and one weekend day; and 83% for two weekend days (*P*=0.227).

Among the 770 participants who were aged 10 years or older, low-energy reporters were more likely to skip breakfast on at least one day. Breakfast was eaten on both days by 84.3% of those who did not under-report (n=573); 65.8% of those who reported a low-energy intake on one day (n=51); and 43.1% who reported low-energy intake on both days (n=146).

When comparing the characteristics of those who were included versus excluded from the analysis, the percentage of participants who reported skipping breakfast in the first 24-hour recall was similar between the two groups (9.4% included, 9.2% excluded, Supplemental Table 2). BMI was also similar between the two groups, however, a higher percentage of those who were excluded from the analysis were missing BMI data. Compared to those included in the analysis, a higher percentage of those excluded were from households that had low income or were missing data for income, or households that ran out of food in the previous 12 months, and were from a single-parent family. The adult respondent for those who were excluded was less likely to report being a current smoker and more likely to report having fair or poor health.

Discussion

In this national sample of Australian children and adolescents, 13.2% of boys and 18.6% of girls skipped breakfast on at least one of the two days. Regular skipping was rare with only 1.4% of boys and 3.8% of girls skipping breakfast on both recall days. The child characteristics associated with skipping breakfast were being female, being older, not having a healthy BMI, having inadequate sleep and poorer diet quality. The household and family correlates of skipping breakfast were lower household income, greater socioeconomic disadvantage, and being from a single parent home.

It is difficult to compare the prevalence of skipping breakfast with other countries due to the different methods used to define breakfast. In our study, breakfast was defined as a meal identified by the participant as breakfast in a 24-hour dietary recall, which had an energy content of at least 210kJ.[25,37] Our results are similar to New Zealand's 2002 National Children's Nutrition Survey, where breakfast was defined using a question that asked how many times in the previous week the child had something to eat or drink before leaving home for school. In that study, 7% of 5–6-year-olds, 13% of 7–10-year-olds and 24% of 11–14-year-olds reported they sometimes or always skipped breakfast the previous week.[16] Our prevalence estimates are also similar to those of the 1999–2006 NHANES studies from the USA, where 20% of 9–13-year-olds and 34% of 14–18-year-olds were classified as breakfast skippers.[38] In that study breakfast was defined, using a 24-hour recall, as any meal named by the participant as 'breakfast'. This definition is similar to that used in the current study but did not include a minimum energy content, so children consuming very low energy breakfasts would be classified as a breakfast eater and the actual prevalence of skipping may be underestimated. In addition, breakfast was only assessed on one day. Our estimates are slightly lower than those for European countries. In the EuropeaN Energy balance Research to prevent excessive weight Gain among Youth (ENERGY) study, 25% of 10–12 year-old children from eight European countries did not eat breakfast the previous day (responded 'no' to the question 'did you eat breakfast yesterday?').[39]

Consistent with previous studies, skipping breakfast was higher among girls than boys. This sex difference has been suggested to be due to higher weight-related concerns among girls than boys.[34] However, in a recent

Table 3: Mean (95%CI) difference in daily energy intake, serves of core and discretionary food groups and percentage energy from sugar and discretionary choices, by breakfast skipping groups.

Nutrition variable	Skipped breakfast 0/2 (n=1,382)	Skipped breakfast 1/2 (n=197)			Skipped breakfast 2/2 (n=41)		
	Mean (95%CI)	Mean difference[a] (95%CI)			Mean difference[a] (95%CI)		
		Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Energy intake (kJ)[b]	7714 (7552, 7875)	-259 (-739, 221)	-761 (-1229, -293)	-710 (-1187, -231)	-713 (-1822, 396)	-1356 (-2281, -431)	-1282 (-2233, -330)
Food group (Mean number of serves)							
Grains	4.4 (4.2, 4.5)	-0.5 (-0.9, -0.1)	-0.7 (-1.2, -0.3)	-0.4 (-0.9, 0.0)	-0.9 (-1.7, -0.1)	-1.2 (-2.1, -0.4)	-0.7 (-1.6, 0.2)
Vegetables[c]	1.8 (1.6, 1.9)	-0.2 (-0.5, 0.1)	-0.4 (-0.7, 0.0)	-0.2 (-0.5, 0.1)	-0.4 (-0.9, 0.1)	-0.6 (-1.1, 0.0)	-0.3 (-0.8, 0.3)
Fruit	1.8 (1.7, 1.9)	-0.4 (-0.6, -0.2)	-0.3 (-0.5, -0.1)	-0.2 (-0.4, 0.0)	-0.7 (-1.3, -0.1)	-0.4 (-1.0, 0.2)	-0.2 (-0.8, 0.4)
Dairy	1.3 (1.2, 1.4)	-0.4 (-0.6, -0.2)	-0.4 (-0.6, -0.1)	-0.2 (-0.4, -0.1)	-0.8 (-1.0, -0.5)	-0.6 (-0.9, -0.4)	-0.4 (-0.7, -0.1)
Meat[d]	1.8 (1.6, 1.9)	0.0 (-0.2, 0.3)	-0.2 (-0.4, 0.1)	-0.1 (-0.3, 0.2)	0.3 (0.0, 0.6)	0.0 (-0.2, 0.3)	0.2 (0.0, 0.5)
Discretionary[e]	7.7 (7.2, 8.1)	1.0 (0.4, 1.7)	0.7 (0.0, 1.3)	1.1 (0.6, 1.6)	1.2 (-1.2, 3.5)	0.5 (-1.6, 2.7)	1.3 (-0.3, 3.0)
Percent of energy (Mean % of daily energy)							
Added sugars	10.6 (10.2, 11.0)	1.8 (0.3, 3.3)	1.1 (-0.4, 2.6)	1.0 (-0.4, 2.5)	3.5 (0.1, 6.9)	2.2 (-1.0, 5.5)	2.2 (-1.0, 5.4)
Discretionary[e]	34.5 (33.4, 35.6)	7.3 (3.6, 10.9)	6.1 (2.3, 9.9)	5.8 (2.1, 9.4)	8.8 (0.3, 17.3)	6.2 (-2.0, 14.3)	5.9 (-1.8, 13.6)

Data have been weighted to obtain nationally representative estimates.

a: Mean difference to those who skipped breakfast 0/2 days, calculated using linear regression. Differences are presented as kJ for energy intake; number of serves for the food group analysis; and percentage points for the percent of energy analysis.

b: Includes dietary fibre.

c: Includes legumes.

d: Includes lean meat and alternatives.

e: Discretionary choices are food and beverages that are not an essential part of the diet. Includes cakes, confectionary, soft drinks etc.

Model 1: unadjusted. Model 2: adjusted for age, sex and socioeconomic status. Model 3: Model 2 plus child BMI, sleep duration, adult breakfast consumption, household type and (food group analysis only) energy intake.

study of 11–18-year-olds from Australia and England, only 4% of adolescents reported that they skipped breakfast for weight control reasons.[34] More common reasons were not having time (43%), not being hungry (24%) and not enjoying breakfast (16%).[34] Whether the reasons for skipping breakfast varied by sex was not reported. An older study of 13-year-old Australian adolescents also found the main reasons for skipping breakfast to be lack of time or not being hungry in the morning.[19] Also consistent with findings of previous studies, skipping breakfast was associated with older age, and not having a healthy BMI.[1,2,14] Age and inadequate sleep were the correlates most strongly associated with skipping breakfast.

Further research is needed to confirm our association between skipping breakfast and inadequate sleep as few participants were classified as having inadequate sleep and the confidence intervals were wide. To our knowledge, no previous studies have examined sleep duration as a correlate of skipping breakfast among children and adolescents. However, less sleep was associated with skipping breakfast in a study of Finnish adults.[14] Children and adolescents who have inadequate sleep may find it harder to get out of bed in time to have breakfast. Inadequate sleep and skipping breakfast may also be indicators of disorganised households or low parental supervision.

Household correlates associated with skipping breakfast were greater socioeconomic disadvantage and being from a single parent home. A review of 24 studies among 6–18-year-olds found the family correlates with the most evidence of an association with skipping breakfast were being from a single-parent home and having a parent who skipped breakfast.[18] In the current study, the adult correlates were not associated with child/adolescent breakfast skipping. We were unable to determine whether the adult respondent from the household was a parent/carer or another adult, as this relationship is not reported in the dataset. Child breakfast behaviours may be more strongly influenced by their primary caregiver than other adults in the household.

Parental modelling has been shown to be an important predictor of eating behaviours among children and adolescents.[14,18,40] In a study of 5,448 16-year-olds from Finland, having a parent who skipped breakfast was found to be the correlate most strongly associated with skipping breakfast.[14] Our finding was similar, with skipping breakfast being higher among children and adolescents from households where the adult respondent was a breakfast skipper. However, the association was attenuated and no longer statistically significant after adjusting for age, sex and SEP. The difference in the study findings may be because children/adolescents breakfast habits are more strongly associated with the breakfast habits of their parents than other adults in the household, lack of power in the current study or cultural differences.

Those who skipped breakfast on at least one of the two days had a poorer diet with fewer serves of dairy and higher intakes of discretionary choices. The strength of the associations was similar for the two skipping breakfast groups but the association was not statistically significant for discretionary choices for those who skipped on both days, probably due to the small number in this group. Breakfast is often a nutritious meal, with common breakfast foods coming from core food groups (grains, dairy, fruit). Children who skip breakfast appear to be making poorer food choices to compensate for missing this meal. Our findings are consistent with a New Zealand study of 5–14-year-olds that reported breakfast skippers had higher intakes of unhealthy snack foods than breakfast consumers.[16] Our results also support findings from an Australian study of 2–18-year-olds that reported those who skipped breakfast on two 24-hour recall days had significantly lower intakes of calcium and higher intakes of total fat than those who ate breakfast on at least one day.[10] The type of foods consumed at breakfast may also impact diet quality, with a 2014 systematic review reporting children and adolescents who regularly ate breakfast cereal had higher milk intake and were more likely to meet their nutrient needs.[41] Children and adolescents in the two breakfast skipping groups had a lower energy intake and were more likely to be overweight or obese than those who ate breakfast on both days, which is consistent with findings from a previous review.[1] Possible explanations for this finding include under reporting and dieting.

This study has a number of limitations. While it is encouraging that very few participants skipped breakfast on both days, the small numbers limit our ability to accurately estimate the national prevalence for this group. Skipping breakfast was defined using two 24-hour recalls, which may not be representative of the child's usual eating pattern. However, the use of two 24-hour recalls gave greater ability to identify those who were occasional skippers than a single 24-hour recall. The dietary and correlate data were self-reported and there is some risk of recall error or reporting socially desirable answers. However, this is true for all nutrition studies. Participants may have reported eating breakfast when they did not, which may result in an underestimation of the prevalence of skipping breakfast. Skipping breakfast was higher among low-energy reporters, which may reflect under-reporting, dieting, or unusually low intake on the day of the recall. While Saturdays were under-represented, the day of the week was not associated with skipping breakfast. There were some differences between those who were included in the analysis and those that were excluded but, reassuringly, the percentage that reported eating breakfast on the first 24-hour recall was similar between the two groups. The other differences were taken into account using weighting. The cross-sectional design is unable to determine the direction of the association.

A major strength of this study was the ability to estimate the prevalence of skipping breakfast among Australian children and adolescents using a nationally representative sample, which allowed us to largely discount the possibility of selection bias. The large sample size was important because skipping was rare. Data were collected using standardised protocols, which minimises measurement error. Both the child and the adult were involved in the 24-hour dietary recall for children, to increase the accuracy of the data.

Conclusion

In this national representative sample of Australian children and adolescents, 13.2% of boys and 18.6% of girls were breakfast skippers. Skipping breakfast increased with age, from 5% of boys and 11% of girls aged 2–3 years to 25% of boys and 36% of girls aged 14–17 years. Most skippers only skipped breakfast on one out of two days, suggesting that few Australian children and adolescents are going without breakfast every day and occasional skipping is more common.

Implications for public health

These findings suggest interventions that aim to increase breakfast consumption among breakfast skippers would be best targeted at adolescents, particularly girls, and low SEP households.

Future research should examine the reasons why children and adolescents skip breakfast in order to develop interventions to increase breakfast consumption among those who skip. School breakfast programs are popular among Australian schools and may be useful for those who miss breakfast due to poverty or lack of time in the morning. However, the limited Australian research suggests that adolescents commonly skip breakfast for other reasons, such as weight control and lack of perceived hunger[19,34] and school breakfast programs may not address these underlying issues.

Acknowledgements

The analysis for this study was funded by an Australian National Heart Foundation Grant in Aid (G12H6431). KJS (APP1072516), LB (APP1034482) and AV (APP1008299) were supported by National Health and Medical Research Council Fellowships. SAM was supported by an Australian Research Council fellowship (FT100100581). SLG was supported by a National Heart Foundation of Australia Fellowship (PH 11H 6047 and FLF 100446).

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Supporting Information

Additional supporting information may be found in the online version of this article:

Supplementary Table 1: Odds ratios for being in a higher category of skipping breakfast for Australian children and adolescents aged 2-17 years, by child and household characteristics.

Supplementary Table 2: Comparison of sociodemographic and lifestyle characteristics between those who were included in the analysis and those who were excluded.