Temporal trends in weight and current weight-related behaviour of Australian Aboriginal school-aged children

The health status of Australian Aboriginal and Torres Strait Islander (hereafter Aboriginal) children is comparatively poorer than for non-Aboriginal Australian children. Such health inequalities may be confounded by social disadvantage. However, Aboriginal adults report higher rates of lifestyle behavioural risk factors associated with chronic diseases including obesity, cardiovascular disease and type 2 diabetes. Given the gap in health status experienced by Aboriginal people, there is a need to focus preventive efforts in childhood, adolescence and early adulthood to minimise risks of chronic diseases later in life. Accordingly, obtaining representative population data on Aboriginal children’s lifestyle behaviour is a priority to understand how best to attenuate chronic disease risk during childhood.

Some evidence suggests that there are no significant differences between school-aged Aboriginal and non-Aboriginal children in the prevalence of overweight and obesity. However, other studies among preschool-aged children show significantly higher rates of overweight and obesity in Aboriginal compared with non-Aboriginal children, suggesting that the new cohort of Aboriginal children entering school may be at higher risk than the current cohort of school-aged children. Evidence of the distribution of weight-related behaviour among Aboriginal children, generated from large representative samples, will help identify priority areas for culturally relevant and appropriate programs.

Our aims were to report temporal trends in weight status of children aged 5–16 years, by Aboriginality, using representative population health monitoring survey data collected in 1997, 2004 and 2010; and to use the 2010 data to examine differences between Aboriginal and non-Aboriginal children’s weight and weight-related behaviour.

Abstract


Design, setting and participants: Cross-sectional population surveys of children aged 5–16 years (n = 18 983) conducted in New South Wales schools in Term 1 of 1997, 2004 and 2010.

Main outcome measures: For trend analysis: body mass index and waist-to-height ratio (WtHr). Analyses of weight-related behaviour from 2010 survey data included indicators of dietary habits, screen time (ST) and physical activity.

Results: Between 1997 and 2010, the relative increase in prevalence of overweight/obesity and WtHr > 0.5 was 22.4% and 113.6%, respectively, among Aboriginal children, and 11.8% and 3.4%, respectively, among non-Aboriginal children. In 2010, Aboriginal children had 1.52 (95% CI, 1.03–2.24) greater odds of having a WtHr > 0.5 than non-Aboriginal children. Compared with non-Aboriginal children, Aboriginal children also had significantly lower odds of eating breakfast daily (adjusted odds ratio [AOR], 0.72; 95% CI, 0.52–0.99) and significantly greater odds of drinking > 1 cup of soft drink daily (AOR, 1.61; 95% CI, 1.13–2.29), having a television in their bedroom (AOR, 2.75; 95% CI, 2.04–3.70), having no ST rules (AOR, 1.34; 95% CI, 1.04–1.73) and exceeding ST recommendations on weekdays (AOR, 1.78; 95% CI, 1.32–2.39).

Conclusions: Overweight/obesity and WtHr have increased more rapidly in overweight/obesity and WtHr > 0.5 was 22.4% and 113.6%, respectively, among Aboriginal than non-Aboriginal children in NSW. Unhealthy weight-related behaviour was frequent among all children, but lack of daily breakfast, excessive ST and soft drink consumption appear particularly problematic among Aboriginal children. Raising awareness with families of the consequences of excessive ST and encouraging strategies to limit ST (such as rethinking placement of televisions in children’s bedrooms and implementing ST rules) hold promise.

Methods

This study involved secondary analysis of the New South Wales Schools Physical Activity and Nutrition Survey (SPANS), a representative cross-sectional population surveillance survey of children’s weight and weight-related behaviour conducted in 1997 (n = 5518), 2004 (n = 5407) and 2010 (n = 8058). For each survey, schools in NSW were selected at random so that the number of schools selected in each education sector (government, Catholic and independent) was proportional to the number of students enrolled in that sector. The likelihood of a school being selected was proportional to the size of student enrolment. In each school, one class was chosen at random from each of the grades being surveyed. Detailed descriptions of each survey’s methodology have been published elsewhere. Briefly, data were collected in Term 1 (February–April) by teams of trained field staff using standardised protocols for survey consistency. As questions on weight-related behaviour have changed across surveys, only findings from 2010 data are presented here for that analysis.

Informed consent from each child’s parent or carer was a requirement for participation. Ethics approval for the study was granted by the University of Sydney Human Research Ethics Committee, the NSW Department of Education and Training and the NSW Catholic Education Commission. The Aboriginal Health and Medical Research Council Ethics Committee approved this publication.

Measures

On each survey, demographic details included the child’s sex, date of birth, postcode of residence and Aboriginality. Postcode of residence was used as a proxy for socioeconomic status (SES), based on the Australian Bureau of Statistics Index of Relative Socio-Economic Disadvantage, and
was used to rank children in tertiles of SES. Aboriginality was determined by asking “Are you of Aboriginal and/or Torres Strait Islander origin?” (responses: Yes, No, Don’t know). Anthropometry was measured and included height (m), weight (kg) and waist circumference (cm). Body mass index (BMI; kg/m²) was calculated, and each student’s BMI status was categorised as overweight/obese or not overweight/obese using the International Obesity Task Force age–sex-adjusted cut-points.10 Waist-to-height ratio (WtHr), an index of cardiometabolic disease risk, was calculated and categorised as < 0.5 or ≥ 0.5.11

**Weight-related behaviour**

In 2010, parents of Grade K, 2 and 4 children were sent a questionnaire to complete about their child’s weight-related behaviour, and Grade 6, 8 and 10 children self-completed the same questionnaire at school.

Indicators of dietary quality and habits came from the validated NSW Child Health Survey, which was developed for population-based monitoring,12,13 and included frequency of consumption of energy-dense, nutrient-poor (EDNP) foods, specifically fried potato products, salty snack products, other snack products, ice-cream or iceblocks, and fast food. The response categories were: never/rarely, 1–2 times/week, 3–4 times/week, 5–6 times/week, daily, and two or more times/day. As reporting on the frequency of eating individual EDNP foods may obscure the true extent of overall EDNP food consumption among children, a combined summary score was generated from the consumption frequency of each item. The cut-point for high EDNP food consumption was based on the distribution of the data, which showed that more than 50% of children consumed one or more items three or more times a week. Soft drinks (including cordial and sports drinks) and fruit juice were also assessed (same response categories) and were examined separately as single variables. Additional diet-related questions included frequency of eating breakfast, frequency of eating dinner in front of the television, and how often good behaviour was rewarded with sweets.

Questions on children’s physical activity came from the NSW Population Child Health Survey (for Grades K/2/4/14 and the Adolescent Physical Activity Recall Questionnaire (for Grades 6/8/10).15 Responses were used to determine whether children met the physical activity recommendation of ≥ 60 min/day.16 Cardiorespiratory endurance (ie, fitness) was assessed among children in Grades 4, 6, 8 and 10, using the 20-metre shuttle run test,17 and children were categorised as “adequately fit” or “unfit” according to published age–sex–adjusted reference cut-points.18 Information on recreational screen time (ST) (ie, watching television or DVDs, using a computer for fun, playing electronic games) was assessed using the Adolescent Sedentary Activity Questionnaire19 and used to determine whether children met the ST recommendation of < 2 h/day.18 Respondents also reported if there was a television in the child’s bedroom and whether there were rules about ST.

### Results

Survey response rates for 1997, 2004 and 2010 were 87%, 65% and 57%, respectively. Students were aged 5–16 years. The characteristics of the sample by Aboriginality and survey year are given in the Appendix (online at mja. com.au). About 2%–3% of the sample in each survey year identified as Aboriginal and were more likely to live in rural and low-SES areas than their non-Aboriginal peers.

### Statistical analysis

Data were analysed in April 2013 using SPSS Complex Samples, version 21 for Windows (IBM), to account for the cluster design of the study and adjust for the standard errors and 95% confidence intervals. Statistical significance was accepted at *P* < 0.05. For the analyses, students were stratified by Aboriginal status as Aboriginal or non-Aboriginal (which included a few who answered “Don’t know”). Within SPSS Complex Samples, χ² tests and tests of independence were used to assess the differences in children’s sociodemographic characteristics according to Aboriginality. Logistic regression was used to assess the differences in the proportion of children who were overweight/obese and had WtHr ≥ 0.5 across surveys (1997, 2004 and 2010), stratified by Aboriginality and sex, controlling for SES and grade. Differences in weight-related behaviour reported in the 2010 survey between Aboriginal and non-Aboriginal children were assessed using logistic regression, controlling for sex, grade and SES.

### Temporal trends across 1997, 2004 and 2010 surveys in the prevalence of overweight/obesity and waist-to-height ratio ≥ 0.5 in New South Wales children aged 5–16 years, by Aboriginality*

<table>
<thead>
<tr>
<th></th>
<th>Aboriginal</th>
<th>Non-Aboriginal</th>
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</thead>
<tbody>
<tr>
<td>Boys (n)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overweight/obese</td>
<td>20.3%</td>
<td>26.2%</td>
</tr>
<tr>
<td>Girls (n)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overweight/obese</td>
<td>27.7%</td>
<td>24.2%</td>
</tr>
<tr>
<td>All (n)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overweight/obese</td>
<td>23.7%</td>
<td>25.2%</td>
</tr>
<tr>
<td>Waist-to-height ratio ≥ 0.5</td>
<td>8.8%</td>
<td>13.0%</td>
</tr>
</tbody>
</table>

* Adjusted for socioeconomic status and grade.
Overall, between 1997 and 2010, the relative increase in the prevalence of overweight/obesity and WtHr \( \geq 0.5 \) was 22.4% and 113.6%, respectively, among Aboriginal children, and 11.8% and 3.4%, respectively, among non-Aboriginal children. Trends in the prevalence of overweight/obesity and WtHr \( \geq 0.5 \) differed according to Aboriginality and sex, after controlling for SES and grade (Box 1). The increase in prevalence of overweight/obesity over time was only statistically significant among non-Aboriginal boys (\( P = 0.003 \)). There was a non-significant increase in the prevalence of overweight/obesity in Aboriginal boys (\( P = 0.56 \)) and girls (\( P = 0.55 \)). The prevalence of WtHr \( \geq 0.5 \) increased overall, but this was only significant for non-Aboriginal children.

Among Aboriginal children, the average annual increase in overweight/obesity between 1997 and 2004 was 0.21 percentage points, and between 2004 and 2010 was 0.63 percentage points. For WtHr \( \geq 0.5 \), the average annual increases were 0.60 and 0.97 percentage points, respectively. For non-Aboriginal children, overweight/obesity increased 0.44 percentage points annually between 1997 and 2004, but decreased 0.12 percentage points annually between 2004 and 2010. Conversely, WtHr \( \geq 0.5 \) decreased 0.76 percentage points annually between 1997 and 2004 and increased 0.95 percentage points annually between 2004 and 2010.

In the 2010 survey, there were 254 Aboriginal children (109 in Grades K/2/4; 145 in Grades 6/8/10) and 7417 non-Aboriginal children (3568 in Grades K/2/4; 3849 in Grades 6/8/10). Box 2 shows the prevalence and unadjusted and adjusted odds ratios (AORs) of weight and weight-related behaviour, by Aboriginality, after controlling for sex, grade and SES. Aboriginal children had 1.52 (95% CI, 1.03–2.24) greater odds of having a WtHr \( \geq 0.5 \) than non-Aboriginal children. Compared with non-Aboriginal children, Aboriginal children had significantly lower odds of eating breakfast daily (AOR, 0.72; 95% CI, 0.52–0.99) and significantly greater odds of drinking \( \geq 1 \) cup of soft drink daily (AOR, 1.61; 95% CI, 1.13–2.29), having a television in their bedroom (AOR, 2.75; 95% CI, 2.04–3.70), having no ST rules (AOR, 1.34; 95% CI, 1.04–1.73) and exceeding ST recommendations on weekdays (AOR, 1.78; 95% CI, 1.32–2.39). There were no significant differences between Aboriginal and non-Aboriginal children’s physical activity measures, including daily activity, adequate fitness and competency in fundamental movement skills.

**Discussion**

This is the first large, representative study to report on temporal trends in
overweight/obesity and WHtR ≥ 0.5 (an index of cardiometabolic disease risk) among Aboriginal children in NSW. While the increases in prevalence were statistically significant only for non-Aboriginal children, a clear increase in both weight measures across time was also observed in Aboriginal children, and the lack of statistical significance needs to be considered in the context of the small sample of Aboriginal children.

The strengths of our study include the large representative sample of school-aged children and, for weight status, comparability across survey years. Aboriginal children comprised 2%–3% of each survey sample, which approximates the population prevalence of about 5% of 5–15-year-olds in NSW. However, the small sample size of Aboriginal children was a limitation, which potentially underpowered our analyses and prevented stratifying the data by individual BMI categories and by sex. Additionally, while the questionnaires were validated, a further limitation was the use of self-report to characterise children’s weight-related behaviour.

Despite these limitations, our finding that almost one in three NSW Aboriginal children (29.0%) aged 5–16 years in 2010 was overweight/obese is comparable to the prevalence for Aboriginal children of a similar age in a national study conducted in 2006. Nearly one in five (18.6%) had WHtR ≥ 0.5 which, compared with non-Aboriginal children, equated to 52% higher odds of central adiposity, which is associated with cardiometabolic ill health. In Aboriginal children, waist circumference has been strongly associated with the metabolic syndrome, but the WHtR is considered a potentially superior indicator of cardiovascular risk clustering in young people and may be a more appropriate index of adiposity in Aboriginal children. However, the body habitus of Aboriginal children, where the limb-to-trunk ratio differs from non-Aboriginal children, may influence the 0.5 cut-point. Further research is required to ascertain the sensitivity of this cut-point in Aboriginal children. Given there is strong evidence that childhood obesity leads to adult obesity and related comorbidities, and behaviour including sedentari ness and physical activity track into adulthood, child obesity prevention programs must be prioritised.

Overall, there were no differences between Aboriginal and non-Aboriginal children in physical activity measures, with less than half of all Grade K/2 children and two-thirds of Grade 6/8/10 children meeting daily physical activity recommendations. Few children were competent in fundamental movement skills and a third were deemed unfit. Parental modelling and support are important influences, but schools are a key setting for promoting children’s physical activity through the health and physical education (HPE) and school sport programs. While NSW primary schools have programs that promote healthy eating and physical activity (eg, Live Life Well @ School), a significant policy gap in Australia is the lack of specialised teachers to deliver HPE in primary schools, disadvantaging all children.

We found some similarities in children’s dietary patterns independent of Aboriginality, including the overconsumption of EDNP food, parental rewarding of good behaviour with sweets, and low vegetable intake. Interestingly, the dietary differences according to Aboriginality in our study are congruent with those from a study based on 24-hour recalls of food intake. Around a quarter of children in our study reported not eating breakfast daily, but this was more prevalent among Aboriginal children, who were also more likely to drink soft drink every day than their non-Aboriginal peers. The adjusted model showed that SES and rurality were confounders of daily breakfast and soft drink consumption, and our sample showed that the Aboriginal children were significantly more likely to be from rural and lower SES areas. Although breakfast programs are run in some NSW schools, our findings indicate that many children are not eating breakfast daily, which suggests these programs may not have the necessary reach into disadvantaged groups, including Aboriginal communities.

Soft drinks are associated with a range of morbidities including obesity, diabetes and dental caries. Both the school and home environments provide key opportunities for children to access soft drinks. A public education campaign would need to target these two environments, aimed at increasing parental awareness of the need to reduce soft drink availability in the home and to encourage schools to implement mandatory policies banning the sale of sugar-sweetened beverages. Reintroducing campaigns promoting water as the drink of first choice would also be of benefit, as these have been shown to be effective at increasing awareness of water-related nutrition and reducing consumption of soft drinks among children. Ensuring culturally appropriate school programs, such as Thumbs Up! (run under the auspices of the Jimmy Little Foundation), is one strategy to encourage young Aboriginal Australians to make better and healthier food choices.

The main difference in weight-related behaviour according to Aboriginality that we found was in ST. Over half of Aboriginal children had a television in their bedroom, a third had no ST rules, and almost two-thirds exceeded the daily ST recommendation on weekdays. While televisions are ubiquitous in most homes, research shows that high ST and televisions in the bedroom are associated with a range of adverse health outcomes including poor diet quality, lower prevalence of regular family meals, sleep disturbances and overweight and obesity. General community awareness of the negative aspects of ST is low, and given the higher weekday ST among Aboriginal children, alternative active after-school entertainment options, such as the Active After-School Communities Program, may hold promise in Aboriginal communities. However, such programs must be culturally relevant and engaging.

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