RESEARCH
Original Research

Trends in Dietary Sodium from Food Sources in Australian Children and Adolescents from 2007 to 2011/12

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ABSTRACT

Background In western countries, most children eat more sodium than is recommended. In Australia in 2009, voluntary sodium reformulation targets were adopted for nine categories of processed foods, but the impact of this initiative on children's sodium intake has not been assessed.

Objective To compare sodium consumption of Australian children aged 2 to 16 years from 2007 to 2011/12.

Design Cross-sectional analysis of data from the 2007 Children's Nutrition and Physical Activity Survey (n=4,487) and the 2011/12 National Nutrition and Physical Activity Survey (n=2,548).

Participants/setting A nationally representative sample of 6,705 Australian children aged 2 to 16 years who provided plausible 24-hour dietary recall data according to Goldberg cutoffs for misreporting of energy intake.

Main outcome measures Mean intakes of energy, sodium, and sodium density (mg/1,000 kcal) were assessed via one 24-hour dietary recall; measurement error models with up to two 24-hour dietary recalls were used to estimate usual sodium intake and the proportion of children exceeding the age-specific upper level for sodium.

Statistical analyses preformed Statistical analysis incorporated survey weights and accounted for the complex survey design. Two-sample *t*-tests and two-sample test of proportions were used to assess differences in continuous and categorical variables between survey years.

Results Dietary sodium declined by 8% between 2007 and 2011/12 (−188±SE 31 mg/day; $P<0.001$), and this was in conjunction with a 5% reduction in energy intake (98±19 kcal/day; $P<0.001$). When stratified by age group, significant reductions in sodium intake remained across all four age groups (ie, 2-3 years, 4-8 years, 9-13 years, and 14-16 years); similarly, with the exception of 2- to 3-year-old children, reductions in energy intake were observed across all other age groups. Overall sodium density declined by 2% (−29 mg/1,000 kcal/day; $P=0.01$); however, in age subgroup analysis the decline in sodium density only remained among children aged 2 to 3 years. The upper level for sodium was exceeded by 94% or more children in 2007 and 78% or more in 2011/2012.

Conclusion Although results suggest a small reduction in reported sodium intake over 5 years, most children in 2011/12 had a sodium intake that exceeded the recommended upper level. Ongoing efforts to reduce sodium in the diets of Australian children are required.
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THE FIRST NATIONAL ESTIMATES OF SODIUM INTAKE among Australian children and adolescents come from the 2007 Children's Nutrition and Physical Activity Survey (CNPAS).[1] Findings from this survey suggested that Australian children aged 2 to 16 years were consuming more sodium than recommended for good health.[1,2] Sodium is an important regulator of blood pressure during childhood, with higher intakes associated with raised blood pressure[3,4] and reduced intakes shown to lower blood pressure.[5] The

effects of sodium on blood pressure during early life are important. This is because blood pressure follows a tracking pattern over the life course,[6,7] and childhood blood pressure predicts subclinical cardiovascular damage in adulthood.[8,9] Other concerns of excess dietary sodium during childhood include greater consumption of sugar-sweetened beverages,[10,11] because higher sodium intakes may trigger a thirst response, which in turn may promote overconsumption of these readily available beverages[12] and increased likelihood of being overweight or obese.[13,14] The mechanism linking sodium intake to adiposity is unclear, but some possible explanations include greater palatability of food and resultant higher-energy intakes or altered fat metabolism.[15] Finally, early exposure to sodium-rich foods may promote the development of taste preferences that favor salty foods.[16] As such, reducing sodium intake among children is an important public health initiative that can contribute to alleviating the future burden of cardiovascular disease.[17]

Because processed foods are estimated to be the major contributor (~70%) to sodium intake,[18] product reformulation to lower sodium in foods is considered an integral strategy to reduce population sodium intake.[19] In Australia in 2009, the Government-led Food and Health Dialogue (FHD) was formed to coordinate work with the food industry to voluntarily reduce sodium levels in selected Australian food products. During the working period of the FHD, the group set voluntary sodium content targets for nine processed food categories, these included bread, breakfast cereal, simmer sauces, processed meats, soups, savory pies, potato/corn/extruded snacks, savory crackers, and cheese.[20,21] These food categories were targeted because of their significant contribution of risk-associated nutrients to the Australian diet. Targets were developed during roundtable discussions with the food industry and the health sector, with consideration to what was realistic and achievable to adhere to safety and quality standards (Table 1, available at www.jandonline.org).[20] In 2015, the FHD was replaced with the Healthy Food Partnership,[21] and although the group has developed a work plan related to reformulation strategies, at the beginning of 2018 no actual targets for sodium reformulation had been set.[22] The potential for FHD targets to decrease sodium levels in Australian packaged foods was demonstrated by Trevena et al,[23] who reported a significant average reduction in the sodium content of bread (9% reduction), breakfast cereals (25% reduction), and processed meats (18% reduction) found in Australian supermarkets between 2010 and 2013.[23] These reported changes within the food supply are encouraging; however, such analyses do not consider consumption patterns, and whether reformulation initiatives have contributed to reducing sodium intake among Australian children is unclear. The release of dietary data collected during the 2011/12 National Nutrition and Physical Activity Survey (NNPAS)[24] provides an opportunity to examine whether sodium intake has changed since the introduction of voluntary FHD sodium reduction targets by making comparisons to the previously collected 2007 national data (ie, CNPAS). Monitoring sodium intake with nationally representative data is important to inform policy related to sodium reduction initiatives.

Hence, the overall aim of this study was to assess trends in sodium intake from food sources among Australian children and adolescents from 2007 to 2011/12. Specifically, between the two time points this study sought to assess differences in i) sodium intake, ii) sodium density, iii) energy intake, iv) the proportion of children exceeding the daily recommended upper level for sodium intake, and v) the amount of sodium from food groups, including "core" and "discretionary" foods, across each survey year.

RESEARCH SNAPSHOT

Research Question: Are Australian children eating less sodium since the 2009 implementation of voluntary sodium reformulation targets on selected Australian food products?

Key Findings: Analysis of cross-sectional data collected in national nutrition surveys completed in 2007 and 2011/12 suggested that among Australian children aged 2 to 16 years a small significant decline in sodium intake of −188 mg/day (8% reduction) occurred; this was coupled with a similar significant reduction in energy intake of 5%. When accounting for the effects of energy, a small significant reduction of 2% (−29 mg/1,000 kcal/day) was found in the sodium density of the diet. Overall, fewer children (78% to 96%) exceeded the age-specific upper level for sodium intake in 2011/12 compared with 2007 (94% to 99%).

METHODS

Participants and Study Design

Data for this study come from the two most recent national nutrition surveys conducted in Australian children: i) the 2007 Children's Nutrition and Physical Activity Survey (2007 CNPAS), and ii) the 2011/12 National Nutrition and Physical Activity Survey (2011/12 NNPAS). Both were cross-sectional surveys designed to capture information related to dietary intake and physical activity in nationally representative samples of children. Survey sampling features are summarized below, and detailed methodology for each survey can be found elsewhere, in the 2007 CNPAS[25] and 2011/12 NNPAS.[26]

2007 CNPAS

The 2007 CNPAS was conducted by the Commonwealth Scientific Industrial Research Organisation and the University of South Australia. Data were collected at two time points, between February and August 2007. The first consisted of a face-to-face computer-assisted personal interview (CAPI) completed in the home of the study participant. During the CAPI, participants completed a 24-hour dietary recall and provided information on demography and anthropometric measures. This was followed (7 to 21 days after the CAPI) by a computer-assisted telephone interview (CATI) during which a second 24-hour dietary recall was completed. Children aged 2 to 16 years were randomly selected for participation using a multistage quota sampling framework. Postcodes were used as the primary sampling unit and were randomly selected as stratified by state/territory and capital city/rest of state. Within selected postcodes, random digit dialing was used to invite eligible households (ie, those with children aged 2 to 16 years) to participate in the study. Participation was restricted to one child per household. The original target quota for each of the age groups 2 to 3, 4 to 8, 9 to 13, and 14 to 16 years was 1,000 participants. During the development of the sampling strategy,