



Vegetable and fruit intake in Australian adolescents: Trends over time and perceptions of consumption



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ABSTRACT

The consumption of vegetables and fruit during adolescence is crucial to ensuring adequate intake of the nutrients required to meet the rapid growth that characterises this developmental period. However, significant reductions in vegetable and fruit intake during adolescence have been observed making the promotion of consumption an important health promotion challenge. To monitor progress in this population segment toward meeting recommended intake levels and identifying at-risk groups, the present study assessed changes in Australian adolescents' vegetable and fruit consumption over time and identified the demographic factors associated with meeting recommendations. As individuals who are aware of their diet deficiencies are likely to be more receptive to healthy eating interventions, the present study also assessed adolescents' perceptions of the adequacy of their vegetable and fruit intake and identified the demographic factors associated with correctly perceiving fruit and vegetable intake to be inadequate. Two cross-sectional samples of Western Australian secondary school students aged 12–17 years were surveyed in 2009–2010 ($n = 1501$) and 2012–2013 ($n = 1406$). Only 14% of students at Wave 1 and 13% at Wave 2 met the recommended guidelines for vegetable intake while 68% and 71% met the guidelines for fruit intake. Females had significantly greater odds of failing to meet guidelines for vegetable intake than males. Only 50% of students correctly identified their vegetable and fruit intake to be inadequate. The observed very low levels of compliance with vegetable intake recommendations suggest that addressing deficiencies in vegetable consumption should be a primary focus of future nutrition interventions. Efforts should also be made to increase adolescents' perceptions of the inadequacy of their intake to optimise the effectiveness of schemes designed to improve vegetable and fruit consumption in this population segment.

1. Introduction

Adolescence is a developmental period characterised by the need for high levels of nutrients to meet rapid growth (Vereecken et al., 2015). The consumption of vegetables and fruit is crucial to ensuring adequate intake of these required nutrients (Boeing et al., 2012), while also providing benefits to long-term health by significantly reducing the risk for a variety of chronic diseases including hypertension, stroke, coronary heart disease, and cancer (Boeing et al., 2012; He, Nowson, & MacGregor, 2006; He, Nowson, Lucas, & MacGregor, 2007). Given the health risks associated with inadequate vegetable and fruit intake and the health benefits associated with increased vegetable and fruit intake, promoting a healthy diet has been identified as a global health priority (World Health Organization, 2013). However, despite the

implementation in many countries of mass media campaigns promoting vegetable and fruit consumption (e.g., Australia's "Go for 2&5", the US and UK's "5 a day"), intake levels continue to fall well below recommended targets (Micha et al., 2015; Parks et al., 2018), particularly in adolescents. For example in the UK, only 7.9% of 11–18 year olds consume the recommended 5 portions of vegetables and fruit per day (Public Health England, 2018). In US 14–18 year olds, just 2.1% consume the recommended 2–3 portions of vegetables per day and 8.5% the recommended 1.5–2 portions of fruit (Moore, Thompson, & Demissie, 2017). In Australian 12–18 year olds, 2.6% consume the recommended 5 portions of vegetables per day and 59.4% the recommended 2 portions of fruit (Australian Bureau of Statistics, 2015).

Adolescence appears to be a particularly critical time for changes in vegetable and fruit consumption (Keast, Fulgoni, Nicklas, & O'Neil,

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2013; Vereecken et al., 2015), with significant reductions in vegetable and fruit intake observed (Albani, Butler, Traill, & Kennedy, 2017; Herrick, Rossen, Nielsen, Branum, & Ogden, 2015). This decrease has been attributed to a number of factors including the greater influence adolescents exert over their food choices (Albani et al., 2017) and the increase in independence and busy lifestyles seen during this development phase that leads to greater reliance on convenience food (Vereecken et al., 2015). The decline in vegetable and fruit consumption seen during adolescence has also been attributed to reductions in environmental support for healthy eating (Albani et al., 2017). In particular, the transition from primary to secondary school has been associated with significant reductions in both vegetable and fruit intake and the deterioration of children's diet generally (Marks, Barnett, & Allender, 2015). Research conducted in Australia suggests that compared to primary school environments, secondary school environments are perceived as being less conducive to promoting healthy eating, with fewer healthy eating policies and lower levels of awareness and compliance with these policies (Marks et al., 2015).

In addition to social and physical environmental influences, researchers have identified the importance of psychosocial factors on adolescent eating behaviours (Story, Neumark-Sztainer, & French, 2002). These factors include taste preferences, perceived self-efficacy for healthy eating, attitudes towards healthy eating, and knowledge about healthy eating (Rasmussen et al., 2006; Story et al., 2002). Of interest to the present study is adolescents' perceptions of their dietary habits, more specifically, the extent to which they perceive their vegetable and fruit intake to be adequate or inadequate. Evidence from previous research conducted in adults suggests that a main barrier to increasing consumption of vegetables and fruit is the perception that current intake is adequate (Pollard, Miller, Woodman, Meng, & Binns, 2009). It follows that efforts to increase vegetable and fruit consumption in adolescents will likely be hampered if those adolescents who are not meeting recommended guidelines incorrectly perceive their intake to be adequate. Conversely, efforts are likely to prove more effective if directed at adolescents who are not meeting recommended guidelines but correctly perceive their intake to be inadequate. This makes the identification of adolescents falling into these categories important to health promotion efforts.

1.1. Present study

The promotion of vegetable and fruit consumption during adolescence is an important health promotion challenge (Carfora, Caso, & Conner, 2016). Surveillance of trends in adolescent vegetable and fruit consumption via large scale, population-representative surveys is crucial to monitoring progress in this population segment toward meeting recommended intake levels, identifying at-risk groups, and informing public health policy and practice via the development of appropriate and effective interventions. Accordingly, the present study aimed to (i) assess changes in Australian adolescents' vegetable and fruit consumption over time and (ii) identify the demographic factors associated with inadequate intake. As individuals who are aware of their diet deficiencies are likely to be more receptive to healthy eating interventions (Ma, Betts, Horacek, Georgiou, & White, 2003; Pollard et al., 2009), the present study also sought to (i) assess adolescents' perceptions of the adequacy of their vegetable and fruit intake and (ii) identify the demographic factors associated with correctly perceiving vegetable and fruit intake to be inadequate.

2. Method

2.1. Design and procedure

Data were obtained from the Western Australian component of the *National Secondary Students' Diet and Activity (NaSSDA) survey* conducted in 2009–2010 (Wave 1; $n = 1501$) and 2012–2013 (Wave 2;

$n = 1406$). At both waves, a representative cross-sectional sample of Western Australian secondary school students from Years 8–11 (aged 12–17 years) completed a web-based self-report questionnaire in their regular class groups. A stratified two-stage probability design was employed, with schools (government, Catholic and independent) proportionally randomly selected at the first stage of sampling and classes selected within schools at the second stage. Detailed information regarding the methodological procedures of the NaSSDA survey can be found in Morley et al. (2012) and Scully et al. (2017).

2.2. Measures

2.2.1. Vegetable and fruit consumption

Students answered items pertaining to their usual daily vegetable (*How many serves of vegetables do you usually eat each day?*) and fruit (*How many serves of fruit do you usually eat each day?*) intake. A serve of vegetables was defined as half a cup of cooked vegetables or one cup of salad vegetables, while a serve of fruit was specified as one medium piece or two small pieces of fruit, or one cup of diced fruit. Images of serving sizes for each were also shown. Responses were recorded on a scale of 1 (*I don't eat vegetables/fruit*) to 8 (*6 serves or more*). To ensure item means adequately reflected intake, responses were subsequently converted into daily equivalent frequencies (e.g., *I don't eat vegetables/fruit* = 0, *Less than one serve* = 0.5, *1 serve* = 1, and so on).

In Australia it is recommended that children aged 12–18 years consume at least 5 servings of vegetables and 2 servings of fruit per day (National Health and Medical Research Council, 2013). For analysis purposes, responses to each item were collapsed into two categories to identify those students meeting recommended guidelines for vegetable and fruit intake (0 = did not meet guidelines; 1 = met guidelines).

2.2.2. Perceptions of adequacy of intake

Using a 5-point scale (1 = *strongly disagree* to 5 = *strongly agree*), students were asked to indicate the extent to which they agreed with the statements *I should eat more vegetables* and *I eat enough fruit*. Responses to the latter statement were reverse-coded. For analysis purposes, responses were collapsed into two categories (1 = does not believe intake to be inadequate (i.e., responded *strongly disagree*, *disagree*, or *neither agree nor disagree*), 2 = believes intake to be inadequate (i.e., responded *agree* or *strongly agree*)).

2.2.3. Demographics

Students reported their sex, age, school year level, and residential postcode (used to calculate socio-economic position (SEP) as per the Australian Bureau of Statistics' Socio-Economic Indexes for Areas classification (Australian Bureau of Statistics, 2011)). Remoteness of living location (i.e., metropolitan or regional/remote) was determined using the Australian Statistical Geography Standard (ASGS) (Australian Bureau of Statistics, 2013).

2.3. Statistical analyses

Data were weighted by education sector, school year level, and sex to ensure comparability to the population of secondary school students in Western Australia (Australian Bureau of Statistics, 2010, 2014). Descriptive analyses were conducted to assess students' compliance with recommended guidelines for vegetable and fruit intake at each wave, overall and by sex. Pearson's chi-square analyses were conducted in SPSS 25 to assess for changes in intake across study waves where data were categorical in nature (i.e., whether students met or did not meet the recommended guidelines for vegetable and fruit intake at W1 and W2), while independent samples *t*-tests were conducted for continuous data (i.e., mean number of servings of vegetable and fruit consumed per day at W1 and W2). Binary logistic regression (categorical data) and multiple linear regression (continuous data) analyses were conducted on the most recent wave data (i.e., 2012–13) in MPlus 8

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