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Parental influences on adolescent fruit consumption: the role of adolescent self-efficacy

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Abstract
The aims of this study were to examine whether adolescent self-efficacy mediates the associations between parental strictness regarding food, perceptions, and barriers to buying fruits and vegetables, and adolescent fruit consumption using a theoretically derived explanatory model. Data were drawn from a community-based sample of 1606 adolescents in years 7 and 9 of secondary school and their parents, from Victoria, Australia. Adolescents completed a web-based survey assessing their fruit consumption and self-efficacy for increasing fruit consumption. Parents completed a survey delivered via mail assessing food practices, perceptions, and barriers to buying fruit and vegetables. Adolescent self-efficacy for increasing fruit consumption mediated the positive associations between parental strictness, and perceptions of the importance of healthy nutrition for child health and adolescent fruit consumption. Furthermore, adolescent self-efficacy mediated the negative association between parental barriers to buying fruits and vegetables and adolescent fruit consumption. The importance of explicating the mechanisms through which parental factors influence adolescent fruit consumption not only relates to the advancement of scientific knowledge, but also offers potential avenues for intervention. Future research should assess the effectiveness of methods to increase adolescent fruit consumption by focusing on both improving adolescents’ dietary self-efficacy, and on targeting parental food-related practices, perceptions and barriers.
Introduction

During adolescence nutritional intake and diet quality are important to support growth, maintain physical health, prevent chronic disease, and promote a healthful weight trajectory [1]. An adequate level of fruit consumption is one indicator of diet quality [2], however, many adolescents fail to meet the dietary recommendations for fruit consumption [3-4]. Adolescence is a critical period for the adoption of eating behaviours and habits, which are likely to persist into adulthood [5-6]. Intervention programmes promoting healthy eating among adolescents have resulted in at best limited improvements in dietary behaviour [7-8]. Successful behaviour change interventions are dependent on the ability to influence the determinants of behaviour [9]. The lack of intervention success may be due to a poor understanding of the mechanisms underpinning adolescent eating behaviours, and incorrect theoretical suppositions regarding the mechanisms through which eating behaviours can be modified [10].

Research indicates that parents play an important role in influencing the eating behaviours of adolescents [11-12]; however, relatively few healthy eating programmes have utilised the home environment or parents as potential avenues for intervening with adolescents [13]. Parents influence the availability of food within the home, but can also exert their influence through their attitudes and beliefs regarding eating, by exposing their adolescents to certain foods, or by actively encouraging or controlling certain eating behaviours [12, 14]. Studies on food-related parenting practices have reported contradictory findings. Some studies have shown no associations between parental strictness, control and rules regarding food choice and adolescent healthy eating behaviours (e.g. consumption of fruits and vegetables).
[15-17], whereas other studies have shown that adolescents consume fewer soft-drinks when they report higher levels of strictness or restriction regarding food, and more food-related rules in their family [16, 18-19]. Most of the research examining parental influences on adolescent fruit consumption has examined adolescent perceptions [12]; less research has examined parent report of parenting practices and their associations with adolescent dietary intakes. However, parental report might be a more valid measure than adolescent report; for example, parents may be able to more accurately report their own attitudes, beliefs and behaviours and may have a better sense than adolescents of the home availability of specific foods, given that parents primarily control which foods are purchased for and served in the home [20].

Adolescent reported barriers to eating healthy foods (e.g. preferences for other foods, social norms) have been associated with lower consumption of healthy foods [21-22]. It is unknown whether parent reported barriers to buying fruits and vegetables are associated with adolescent consumption of these foods. Research conducted with adults has shown that many perceive high costs and limited availability of fresh produce in local shops as barriers to buying fruits and vegetables, which negatively influences their consumption of such food items [23-24]. It could be hypothesised that higher perceived barriers to purchasing healthy food items could limit the home availability of fruits and vegetables, which may impact on adolescent consumption of such food items. Furthermore, parent’s perceptions of the importance of healthy nutrition for child health could influence adolescent eating behaviours. Previous research has shown that in choosing foods for their
children, parents considered health to be the most important factor [25]. However, these associations have not been examined among adolescents.

The Environmental Research framework for weight gain Prevention (EnRG) posits that socio-environmental factors (e.g. parenting practices) influence adolescent eating behaviour either directly or indirectly via cognitions [26]. One potential mediator of the association between parental influences and adolescent eating behaviours is adolescent dietary self-efficacy [18, 27]. Self-efficacy is a social cognition that reflects individuals’ judgments of their capabilities to organize and execute courses of action required to attain designated types of performances [28]. Dietary self-efficacy is one’s perceived capability to choose more healthy foods even in difficult circumstances (e.g. when limited healthy options are available, or when feeling unmotivated). Parents influence the development of adolescent general self-efficacy [28-29], and studies with adolescents show that self-efficacy for making healthy food choices is associated with healthful food choices [30-31]. To our knowledge, no previous studies have examined whether parent-reported food-related practices and perceptions are associated with adolescent dietary self-efficacy, or whether adolescent reported dietary self-efficacy mediates the associations between parent reported factors and adolescent fruit consumption.

This study aimed to (i) examine the associations between parent-reported controlling food practices, barriers to buying fruit and vegetables, and perceptions of the importance of healthy nutrition for child health, and adolescent consumption of fruit; (ii) examine the association between parental strictness, barriers to buying fruit and vegetables, and
perceptions of the importance of healthy nutrition for child health and adolescent dietary self-efficacy; and (iii) to examine whether associations between parental influences and adolescent fruit consumption are mediated by adolescent dietary self-efficacy.

Methods

Study procedure

As part of a cohort study investigating influences on changes in dietary habits among adolescents in Melbourne, Australia, adolescents and their parents/care providers were administered self-completion questionnaires between September 2004 and July 2005. Study procedures were approved by the Ethics committee of Deakin University, the Victorian Department of Education and Training, and the Catholic Education Office. Survey participant recruitment and study procedures has been provided in previous publications [32-33]. In brief, all co-educational state (government) and Catholic secondary schools (years 7 to 12) with enrolments over 200, located in the southern metropolitan region of Melbourne and the non-metropolitan region of Gippsland, to the east of Melbourne, were invited to participate in the study. Of the 70 schools (47 metropolitan and 23 non-metropolitan) that met these criteria, 37 schools (20 metropolitan and 17 non-metropolitan) agreed to participate.

Participants

All students (n = 9,842) from year 7 (aged 12-13 years) and year 9 (aged 14-15 years) from participating schools were invited to participate. Teachers distributed parental consent
forms via students. In addition to requesting consent for their adolescent to participate in the study, parents were asked whether they would be willing to complete a questionnaire about their child’s eating habits. Parental consent was obtained for 4,502 (46%) of all eligible students. Due to absence from school on the day of testing, teachers administered an online food habits survey to 3,264 adolescents during class time when they had access to computers. A parental survey was also mailed to 2,534 parents who indicated that they would be willing to complete a questionnaire; of these 1,622 (64%) returned a completed survey.

The present analyses are based on the subset of 1606 parents and adolescents who had non-missing data for all of the variables examined in this study. Comparison of these 1606 adolescents with those whose parents did not complete the questionnaire showed that adolescents whose parents completed the parent survey had slightly higher scores for self-efficacy for increasing fruit consumption (9.33 versus 9.14, p<0.05), and slightly higher average daily consumption of fruit (0.96 versus 0.88, p<0.05) than those whose parents did not complete the survey.

**Measures**

**Outcome measure: adolescent consumption of fruit**

Consistent with other large-scale studies of dietary intake and eating behaviours of adolescents [34], food intake was assessed using a brief food frequency questionnaire (FFQ). This FFQ was based on previously validated indices of food intake [35] and is described in
detail in previous publications [32-33]. Respondents indicated how frequently they had consumed 37 food items during the previous month. The present analyses are based on adolescent frequency of consumption of fruit. The daily intake of fruit included fruit as one item (fresh, canned, frozen or dried). Seven responses categories ranged from ‘never or not in the last month’ to ‘several times a day’. The frequency of consumption of fruit in the past month was converted to a daily equivalent, which is an established method [36] that has been used in other dietary studies [34, 37]. A daily equivalent score for fruit consumption was calculated as follows: not in the last month (0.00 per day), several times per month (0.11 per day), once a week (0.14 per day), a few times a week (0.36 per day), on most days (0.71 per day), once per day (1.00 per day) and several times per day (2.50 per day).

Mediator

Adolescents were asked three questions about their confidence in eating more fruit: ‘If you wanted to, about how confident (sure) are you that you could eat more fruit when you’re hanging out with friends’, ‘... at school’ and ‘... at home’. Response options were given on a four-point Likert scale, ranging from (1) not at all confident to (4) very confident. Responses were summed separately to provide self-efficacy scores one for increasing fruit consumption (Cronbach’s alpha = 0.84).

Predictor measures: parent reported

Parents were asked questions about their food-related parenting practices, their perceptions of the importance of child healthy nutrition for child health, and their perceived barriers to
buying fruits and vegetables. To assess food-related parenting practices, parents were asked two questions about their level of strictness regarding the foods/meals that their child eats (I am clear about my parental role in the types of foods/meals I allow my child to eat so I have the final say; I expect my child to obey the rules that I make when it comes to eating). These items were adapted from an instrument, based on previous work [38-39], measuring the general parenting style dimensions of ‘involvement’ (warmth and acceptance) and ‘control’ [40]. Response options were given on a five-point Likert scale, ranging from (1) never to (5) always. Responses were summed to provide a score for parental control (Cronbach’s alpha = 0.62).

Parents were asked six questions about their views on the importance of child nutrition in terms of their child’s current health and well-being (e.g. ‘How important is the way your child eats and drinks now in terms of their current health’, ‘...fitness’, ‘...weight’, ‘...feelings of well-being’, ‘...ability to stay alert and learn’, and ‘...ability to socialise’. Response options were given on a three-point Likert scale, ranging from (1) not at all important to (3) very important. Responses were summed to provide a score for parental views on the importance of child nutrition to child’s current health and well-being (Cronbach’s alpha = 0.82).

Parents were asked six questions about their barriers to buying fruits and vegetables: (i) I don’t buy much fruit because most of my family don’t like it; (ii) I don’t buy much fruit because it costs too much; (iii) I don’t buy many vegetables because they cost too much; (iv) At the shop where I buy my groceries, the variety of fresh fruits and vegetables is limited; (v)
At the shop where I buy my groceries, the condition of the fresh fruits and vegetables is poor; (vi) The fresh produce in my area is usually of high quality (this item was reverse coded). Response options were given on a five-point Likert scale ranging from (1) strongly disagree to (5) strongly agree. Responses were summed to provide a score for parental barriers to buying fruits and vegetables (Cronbach’s alpha = 0.77).

**Statistical analysis**

All analyses were conducted using Stata 11 (Stata Corp, College Station TX, 2003). Descriptive statistics including frequencies, means, and standard deviations were calculated for all study variables according to gender and year level of adolescent participants.

Firstly, linear regression analyses were used to examine associations between parent reported predictor variables and adolescent self-efficacy, and between adolescent self-efficacy and adolescent fruit consumption. Secondly, as suggested by Cerin et al. [41], the mediating effects of adolescent self-efficacy on the association between parental influences and adolescent fruit consumption were assessed using the Freedman-Schatzkin test of mediation [42]. The Freedman-Schatzkin test is based on the difference in the unstandardised regression coefficients for the association between an independent (e.g. parent reported barriers to buying fruit and vegetables) and dependent variable (adolescent fruit consumption), unadjusted (τ) and adjusted (τ’) for the proposed mediator(s). The significance of the mediating effect is computed by dividing this difference (τ-τ’) by its standard error and comparing the obtained value to a t-distribution with n-2 degrees of freedom. In this study, single mediator models were tested separately for each predictor
variable. All regression models were adjusted for gender and year level of adolescents, and potential clustering by school.

**Results**

Slightly more of the adolescent sample were girls (52%), and in year 7 of secondary school (63%). The majority of the parent sample were mothers/female carers (90%) with a mean age of 42.4 years (SD=12.04). Of the parent sample, 19% were single parents, 26% were in full-time paid employment, 39% were in part-time paid employment, and 32% reported home-duties as their main daily activity. Table I displays the means and standard deviations for the study variables according to adolescent gender and year level. Several small but significant differences were found. Parents of boys and parents of year 7 students reported higher strict food-practices, compared to those of girls and those of year 9 students. Girls reported higher self-efficacy for increasing fruit consumption, and higher frequency of consumption of fruit compared to boys.

Linear regression analyses, adjusted for adolescent gender and year level, revealed that parental strictness and parental perceptions of the importance of child nutrition for child health were positively associated with adolescent self-efficacy for increasing fruit consumption (Table II). Parental reported barriers for buying fruit and vegetables were inversely associated with adolescent self-efficacy for increasing fruit consumption. Further linear regression analyses revealed that self-efficacy for increasing fruit consumption was positively associated with adolescent fruit consumption ($\beta=0.13$, 95% CI 0.11-0.14, p<0.001).
Table III shows the mediating effects of adolescent self-efficacy on the associations between parental influences and adolescent fruit consumption. Self-efficacy for increasing fruit consumption mediated the association between parental strictness and adolescent fruit consumption and the association between parental perceptions of the importance of child healthy nutrition for child health and adolescent fruit consumption. Self-efficacy for increasing fruit consumption also mediated the negative association between parent reported barriers to buying fruit and vegetables and adolescent fruit consumption (Table III).

Discussion

Several mechanisms through which socio-environmental factors (e.g. parental behaviours) influence young people’s health behaviours have been proposed [26]; however, little is known about potential mechanisms underpinning the association between parent-reported food-practices, perceptions and barriers, and adolescent consumption of fruit. The present study is one of the first to examine both the direct and indirect associations between parent-reported factors and adolescent consumption of fruit. The results of the present study show that parental strictness regarding food, perceptions and barriers are significantly associated with adolescent fruit consumption and adolescent dietary self-efficacy. Furthermore, associations between parent variables and adolescent fruit consumption were mediated by adolescent self-efficacy. Acknowledging the cross-sectional study design, our findings give weight to the likely importance of addressing parental factors, as well as adolescent self-efficacy, in interventions aimed at promoting healthy eating among adolescents.
Previous evidence on the relationships between parental strictness regarding food and adolescent eating behaviours is mixed. On the one hand, the results of some studies indicate that strict parenting practices may increase children’s preference for (and the intake of) restricted foods [43-45]. Other studies have shown that adolescents have healthier diets and consume fewer soft-drinks when they report higher levels of strictness and more food-related rules in their family [16, 18-19]. The present study found that adolescents whose parents reported higher levels of strictness had higher consumptions of fruit. Differences in results among different studies might be explained by the diverse measures used to assess parent food practices, or by differences between parent-report and adolescent report. We assessed parental strictness regarding food using parent-report, whereas other studies have relied on adolescent perceptions of food-practices. The association between parental practices and adolescent fruit consumption observed in the present study may be attributable to a number of factors. For example, parents who are clear and decisive in their actions about the foods they allow their adolescent to eat may be firmer or more directive in encouraging their adolescent to consume fruits; they may be providing more fruits as snacks and as part of meals, and they may limit other food options. Future research is needed to elicit the means by which parental strictness is associated with eating behaviours such as fruit consumption.

Previous research has shown that mothers who report a higher level of concern for healthful eating are more likely to have home food environments supportive of healthy eating, for example, a greater availability of fruits and lower availability of energy-dense snacks within the home [46], factors shown to predict greater consumption of fruits and vegetables [11,
The results of the present study add to the literature by demonstrating that adolescents whose parents perceived healthy nutrition as important for child health had higher consumptions of fruit. Possibly, parents who place a greater importance on healthy nutrition ensure that they provide more healthy foods (such as fruits) at home, which leads to increased consumption amongst adolescents, although such mediating pathways remain to be elucidated.

To the best of our knowledge no studies have examined the associations between parent reported barriers to buying fruits and vegetables and adolescent consumption of fruit. The present study shows that adolescents whose parents report more barriers to buying fruits and vegetables eat fewer fruits. Plausibly, parents who report more barriers to buying fruit and vegetables, actually buy fewer and thus have fewer available in the home for adolescent consumption. We cannot, however, rule out the reverse possibility – that, for example, adolescents’ dislike for fruits may be perceived as a barrier to consumption, which could lead to less purchasing of fruits by parents, and hence lower consumption. Future research should examine the pathways by which parental practices, perceptions and barriers might influence adolescent eating behaviours, in particular via factors relating to the availability of foods in the home environment.

The present study showed that adolescent self-efficacy to increase fruit consumption was positively associated with adolescent fruit consumption. Such findings add to previous research highlighting the importance of self-efficacy for healthy eating behaviours among
adolescents [30-31]. However, little is known about why some adolescents report higher levels of self-efficacy for healthy eating than others. Research on child socialisation suggests that the quality of parent-child interactions is significantly related to the development of adolescent general self-efficacy [28-29]. Bandura suggests that people’s beliefs concerning their efficacy can be developed by factors including vicarious experiences (provided by social models) and social persuasion (verbal persuasion by social models) [48]. To the best of our knowledge there are no studies examining the association between parenting factors and adolescent self-efficacy for increasing fruit consumption. The present study advances the literature in this field by demonstrating that parental strict food-practices and perceptions of the importance of healthy nutrition to child health are positively associated with adolescent self-efficacy for increasing fruit consumption, and that parental barriers for buying fruit and vegetables are negatively associated with adolescent self-efficacy for increasing fruit consumption (β values were small but significant). In addition, this study demonstrated that self-efficacy for increasing fruit consumption mediates the association between parental factors and adolescent fruit consumption. The relationship between parental strict food-practices, perceptions of the importance of healthy nutrition to child health, and barriers for buying fruit and vegetables and adolescent self-efficacy for increasing fruit consumption indicates that adolescent self-efficacy could potentially be influenced by targeting such parental variables.

In considering these findings it is important to acknowledge the limitations of the study. There were some differences between adolescents whose parents had completed questionnaires and those whose hadn’t, although the sample remained diverse. The reach
of the whole study was low (46%), however this is comparative to other large scale longitudinal studies. The generalisability of the results is limited because our sample was drawn from schools in Victoria, Australia and so does not represent the population at large. A mixture of food-specific (e.g. self-efficacy for increasing fruit consumption and barriers to buying fruit and vegetables) and more general (e.g. parental control) variables were examined in relation to fruit consumption in the present study. Examining the associations between food-specific predictor variables and specific eating behaviours could be insightful; however, due to the nature of the YEP study, this was not possible. To overcome some of the challenges with the YEP study relating to participation rate, the original questionnaire was reduced after pilot testing to minimise respondent burden. Furthermore, the YEP study was designed to look at a range of dietary outcomes of which fruit was just one, so given the need to minimise the respondent burden as mentioned earlier, in most cases, it was not possible to include predictors specific to each dietary outcome. All data were collected by self-report and are subject to socially desirable response bias or other misreporting, furthermore the items used to assess parental strictness had only moderate reliability (α=0.62), which could affect the reliability of the results. The cross-sectional study design does not permit causal inferences to be drawn; potentially a third unmeasured variable could account for the associations observed. Strengths of the study include the large regionally diverse sample of adolescents and parents, the use of powerful statistical mediation techniques, and the use of a theoretical framework to base/test hypothesised pathways.
The EnRG framework provides a valuable model for understanding the direct and indirect influences that parents have on adolescent fruit consumption and offers a useful guide for public health programmes focusing on adolescent healthy eating. Explicating the mechanisms through which parental food-related practices, perceptions and barriers influence adolescent fruit consumption is important not only for the advancement of scientific knowledge: understanding these mechanisms is also crucial because it offers potential avenues for intervention programmes. The results of the present study suggest that parents have a significant role to play in adolescent eating behaviours. Future research should assess the efficacy of methods to increase adolescent fruit consumption by focusing on improving adolescent self-efficacy, and on targeting parental food-related practices, perceptions and barriers to buying fruits and vegetables.

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**Conflict of interest statement**

None declared
References


Table I. Description of predictor, mediating, and outcome variables according to gender and year level of adolescent participants.

<table>
<thead>
<tr>
<th>Predictor variables (means, SD)</th>
<th>Gender</th>
<th>Year level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Boy (n=777)</td>
<td>Girl (n=829)</td>
</tr>
<tr>
<td>Parental controlling food practices (range 2-10)</td>
<td>7.64 (1.50)</td>
<td>7.47 (1.48)*</td>
</tr>
<tr>
<td>Parental perceptions of the importance of healthy nutrition for child health (range 6-18)</td>
<td>15.9 (2.67)</td>
<td>16.0 (2.68)</td>
</tr>
<tr>
<td>Parent reported barriers to buying fruit and vegetables (range 6-30)</td>
<td>10.4 (3.38)</td>
<td>10.4 (3.42)</td>
</tr>
<tr>
<td>Potential mediating variable (means, SD)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-efficacy for increasing fruit consumption (range 3-12)</td>
<td>9.05 (2.59)</td>
<td>9.58 (2.30)**</td>
</tr>
<tr>
<td>Outcome variable (means, SD)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fruit serves/day</td>
<td>0.89 (0.87)</td>
<td>1.01 (0.87)**</td>
</tr>
</tbody>
</table>

Independent t-tests examining differences in means by adolescent gender and year level
*p<0.05; **p<0.01; ***p<0.001
Table II. Associations between parent-reported variables and adolescent self-efficacy

<table>
<thead>
<tr>
<th>Predictor variables</th>
<th>Self-efficacy for increasing fruit consumption</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Unstandardised regression coefficient (95% CI)</td>
<td></td>
</tr>
<tr>
<td>Parental controlling food practices</td>
<td>0.08 (0.017-0.14)</td>
<td>0.014</td>
</tr>
<tr>
<td>Parental perceptions of the importance of healthy nutrition for child health</td>
<td>0.07 (0.03-0.80)</td>
<td>0.001</td>
</tr>
<tr>
<td>Parent reported barriers to buying fruit and vegetables</td>
<td>-0.04 (-0.07 - 0.004)</td>
<td>0.025</td>
</tr>
</tbody>
</table>

Linear regression analyses controlling for adolescent gender, year level and potential clustering by school.
Table III. Effects of adjustment for adolescent self-efficacy for increasing fruit consumption in the association between parental controlling food-practices, perceptions of the importance of healthy nutrition for child health and barriers to buying fruit and vegetables and adolescent fruit consumption (n=1606).

<table>
<thead>
<tr>
<th>Parent-reported variables</th>
<th>τ (SE)</th>
<th>τ' (SE)</th>
<th>τ – τ' (SE)</th>
<th>t</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parental controlling food-practices</td>
<td>0.040 (0.015)</td>
<td>0.032 (0.014)</td>
<td>0.008 (0.001)</td>
<td>6.71</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Parental perceptions of the importance of healthy nutrition</td>
<td>0.018 (0.008)</td>
<td>0.009 (0.008)</td>
<td>0.009 (0.001)</td>
<td>14.5</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>for child health</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parent barriers for buying fruits and vegetables</td>
<td>-0.034 (0.006)</td>
<td>-0.030 (0.006)</td>
<td>-0.004 (0.0003)</td>
<td>-13.3</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

τ, unstandardised regression coefficient for association between parent-reported variable and adolescent fruit consumption, adjusting for confounders (gender and year level), before adjustment for mediator; τ', unstandardised regression coefficient for association between parent-reported variable and adolescent fruit consumption, adjusting for confounders (gender, year level and potential clustering by school), and mediator (self-efficacy for increasing fruit consumption); τ – τ', difference between the two regression coefficients, which when divided by its standard error, can be compared against a t-distribution with n – 2 degrees of freedom; SE, standard error.