

ORIGINAL ARTICLE

Correlates of dietary resilience among socioeconomically disadvantaged adolescents

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Background/Objectives: Despite increased risk for unhealthy diets, some socioeconomically disadvantaged adolescents manage to consume a healthy diet, thereby showing 'dietary resilience'. This investigation aimed to describe the vegetable and fruit intakes of socioeconomically disadvantaged adolescents, and explore the intrapersonal, social and environmental factors associated with more favourable dietary intakes among socioeconomically disadvantaged adolescents.

Subjects/Methods: The present investigation draws on data from 1014 socioeconomically disadvantaged adolescents (55% girls), a sub-sample of 3264 adolescents aged 12–15 years recruited from 37 secondary schools in Victoria, Australia. The adolescents completed an online survey in 2004–2005 comprising an FFQ and questions pertaining to intrapersonal, social and environmental factors informed by the Social Cognitive Theory (SCT). Frequent vegetable and fruit intake was defined as ≥ 2 times per day and ≥ 1 time per day, respectively.

Results: Approximately one-third of socioeconomically disadvantaged adolescents frequently consumed vegetables and fruit (boys, 29% and 27% respectively; girls, 29% and 36% respectively). Greater perceived importance of health, and frequently being served vegetables with dinner, were associated with frequent intakes. Friends' support for healthy eating was associated with boys' frequent vegetable intake. Less stringent adherence to family meal-time rules was associated with frequent intakes; however, the opposite was observed when girls were expected to eat all foods served.

Conclusions: Nutrition promotion messages targeting socioeconomically disadvantaged adolescents could focus on fostering appreciation for health and providing families with strategies to increase meal-time vegetable availability. Friends could be encouraged to support healthy eating among boys. Family meal-time rules warrant further investigation.

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Introduction

Nutrition is important for promoting health and preventing chronic diseases (World Health Organization, 2003). Consequently, many countries have implemented national dietary guidelines: for example, the 'Australian Guide to Healthy Eating' (Department of Health and Ageing, 2001). Consumption of vegetables and fruit was the focus of the present study, as there is strong evidence that consuming recommended amounts of these foods is important for

reducing chronic disease risk (World Health Organization, 2003). Nutritionally, adolescence is a vulnerable period in life, as adolescents require increased nutrients for development (Spear, 2002). Eating behaviours acquired during adolescence are likely to influence long-term behaviours (te Velde *et al.*, 2007), therefore it is important to promote healthy eating among adolescents as their eating behaviours can worsen during this period in life (Larson *et al.*, 2007).

Despite the importance of a nutrient-rich diet, many adolescents fail to meet dietary recommendations (Larson *et al.*, 2007; Nelson *et al.*, 2007; Department of Health and Ageing, Australian Food and Grocery Council & Department of Agriculture Fisheries and Forestry, 2008). In the 2007 Australian National Children's Nutrition and Physical Activity Survey, only 5% of adolescents aged 14–16 years met the Australian Guide to Healthy Eating recommendations for

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vegetables (≥ 4 daily serves, including potatoes), whereas only 1% met the recommendations for fruit (≥ 3 daily serves, excluding juice) (Department of Health and Ageing, Australian Food and Grocery Council & Department of Agriculture Fisheries and Forestry, 2008). Project EAT-I and EAT-II conducted in the United States in 1999 and 2004, respectively, showed that combined fruit and vegetable intake in adolescents decreased during the transition from early to mid-adolescence (Larson *et al.*, 2007). In order to improve eating behaviours, a better understanding of the factors influencing adolescent nutrition is required.

Whereas adolescents from a low socioeconomic position (SEP) tend to have a poorer nutritional status than those of higher SEP (Nelson *et al.*, 2007; Pearson *et al.*, 2009), some manage to consume a more healthy diet. 'Resilience' is a dynamic concept reflecting an individual's positive adaptation despite risk and adversity, and arises from many processes and interactions that extend beyond the boundaries of the individual, including close relationships and social support (Masten and Wright, 2009). Ball and Crawford (2006) suggested that the concept of resilience might help to explain the mechanisms by which some individuals of low SEP manage to engage in healthy behaviours despite their disadvantageous circumstances (for example, adolescents' dietary resilient consumption of vegetables and fruit). Understanding the factors supporting 'resilience' to poor eating behaviours may provide insights for informing the development of initiatives promoting healthier diets among adolescents of low SEP.

Social Cognitive Theory (SCT) is a useful theoretical framework for understanding the determinants of eating behaviour. SCT hypothesizes that behaviour is determined by interactions between intrapersonal, social and environmental influences (Bandura, 1986). A range of influences impacting adolescent eating behaviours has been reviewed (Rasmussen *et al.*, 2006; van der Horst *et al.*, 2007; Pearson *et al.*, 2009). Intrapersonal factors include perceived importance of health behaviours, self-efficacy, taste preferences, food-related behaviours (for example, meal frequency, snacking) and barriers (for example, cost, time, inconvenience) (Rasmussen *et al.*, 2006). Adolescents' interactions with family, friends and peers are key social determinants of dietary intake. Parenting style, role-modelling, reinforcement, perceived norms and cultural factors may also be important (Rasmussen *et al.*, 2006; van der Horst *et al.*, 2007; Pearson *et al.*, 2009). The environmental features impacting adolescent dietary intake include food availability; accessibility and affordability in the home, school and local neighbourhood (Rasmussen *et al.*, 2006; van der Horst *et al.*, 2007; Pearson *et al.*, 2009).

To our knowledge, factors associated with 'dietary resilience' among disadvantaged adolescents have not been examined. The aims of this study are to describe intakes of vegetables and fruit by adolescents experiencing socioeconomic disadvantage, and explore the intrapersonal, social

and environmental independent variables associated with dietary resilient intakes informed by the SCT.

Materials and methods

Participants and setting

The present study is based on cross-sectional data from the Youth Eating Patterns (YEP) Study, an online food habits survey conducted in 37 secondary schools in the metropolitan and non-metropolitan regions of Victoria, Australia, during 2004–2005 (MacFarlane *et al.*, 2007; Savige *et al.*, 2007a, b; Ball *et al.*, 2009).

In brief, all co-educational government and Catholic secondary schools located in metropolitan Melbourne and non-metropolitan Gippsland, east of Melbourne, Australia, that included Years 7–12 and had >200 enrolments were invited to participate. Of the 70 schools that met these criteria, 37 schools (20 metropolitan and 17 non-metropolitan) agreed to participate. All students ($n=9842$) from Year-7 (aged 12–13 years) and Year-9 (aged 14–15 years) were invited to participate. Written informed consent was received from adolescents' parents, and the survey was completed during class time by 3264 socio-demographically diverse secondary students (response rate 33.2%) ($n=2010$ in Year-7 and $n=1254$ in Year-9). A survey assessing the socio-demographics of the parent and their partner, including highest level of education, and additional questions about their adolescent's eating patterns was mailed out to those parents who had given informed consent for their adolescents to participate (response rate 49.7%).

Maternal education was used as an indicator of adolescents' SEP: 'low' indicating mother completed up to Year-10 of high school; 'medium' indicating mother completed Year-12 of high school and/or a technical or trade school certificate/apprenticeship; and 'high' indicating mother completed a university or tertiary qualification. Adolescents who had non-missing data for all the variables examined in the present study were included in analyses (total $n=2171$ adolescents: 1014 'low' SEP, 641 'medium' SEP and 516 'high' SEP). The study was approved by the Deakin University Ethics Committee, the Victorian Department of Education and Training, and the Catholic Education Office.

Measures

Outcome variables. The online survey included a 38-item food frequency questionnaire (FFQ), based on food intake questions recommended by the Australian Food and Nutrition Monitoring and Surveillance Unit (Marks *et al.*, 2001). Adolescents reported their usual intake frequency of food and beverages over the past month. The food items from the FFQ that were included in the present investigation are shown in Table 1. As the FFQ did not include portion size, calculation of serving size was not possible. The FFQ response scale was converted to daily equivalent frequencies.

Table 1 Food items included in the present investigation, as selected from the 38-item YEP FFQ^a

Food group	Food item
Vegetables	Potatoes (not including chips, French fries, wedges, fried potato) Salad (salad includes mixed green salad and other mixtures of raw vegetables) Cooked vegetables (not including potatoes)
Fruit	Fruit (including fresh, canned, frozen, dried)

Abbreviations: FFQ, food frequency questionnaire; YEP, Youth Eating Patterns Study.

^aAdolescents were asked to indicate on a seven-point scale the frequency with which they had consumed each food item in the previous month. These were then converted to equivalent daily frequencies as follows: 'not in the last month' (scored 0.00—that is, consumed 0.00 times daily), 'several times per month' (0.07), 'once a week' (0.14), 'a few times a week' (0.36), 'most days' (0.71), 'once per day' (1.00) and 'several times per day' (2.50).

The 'vegetables' food group included potatoes (excluding chips, French fries, wedges, fried potato), salad and cooked vegetables, whereas the 'fruit' food group included fruit only, excluding fruit juice.

Among socioeconomically disadvantaged adolescents, 'dietary resilience' was conceptualized as consuming fruits and vegetables frequently, that is, at least daily consumption; therefore frequent intakes of vegetables and fruit were ≥ 2 times per day and ≥ 1 time per day, respectively. The dietary resilience cut-off points are reasonable as past research has shown that socioeconomically disadvantaged adolescents struggle to meet the dietary recommendations. Further, epidemiological evidence suggests that consumption of even small amounts of fruit and vegetables can reduce disease risk (Steinmetz and Potter, 1996; McCullough *et al.*, 2003).

Independent variables. The survey items hypothesized to influence adolescent eating behaviours were developed to assess the intrapersonal, social and environmental factors drawn from SCT. The questionnaire was pilot-tested among 20 adolescents, with survey items modified slightly for clarity based on adolescents' feedback prior to being administered to the larger sample. Table 2 summarizes intrapersonal, social and environmental measures included in this investigation.

Socio-demographic characteristics. As sex has been shown to be associated frequently with adolescent diet (Rasmussen *et al.*, 2006), analyses were stratified by sex. Other socio-demographic characteristics, including age (Rasmussen *et al.*, 2006) and region of residence (Shi *et al.*, 2005), have been reported commonly as independent variables associated with adolescent diet, and were therefore considered as covariates.

Statistical analyses

Except where indicated, all analyses were stratified by sex. Descriptive statistics were used to describe the socio-demographic characteristics of the adolescents participating in the present investigation, and to examine the proportions of adolescents showing frequent intakes of vegetables and fruit stratified by SEP. Pearson's χ^2 -tests of significance were used to identify associations between SEP and frequent vegetable and fruit intakes.

Associations between each socio-demographic characteristic (sex, age and region of residence) and frequent intake for both food group outcomes were identified in bivariable logistic regressions.

Spearman non-parametric correlation coefficients were calculated to indicate co-linearity between independent variables. Two independent variables were considered to be co-linear if $\rho \geq 0.4$, indicating a moderate correlation (O'Rourke *et al.*, 2005). Of those two co-linear independent variables, only the independent variable most strongly associated with either of the two food group outcomes was included in further analyses. The 'Self-efficacy for fruit' scale and the 'Expected to have good manners' categorical-response item were excluded from analyses among both boys and girls. Additionally, the 'Self-efficacy for energy-dense food' and the 'Home availability of nutritious food' scales were excluded from analyses among boys only.

Bivariable logistic regressions were used to identify associations between independent variables and frequent intake for both food group outcomes, adjusted for covariates (if applicable). The statistically significant ($P \leq 0.20$) factors identified in bivariable analyses were entered into multi-variable logistic regressions. As the relatively large sample size used and the large number of tests conducted in the present investigation increased the likelihood of a type-I error, $P \leq 0.01$ (rather than $P \leq 0.05$) was applied for determining statistical significance between independent variables and the outcomes in the multivariable logistic regression models. As the YEP Study involved the recruitment of a sample of adolescents clustered by school, school ID was used to account for potential clustering effects in regression models, in which the 'cluster by' command in STATA was used to generate robust standard errors. The statistical analyses were conducted using SPSS v.17.0.1 for Windows (computer software; SPSS Inc., Chicago, IL, USA) and STATA v.10 (computer software; StataCorp., College Station, TX, USA).

Results

The sample of adolescents participating in the present investigation was socio-demographically diverse (Table 3). Significant socioeconomic disparities existed when

Table 2 The intrapersonal, social and environmental measures from the YEP adolescent survey used in the present study

Measure	Item type	Range	Cronbach's α	Source
<i>Intrapersonal measures</i>				
Perceived importance of health behaviours	Scale	3–12	0.74	Original
Self-efficacy (for fruit or energy-dense food)	Scale	3–12	0.84 (fruit), 0.82 (energy-dense food)	Adapted from Kremers <i>et al.</i> (2003) and Neumark-Sztainer <i>et al.</i> (2003)
Spending money	Individual item	1–6	NA	Original
<i>Social measures</i>				
Family support for healthy eating	Scale	5–15	0.76	Adapted from Sallis <i>et al.</i> (1987)
Friends' support for healthy eating	Scale	5–15	0.78	Adapted from Sallis <i>et al.</i> (1987)
Mother's role-modelling of healthy eating	Scale	4–12	0.71	Original
Father's role-modelling of healthy eating	Scale	4–12	0.75	Original
Friends' role-modelling of healthy eating	Scale	4–12	0.76	Original
Meal-time atmosphere	Individual items	1–4	NA	Adapted from Fulkerson <i>et al.</i> (2006)
Family meal-time rules	Individual items ^a	1–4	NA	Adapted from Fulkerson <i>et al.</i> (2006)
	'How important are the following to you?'			
	'Eating healthy food'			
	'Limiting the amount of 'junk-food' you eat' and			
	'Exercising and staying fit'			
	'If you wanted to, how confident (sure) are you that you could eat			
	more fruit' (or '... could cut down on junk-food...')			
	'... when you're hanging out with friends?'			
	'... when you're at school?'			
	'... when you're at home?'			
	'In a typical week, about how much money do you have available			
	to spend on yourself (for example, from pocket money, a part-			
	time job)?'			
	'During the past year, about how often have your family (parents/			
	brothers or sisters) said or done this'			
	'...made you feel good about the way you eat?'			
	'... eaten healthy foods with you?'			
	'... encouraged you not to eat 'junk food' when you felt like it?'			
	'... encouraged you to eat healthy foods?'			
	'... encouraged you to try new foods?'			
	The same set of five questions about family support was repeated			
	to assess support for healthy eating from friends			
	'My mother...'			
	'... eats healthy food'			
	'... limits the amount of 'junk food' they eat'			
	'... eats vegetables most days' and			
	'... eats fruit most days'			
	The same set of four questions about mother's role-modelling was			
	repeated to assess role-modelling by the father			
	The same set of four questions about mother's role-modelling was			
	repeated to assess role-modelling by friends			
	Two individual items:			
	'The evening meal is an unpleasant time for my family' and			
	'The evening meal is a time when my family really talks and			
	catches up with each other'			
	Eight individual items:			
	'I eat whatever I like at home'			
	'During meal times, I'm allowed to put the TV on'			
	'At meal times I have to follow certain rules (for example, not			
	talking with my mouth full)'			
	'I'm expected to be home for dinner unless otherwise arranged'			
	'I'm expected to have good manners at the dinner table (for			
	example, handling food politely—using my knife and fork			
	properly)'			
	'I'm expected to eat all the foods served even if I don't like them'			
	'It's OK for me to make something else to eat if I don't like the			
	food being served for dinner' and			
	'I'm always allowed to buy whatever I want from fast food places'			

Table 2 Continued

Measure	Item type	Range	Cronbach's α	Source
<i>Environmental measures</i>				
Home access to food (nutritious food or energy-dense food)	Individual items	1–4	NA	Adapted from Neumark-Sztainer <i>et al.</i> (2003)
Home availability of food (nutritious food or energy-dense food)	Scale	2–8	0.75	Adapted from and Campbell <i>et al.</i> (2007)
Perception of school canteen	Scale	5–20	0.75	
Perception of school canteen	Scale	5–25	0.81	Original
Neighbourhood availability of energy-dense food	Scale	4–15	0.70	Original

Abbreviations: NA, not applicable; YEP, Youth Eating Patterns Study.

^aThe 'Family meal-time rules' items were examined individually rather than as a scale to determine if specific rules were associated with frequent intake.

Table 3 The socio-demographic characteristics of the Australian adolescents participating in the present investigation, and the proportions of adolescents showing frequent vegetable and fruit intakes according to SEP, stratified by sex ($n=2171$: boys, $n=991$; girls, $n=1180$)

Sociodemographic characteristics	Total		Low-SEP boys		Low-SEP girls	
	n	%	n	%	n	%
Total sample	2171	100	459	45	555	55
Sex						
Boys	991	46	NA	NA	NA	NA
Girls	1180	54				
Age group						
Year-7	1337	62	306	67	338	61
Year-9	834	38	153	33	217	39
Region of residence						
Metropolitan	1435	66	295	64	358	65
Non-metropolitan	736	34	164	36	197	35
SEP ^a						
Low	1014	47	NA	NA	NA	NA
Medium	641	30				
High	516	24				
Dietary outcome by SEP						
		Boys		Girls		
		n	%	n	%	
Total sample		991	100	1180	100	
SEP						
Low		459	46	555	47	
Medium		278	28	363	31	
High		254	26	262	22	
Frequent vegetable intake ^b						
SEP						
Low		134	29	159	29	
Medium		92	33	110	30	
High		89	35	100	38	
P-value			0.237		0.021*	
Frequent fruit intake ^c						
SEP						
Low		125	27	201	36	
Medium		83	30	153	42	
High		125	49	141	54	
P-value			<0.001*		<0.001*	

Abbreviations: NA, not applicable; SEP, socioeconomic position.

^aMaternal education defined as follows: 'Low' \leq Year-10 of high school (boys, $n=459$; girls, $n=555$), 'Medium' = Year-12 of high school/trade certificate (boys, $n=278$; girls, $n=363$) and 'High' = tertiary education (boys, $n=254$; girls, $n=262$).

^bFrequent intake defined as vegetable consumption ≥ 2 times per day.

^cFrequent intake defined as fruit consumption ≥ 1 time per day.

* $P \leq 0.05$.

proportions of adolescents showing frequent vegetable and fruit intakes were compared by SEP level, except for boys' frequent vegetable intakes. Smaller proportions of low-SEP adolescents frequently consumed vegetables and fruit when compared with adolescents of medium and high SEP.

Among this sample of socioeconomically disadvantaged boys, 29% showed frequent vegetable intake (consumption ≥ 2 times per day) and 27% showed frequent fruit intake (consumption ≥ 1 time per day). Twenty-nine percent and 36% of disadvantaged girls had frequent intakes of

vegetables and fruit, respectively. More girls than boys had frequent fruit consumption ($P \leq 0.004$).

To identify independent variables associated with frequent intake, bivariable analyses were conducted stratified by sex (data not shown). Several intrapersonal, social and environmental factors were identified that predicted frequent intakes of vegetables and fruit among disadvantaged adolescent boys and girls.

The statistically significant ($P \leq 0.01$) independent variables associated with boys' frequent vegetable and fruit

Table 4 SCT factors significantly associated with socioeconomically disadvantaged Australian adolescent boys' frequent intakes of vegetables and fruit identified in multivariable logistic regression analysis (*n* = 459)

	Frequent intake % (<i>n</i> = 134)	Infrequent intake % (<i>n</i> = 325)	OR (95% CI)	P-value
Frequent vegetable intake^a				
Socio-demographic characteristics				
<i>Region of residence</i>				
Metropolitan	56	68	1.00	0.310
Non-metropolitan	44	32	1.37 (0.74–2.55)	
<i>Intrapersonal factors</i>				
Perceived importance of health behaviours (mean (s.d.))	9.99 (± 1.83)	8.91 (± 2.09)	1.29 (1.12–1.49)	0.001*
<i>Spending money</i>				
\$30 or more per week/\$20–\$29 per week	23	21	1.00	
\$10–\$19 per week	20	19	1.24 (0.53–2.91)	0.606
\$5–\$9 per week	17	23	0.62 (0.35–1.09)	0.094
< \$5 per week	18	20	0.80 (0.31–2.06)	0.636
None	22	17	1.31 (0.64–2.71)	0.453
<i>Social factors</i>				
Family support for healthy eating (mean (s.d.))	11.66 (± 2.53)	11.00 (± 2.64)	0.99 (0.86–1.13)	0.849
Friends' support for healthy eating (mean (s.d.))	8.91 (± 2.83)	7.83 (± 2.35)	1.16 (1.04–1.30)	0.009*
Father's role-modelling of healthy eating (mean (s.d.))	10.26 (± 1.95)	9.98 (± 1.94)	0.91 (0.78–1.06)	0.226
Friend's role-modelling of healthy eating (mean (s.d.))	9.19 (± 2.18)	8.62 (± 2.09)	1.03 (0.90–1.17)	0.700
Meal-time atmosphere				
<i>Evening meal—family talks and catches up</i>				
Never	13	14	1.00	
Sometimes	28	37	0.80 (0.30–2.18)	0.658
Usually	28	31	0.73 (0.29–1.86)	0.505
Always	31	18	1.06 (0.35–3.21)	0.918
Family meal-time rules				
<i>Allowed television during meal times</i>				
Always	33	30	1.00	
Usually	21	28	0.72 (0.38–1.35)	0.293
Sometimes	25	30	0.70 (0.36–1.34)	0.269
Never	21	12	1.06 (0.57–1.96)	0.850
<i>Expected to follow certain meal-time rules</i>				
Never	10	16	1.00	0.312
Sometimes	22	25	1.64 (0.62–4.36)	0.328
Usually	28	28	1.68 (0.58–4.83)	0.685
Always	40	31	1.22 (0.46–3.23)	
<i>Expected to be home for dinner</i>				
Never/sometimes	14	21	1.00	
Usually	23	28	1.14 (0.57–2.26)	0.711
Always	63	51	1.27 (0.67–2.41)	0.452
<i>Expected to eat all foods served even if disliked</i>				
Never	17	21	1.00	
Sometimes	26	33	0.87 (0.53–1.42)	0.558
Usually	25	29	1.02 (0.50–2.07)	0.953
Always	32	17	1.07 (0.57–1.99)	0.830
<i>Allowed to make something else for dinner</i>				
Always	13	11	1.00	0.560
Usually	17	20	1.32 (0.51–3.38)	
Sometimes	34	45	0.91 (0.35–2.40)	0.851
Never	36	24	1.25 (0.56–2.78)	0.578
<i>Allowed to buy whatever is liked at fast food places</i>				
Always	25	18	1.00	0.004*
Usually	17	30	0.28 (0.12–0.65)	0.087
Sometimes/never	58	52	0.47 (0.20–1.12)	

Table 4 Continued

	Frequent intake % (n = 134)	Infrequent intake % (n = 325)	OR (95% CI)	P-value
<i>Environmental factors</i>				
Home access to food				
<i>Vegetables served at dinner</i>				
Never/sometimes/usually	25	54	1.00	
Always	75	46	2.79 (1.69–4.58)	<0.001*
Neighbourhood availability of energy-dense food (mean (s.d.))	7.71 (± 2.12)	8.48 (± 2.20)	0.84 (0.71–0.99)	0.041
Frequent fruit intake ^b				
<i>Intrapersonal factors</i>				
Perceived importance of health behaviours (mean (s.d.))	9.86 (± 1.80)	8.98 (± 2.12)	1.21 (1.05–1.38)	0.010*
<i>Social factors</i>				
Family support for healthy eating (mean (s.d.))	11.97 (± 2.31)	10.91 (± 2.67)	1.16 (1.03–1.30)	0.016
Mother's role-modelling of healthy eating (mean (s.d.))	11.06 (± 1.36)	10.80 (± 1.61)	0.86 (0.72–1.02)	0.075
Father's role-modelling of healthy eating (mean (s.d.))	10.30 (± 1.91)	9.97 (± 1.95)	0.99 (0.89–1.10)	0.792
Meal-time atmosphere				
<i>Evening meal—unpleasant for family</i>				
Always/usually	7	19	1.00	
Sometimes	25	24	2.41 (0.99–5.89)	0.054
Never	68	57	2.46 (1.12–5.40)	0.027
<i>Evening meal—family talks and catches up</i>				
Never	16	13	1.00	
Sometimes	33	35	0.85 (0.47–1.52)	0.566
Usually	23	33	0.43 (0.17–1.07)	0.069
Always	28	20	0.61 (0.28–1.33)	0.204
Family meal-time rules				
<i>Allowed television during mealtimes</i>				
Always	36	29	1.00	
Usually	20	28	0.59 (0.32–1.09)	0.090
Sometimes	27	29	0.97 (0.56–1.67)	0.902
Never	17	14	0.70 (0.39–1.26)	0.226
<i>Expected to follow certain meal-time rules</i>				
Never	16	14	1.00	
Sometimes	19	26	0.75 (0.37–1.50)	0.400
Usually	22	30	0.76 (0.31–1.90)	0.552
Always	43	30	1.16 (0.53–2.53)	0.699
<i>Expected to eat all foods served even if disliked</i>				
Never	24	19	1.00	
Sometimes	22	34	0.48 (0.28–0.82)	0.009*
Usually	27	27	0.90 (0.39–2.06)	0.789
Always	27	20	0.78 (0.40–1.50)	0.444
<i>Environmental factors</i>				
Home access to food				
<i>Plenty of food at home</i>				
Never/sometimes	8	17	1.00	
Usually	27	37	1.59 (0.70–3.63)	0.260
Always	65	46	2.45 (0.99–6.03)	0.052
<i>Vegetables served at dinner</i>				
Never/sometimes/usually	35	50	1.00	
Always	65	50	1.34 (0.92–1.94)	0.124
Perception of school canteen (mean (s.d.))	14.92 (± 5.38)	13.76 (± 4.71)	1.04 (0.98–1.09)	0.211

Abbreviations: CI, confidence interval; OR, odds ratio; SCT, Social Cognitive Theory.

^aFrequent intake defined as vegetable consumption ≥ 2 times per day; 29% of adolescent boys frequently consumed vegetables;

^bFrequent intake defined as fruit consumption ≥ 1 time per day; 27% of adolescent boys frequently consumed fruit.

* $P < 0.01$.

intakes identified in multivariable logistic regression analyses are summarized in Table 4. After including all independent variables found to have $P \leq 0.20$ in bivariable logistic regression analyses, four intrapersonal, social and environmental variables were associated with frequent vegetable intake among boys. Each unit increase on the 'perceived importance of health behaviours' scale predicted a 29% increase in the odds of frequently consuming vegetables among boys, that is, boys who perceived their health to be important were more likely to consume vegetables frequently than those for whom health was less important. Boys who perceived greater social support for healthy eating from friends were 16% more likely to consume vegetables frequently than those who perceived less support. When compared with boys who were always allowed to buy whatever they liked at fast food restaurants, those who reported usually being allowed to buy whatever they liked at fast food restaurants were 72% less likely to have frequent vegetable intake. Boys who were always served vegetables with dinner were more than two-and-a-half times more likely to frequently consume vegetables when compared with those who were served vegetables at dinner less frequently.

Only two factors were strongly associated with frequent fruit intake. Boys who perceived their health to be important were 20% more likely to consume fruit frequently than those for whom health was less important. Boys who were sometimes expected to eat all foods served even if disliked were half as likely to consume fruit frequently as those who were never expected to eat all foods served.

Four intrapersonal, social and environmental variables remained significantly associated with frequent vegetable intakes in the multivariable model among girls (Table 5). For each unit increase on the 'perceived importance of health behaviours' scale, girls were 21% more likely to consume vegetables frequently than those for whom health was less important. Girls who were always expected to eat all foods served even if disliked were two-and-a-half times as likely to consume vegetables frequently as those who were never expected to eat all foods served. Compared with girls who were always allowed to buy whatever they liked at fast food restaurants, those who reported sometimes or never being allowed to buy whatever they liked were half as likely to have frequent vegetable intake. When compared with girls who were not always served vegetables at dinner, girls who reported always being served vegetables at dinner were more than twice as likely to have frequent vegetable intakes.

Only two intrapersonal and environmental variables remained associated with frequent fruit intake in the multivariable model (Table 5). Girls who placed greater value on their health were 29% more likely to consume fruit frequently than those who valued their health less, and girls who reported always being served vegetables at dinner time were more than twice as likely to have frequent fruit intakes when compared with girls who were served vegetables less frequently.

Discussion

When compared with adolescents from higher SEP levels, the socioeconomically disadvantaged adolescents in the present investigation had poor dietary intakes. However, some showed dietary resilience, managing to consume vegetables and fruit frequently despite being at increased risk for having a poorer diet, usually associated with low SEP. As far as we are aware, this paper is the first to identify associations between intrapersonal, social and environmental factors and dietary resilience for vegetables and fruit among adolescent boys and girls.

Consistent with previous literature (Nelson *et al.*, 2007; Pearson *et al.*, 2009) smaller proportions of socioeconomically disadvantaged adolescents frequently consumed vegetables and fruit when compared with more advantaged adolescents. While no significant SEP differences were observed among proportions of boys showing dietary resilient vegetable intakes, a positive trend was apparent; that is, as SEP increased so too did the proportion of boys showing dietary resilient intake.

Acknowledging differences in methodologies and SEP levels between studies, previous studies show few disadvantaged adolescents achieve dietary recommendations. Only 43% of adolescent boys and 39% of girls residing in the most deprived areas of London, UK, managed to consume ≥ 5 fruit and vegetable servings daily (Wardle *et al.*, 2003). More recently, 17% of disadvantaged African-American adolescents consumed five combined daily servings of fruit and vegetables (Di Noia *et al.*, 2006). Drawing direct comparisons between findings from the present investigation with those of previous studies is difficult as disadvantaged adolescents' dietary intakes of vegetables and fruit are reported in terms of frequency of consumption rather than daily servings. However, in broad terms our findings support the observation that disadvantaged adolescents manage to consume a diet more in line with dietary recommendations.

The independent variables associated with dietary resilience for both sexes included perceived importance of health behaviours, home access to nutritious food and family meal-time rules. In the present investigation, adolescents who gave greater importance to their health were more likely to show resilient vegetable and fruit consumption than those who did not give their health as much importance. Research investigating associations between adolescents' perceived importance of health behaviours and fruit and vegetable consumption is limited. A recent analysis of the YEP Study showed that low-SEP adolescents reported lower perceived importance of healthy behaviours when compared with high-SEP adolescents, and that these variations mediated socioeconomic differences in intakes of fruit, energy-dense snacks and fast food (Ball *et al.*, 2009). Similarly, low-SEP adults placed less importance on healthy eating, subsequently having poorer dietary intakes than more advantaged adults (Wardle and Steptoe, 2003). Our findings suggest that, despite increased risk for having a

Table 5 SCT factors significantly associated with socioeconomically disadvantaged Australian adolescent girls' frequent intakes of vegetables and fruit identified in multivariable logistic regression analysis ($n=555$)

	Frequent intake % ($n = 159$)	Infrequent intake % ($n = 396$)	OR (95% CI)	P-value
Frequent vegetable intake ^a				
Socio-demographic characteristics				
Age				
Year-7	65	59	1.00	
Year-9	35	41	0.84 (0.55–1.22)	0.351
Intrapersonal factors				
Self-efficacy for fruit (mean (s.d.))	9.88 (\pm 2.36)	9.26 (\pm 2.26)	1.01 (0.90–1.13)	0.858
Perceived importance of health behaviours (mean (s.d.))	9.96 (\pm 1.81)	9.15 (\pm 1.97)	1.21 (1.05–1.38)	0.009*
Spending money				
\$30 or more per week/\$20–\$29 per week	23	21	1.00	
\$10–\$19 per week	20	19	0.83 (0.43–1.61)	0.565
\$5–\$9 per week	17	23	1.10 (0.60–2.01)	0.744
< \$5 per week	18	20	0.77 (0.42–1.44)	0.405
None	22	17	0.44 (0.21–0.92)	0.031
Social factors				
Family support for healthy eating (mean (s.d.))	12.06 (\pm 2.42)	11.59 (\pm 2.31)	0.98 (0.87–1.11)	0.764
Friends' support for healthy eating (mean (s.d.))	9.50 (\pm 2.65)	9.07 (\pm 2.47)	1.00 (0.91–1.10)	0.945
Friend's role-modelling of healthy eating (mean (s.d.))	9.61 (\pm 2.18)	9.23 (\pm 2.16)	1.06 (0.94–1.18)	0.339
Meal-time atmosphere				
Evening meal—family talks and catches up				
Never	17	18	1.00	
Sometimes	26	34	0.72 (0.41–1.28)	0.254
Usually	26	27	0.74 (0.42–1.32)	0.299
Always	31	21	1.03 (0.54–1.98)	0.932
Family meal-time rules				
Allowed television during meal times				
Always	37	34	1.00	
Usually	19	25	0.72 (0.42–1.22)	0.214
Sometimes	29	29	0.91 (0.57–1.47)	0.697
Never	16	13	0.99 (0.55–1.79)	0.971
Expected to follow certain meal-time rules				
Never	11	20	1.00	
Sometimes	25	25	1.73 (0.91–3.28)	0.093
Usually	28	25	1.68 (0.84–3.36)	0.138
Always	36	30	1.22 (0.70–2.12)	0.479
Expected to be home for dinner				
Never/sometimes	16	23	1.00	
Usually	23	28	1.03 (0.52–2.04)	0.940
Always	61	49	1.31 (0.67–2.54)	0.416
Expected to eat all foods served even if disliked				
Never	22	32	1.00	
Sometimes	28	31	1.29 (0.66–2.54)	0.446
Usually	30	26	1.59 (0.88–2.87)	0.122
Always	20	11	2.50 (1.36–4.60)	0.004*
Allowed to buy whatever is liked at fast food places				
Always	22	16	1.00	
Usually	21	27	0.50 (0.27–0.94)	0.033
Sometimes/never	57	57	0.50 (0.31–0.80)	0.005*
Environmental factors				
Home access to food:				
Plenty of food at home				
Never/sometimes	10	14	1.00	
Usually	35	35	1.28 (0.64–2.55)	0.480
Always	55	51	1.04 (0.53–2.01)	0.916
Vegetables served at dinner				
Never/sometimes/usually	23	43	1.00	0.001*
Always	77	57	2.31 (1.42–3.73)	

Table 5 Continued

	Frequent intake % (n = 159)	Infrequent intake % (n = 396)	OR (95% CI)	P-value
Home availability of nutritious food (mean (s.d.))	7.68 (± 0.86)	7.46 (± 1.03)	0.99 (0.75–1.32)	0.962
Perception of school canteen (mean (s.d.))	14.56 (± 4.50)	14.02 (± 4.21)	1.01 (0.96–1.07)	0.696
Frequent fruit intake ^b				
<i>Intrapersonal factors</i>				
Self-efficacy for fruit (mean (s.d.))	10.11 (± 2.06)	9.06 (± 2.35)	1.11 (0.98–1.25)	0.094
Perceived importance of health behaviours (mean (s.d.))	10.11 (± 1.59)	8.97 (± 2.03)	1.29 (1.12–1.47)	0.001*
<i>Social factors</i>				
Family support for healthy eating (mean (s.d.))	12.26 (± 2.25)	11.42 (± 2.35)	1.06 (0.97–1.16)	0.188
Mother's role-modelling of healthy eating (mean (s.d.))	11.25 (± 1.30)	10.84 (± 1.58)	1.09 (0.95–1.26)	0.227
Father's role-modelling of healthy eating (mean (s.d.))	10.19 (± 2.13)	9.91 (± 2.07)	0.92 (0.82–1.03)	0.132
Friend's role-modelling of healthy eating (mean (s.d.))	9.62 (± 2.16)	9.18 (± 2.17)	1.01 (0.93–1.11)	0.771
Meal-time atmosphere				
<i>Evening meal—unpleasant for family</i>				
Always/usually	9	12	1.00	
Sometimes	17	23	0.90 (0.41–1.97)	0.779
Never	74	65	1.17 (0.63–2.17)	0.620
<i>Evening meal—family talks and catches up</i>				
Never	15	19	1.00	
Sometimes	29	34	0.98 (0.54–1.77)	0.948
Usually	30	25	1.12 (0.59–2.12)	0.716
Always	26	22	0.74 (0.44–1.26)	0.258
Family meal-time rules				
<i>Eats whatever they like at home</i>				
Always	14	19	1.00	
Usually	29	33	1.17 (0.63–2.17)	0.603
Sometimes	46	40	1.33 (0.68–2.57)	0.397
Never	11	8	1.79 (0.63–5.06)	0.265
<i>Expected to follow certain meal-time rules</i>				
Never	15	19	1.00	
Sometimes	22	27	0.76 (0.42–1.35)	0.332
Usually	27	25	0.89 (0.46–1.72)	0.723
Always	36	29	0.75 (0.46–1.25)	0.261
<i>Expected to be home for dinner</i>				
Never/sometimes	18	23	1.00	
Usually	20	31	0.61 (0.36–1.03)	0.061
Always	62	47	1.17 (0.67–2.04)	0.566
<i>Expected to eat all foods served even if disliked</i>				
Never	22	33	1.00	
Sometimes	31	30	1.70 (0.97–2.98)	0.065
Usually	29	26	1.62 (0.71–3.66)	0.241
Always	18	11	2.00 (1.06–3.80)	0.034
<i>Allowed to buy whatever is liked at fast food places</i>				
Always	18	20	1.00	
Usually	22	28	0.69 (0.37–1.26)	0.217
Sometimes/never	60	52	0.77 (0.45–1.31)	0.317
<i>Environmental factors</i>				
Home access to food				
<i>Vegetables served at dinner</i>				
Never/sometimes/usually	23	46	1.00	
Always	77	54	2.11 (1.22–3.66)	0.009*
Home availability of nutritious food (mean (s.d.))	7.76 (± 0.75)	7.39 (± 1.08)	1.25 (0.86–1.80)	0.233

Abbreviations: CI, confidence interval; OR, odds ratio; SCT, Social Cognitive Theory.

^aFrequent intake defined as vegetable consumption ≥ 2 times per day; 29% of adolescent girls frequently consumed vegetables.

^bFrequent intake defined as fruit consumption ≥ 1 time per day; 36% of adolescent girls frequently consumed fruit.

* $P \leq 0.01$.

poorer diet associated with socioeconomic disadvantage dietary resilient adolescents perceive their health to be important.

How a more favourable perception of the importance of health behaviours was achieved among dietary resilient adolescents remains unclear, and requires further investigation. Past research has shown that adolescents identified a healthy diet as being important for preventing the onset of disease, prolonging the lifespan and improving future health (O'Dea, 2003). While adolescents ranked these factors as only moderately important (O'Dea, 2003), improved dietary intakes among disadvantaged adolescents may be accomplished through initiatives focusing on promoting long-term benefits of good health as achieved through consumption of a nutritious diet.

Disadvantaged adolescents who were always served vegetables at dinner were more likely to show dietary resilience when compared with those who were infrequently served vegetables at dinner. Few studies have examined the associations between home food availability and dietary intakes among disadvantaged adolescents. MacFarlane *et al.* (2007) showed that disadvantaged Australian adolescents participating in the YEP Study less often reported having vegetables always served at dinner when compared with adolescents with higher SEP. Similarly, socioeconomically disadvantaged adults were less likely to purchase food items in line with dietary guidelines (Turrell *et al.*, 2002). Other measures of home availability of nutritious foods were not associated with disadvantaged adolescents' dietary resilient vegetable intakes. Adolescents may not perceive the availability of nutritious foods at home, even though such foods are present, as indicated by frequent consumption of vegetables at dinner.

The means by which families of resilient adolescents manage to provide vegetables in the home despite challenges associated with socioeconomic disadvantage remain unclear, and require further exploration. Past research examining adolescents from all levels of SEP showed that home availability of fruit and vegetables was strongly correlated positively with their consumption (Bere *et al.*, 2008). Nutrition promotion initiatives could therefore encourage families of disadvantaged adolescents to increase the home availability of fruit and vegetables in place of energy-dense snacks, for example, through promotion of the purchase and preparation of nutritious, appealing meals and snacks.

Friends' social support for healthy eating and family meal-time rules were associated with dietary resilience among adolescent boys only. Past research has similarly showed a positive association between perceived friends' social support and fibre intakes among adolescents from all levels of SEP (Stanton *et al.*, 2007). Disadvantaged adolescents previously reported that feeling influenced by their peers helped motivate their intake of healthy foods (Evans *et al.*, 2006). A possible explanation for friends' social support for healthy eating supporting dietary resilience among adolescent boys could be that these adolescents consume meals with peers

who value healthy nutrition to a similar degree (Contento *et al.*, 2006).

In the present investigation adolescent girls who reported always being expected to eat all foods served even if disliked were more than twice as likely to show dietary resilient vegetable consumption as those who did not have to adhere to this meal-time rule. Previous research showed that disadvantaged adolescents were less likely to have strict family rules regarding the consumption of a range of food items (Hupkens *et al.*, 1998; MacFarlane *et al.*, 2007), and consequently this lack of meal-time rules has been associated with consumption of more fast foods, sweets, snacks and making of less healthy food choices (De Bourdeaudhuij, 1997), for example, consuming less fruit (Haerens *et al.*, 2008).

By contrast, the dietary resilient adolescent boys and girls in the present investigation were often allowed to buy whatever they liked at fast food places, and boys were not always expected to eat the foods served for a meal even if disliked. The association between more lenient meal-time rules and dietary resilience may reflect greater autonomy in food choices because their parents are confident that their child will choose healthy foods. Alternately, nutrient-dense foods such as fruits and vegetables may be more readily available at home. Parents may therefore feel confident that their adolescents could make healthy choices for meals and snacks, and hence perceive less need for family meal-time rules.

As resilience concerns the processes and outcomes of good adaptation in relation to significant threats, to study resilience 'good adaptation' and 'significant threat' require definition, including any processes and/or resources hypothesized to explain individual differences in the outcome (Masten and Wright, 2009). The present investigation has, therefore, described the socioeconomically disadvantaged adolescents' 'good adaptation' (that is, frequent vegetable and fruit intakes) in the face of 'significant threat' (that is, greater risk of poorer diet and consequent higher rates of morbidity and mortality from diet-related diseases).

Several limitations of this study should be acknowledged. The dietary intake data were based on a self-reported 38-item FFQ. Although FFQs may provide less detailed dietary data, past research has shown that this methodology is appropriate for ranking participants according to their fruit and vegetable intakes, and for examining associations with independent variables (Vereecken *et al.*, 2005). Although the response rate for the YEP Study was low, the sample was socio-demographically diverse. The use of maternal education as an indicator of SEP does not take into account material wealth, as might be indicated by a combined parental education measure. The majority (84%) of the parental socio-demographic data were provided by mothers, and paternal education was only available for a small number of adolescents ($n=234$). However, past research shows no significant associations between paternal education level and adolescents' vegetable and fruit intakes (Von Post-Skagegard *et al.*, 2002; Shi *et al.*, 2005; Rasmussen *et al.*, 2006). Conversion of ordinal responses to equivalent daily

frequencies poses a possible source of error; however, such an approach was used as adolescents' intakes were characterized rather than measured exactly. The associations between family meal-time rules and dietary resilience did not show a stepwise dose response, as might be expected, suggesting that these observations may have been because of chance. Temporal associations between independent variables and dietary resilience cannot be determined owing to the cross-sectional nature of the present investigation. The baseline sample comprised adolescents in early- to mid-adolescence, therefore factors found to be associated with dietary resilience may not be relevant among older adolescents.

There are several strengths of the present investigation. Vegetable and fruit resilience were examined as separate outcomes in the present investigation, rather than composite fruit and vegetable intakes (Di Noia *et al.*, 2006), as independent variables associated with frequent vegetable intake may differ from those associated with frequent fruit intake. Data were drawn from a large sample of socio-demographically diverse disadvantaged adolescents, and as the YEP Study sample incorporated two age cohorts, analyses of dietary intakes and dietary resilience could be examined among adolescents from a wide age range. The large sample size also enabled analyses to be stratified by sex. Finally, a comprehensive SCT model was used to examine a range of factors associated with dietary resilience in the present investigation, whereas other studies have investigated only a few factors (Di Noia *et al.*, 2006).

Conclusions

While socioeconomically disadvantaged adolescents' diets tend to be poor, the present study showed approximately one-third of adolescents showed dietary resilience, managing to consume vegetables and fruit at least daily.

Our findings suggest that the following strategies could be used to promote improved dietary intakes among disadvantaged adolescents. Adolescents could be encouraged to foster a more favourable perception of the importance of health behaviours. The families of disadvantaged adolescents could be encouraged to provide tasty, healthy options in place of energy-dense foods at home, for example, through regularly providing vegetables during dinner. Initiatives aimed at promoting nutrition among disadvantaged boys might need to target whole peer/friendship groups and include strategies to encourage them to support their friends in eating healthily. Further research is required to understand why lenience in some meal-time rules predicted dietary resilience among disadvantaged adolescents.

It is important to note that, although some socioeconomically disadvantaged adolescents managed to show dietary resilience, achieving dietary resilience as defined in this study does not reflect achieving dietary recommendations; therefore dietary resilient disadvantaged adolescents could also benefit from interventions to assist them in meeting the fruit and vegetable consumption recommendations for good health.

Conflict of interest

The authors declare no conflict of interest.

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