



## Rapid communication

# Association between food-outlet availability near secondary schools and junk-food purchasing among Australian adolescents

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## ABSTRACT

**Objectives:** We sought to investigate the association between food-outlet availability near Australian secondary schools and frequency of Australian students' discretionary food purchases.

**Methods:** Secondary-school students in Perth (Western Australia) reported the frequency of their discretionary food purchases from food outlets near their school (17 schools,  $n = 2389$  students grades 7–12, ages 12–17 y). Food-outlet availability was sourced from local governments, then geocoded. A mixed-effects model was used in analyses.

**Results:** Almost half of students (45%) purchased discretionary foods from food outlets near their secondary school at least weekly. Only the density of top-ranking fast-food chain outlets near secondary schools was associated with a significant increase in the frequency of discretionary food purchases.

**Conclusions:** Availability of major fast-food chains near Australian secondary schools appears to be a key driver of Australian students' discretionary food purchasing. Restricting these outlets near schools may help reduce adolescents' discretionary food intake.

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## Introduction

Strategies to improve diet and reduce obesity in children have traditionally been focused on classroom curriculum and improving the nutritional standard of foods available within schools [1].

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However, the food environment immediately surrounding the school grounds is also important, as it can offer a wider range of food, a space for social gathering, and exposure to unhealthy food advertising. Indeed, several studies have shown that many schoolchildren visit food retailers on their way to and from school, mostly purchasing “discretionary foods”—that is, foods that are high in sugar, fat, and energy but low in nutritional value [2–4]. These purchases have been identified as a major source of calories for schoolchildren [5], increasing their risk of overweight and obesity [6].

Policies and programs aimed at mitigating the availability of unhealthy food outlets near schools might be a promising strategy to improve dietary intakes and reduce obesity in schoolchildren. Context-specific evidence is best for informing local policies; however, Australian evidence is scarce with regard to how schoolchildren interact with food outlets near schools and whether the “food environment” (i.e., the type, location, and number of food outlets within a geographic location) near schools is associated with student food purchasing.

Older students in secondary school, who have more autonomy over their food choices, more disposable income, and more

freedom to travel independently without parent supervision, may be more susceptible to unhealthy food outlets than younger students in primary schools. Consequently, our objective was to investigate the relationship between frequency of Australian secondary-school students' discretionary food purchasing from food outlets near their school and the types and number of food outlets present in the surrounding food environment.

## Materials and methods

### Participants

Data were drawn from a recent survey [7] of adolescent energy-drink use. Participants ( $n = 2389$ ) were students attending 17 Perth-metropolitan secondary schools in grades 7 through 10 (ages 12–17 y). The online survey was completed in class during 2017 and 2018. Ethical approval for this study was obtained from the University of Western Australia Human Research Ethics Committee.

### Frequency of discretionary food purchasing

Participants were asked, "How often do you purchase snacks (e.g. soft drinks, energy drinks, cakes/biscuits, chocolate, crisps/chips, hot chips, burgers, sausage rolls, pies) from food outlets near your school?" Twelve response options ranging from "never" to "everyday" were recoded into four frequency categories: "everyday," "weekly" (including 1 d/wk, 2 d/wk, 3 d/wk, 4 d/wk, 5 d/wk, and 6 d/wk), "monthly or less" (including "rarely or less than once a month," 1 d/mo, 2 d/mo, and 3 d/mo), and "never."

### School food-environment measures

A list of all food businesses in 2018 was obtained from all Perth local governments ( $n = 32$ ) and geocoded in ArcGIS (version 10.5; Esri, Redlands, California). For each secondary school, the number and types of food-retail and food-service outlets were generated within 400-m, 800-m, and 1-km radial zones around the school boundary. Food businesses present near secondary schools were further classified into fast-food outlets (as well as a subsample variable consisting of four top-ranking fast-food chains) [8], supermarkets, convenience stores, other snack/beverage stores (i.e., cafes/coffee shops, confectionery shops, bakeries/cake/pastry shops), and fruit and vegetable stores (including supermarkets, fruit and vegetable stores, and greengrocers and markets). Based on market research [8], four of the leading fast-food chains in 2018 were chosen for our subsample fast-food variable: McDonald's (ranked first for popularity), KFC (second), Hungry Jack's (fourth), and

Red Rooster (sixth). Subway (ranked third) was excluded on the basis that they offer a substantially different product from the other chains, and Domino's Pizza (ranked fifth) was excluded based on their limited opening hours and not having products available for immediate purchase and consumption. Previous Australian research by Reidpath et al. [9] and Thornton et al. [10] has investigated these same four chains, finding greater access around secondary schools and in disadvantaged areas in Victoria.

### Sociodemographic variables

Participants self-reported their sex (i.e., male, female) and grade level (7–12). A composite score of five items measuring family affluence was adapted from the Family Affluence Scale II [9] and III [10] and recoded into tertiles (low, medium, high). The socioeconomic status (high versus low) of the participants was determined using the Index of Community Socio-Educational Advantage score for schools [11].

### Statistical analysis

Descriptive statistics were used to describe the sample. A  $\chi^2$  test was performed on the cross-tabulation of each demographic variable with purchase frequency. A mixed-effects ordinal logistic regression model was used to analyze the association between frequency of discretionary food purchasing from food outlets and the number of food outlets within 400-m, 800-m, and 1-km radial zones around the secondary-school boundary. The model was adjusted for sex, age, family affluence, and school socioeconomic status, and included school ID as the random effect. Purchase frequency was the dependent, four-level variable in all models. Results of ordinal regression are presented as odds ratios with confidence intervals. Analyses were performed using the ordinal package in R.

## Results

Participant characteristics and frequency of discretionary food purchasing [11–13] are presented in Table 1. Family affluence and school socioeconomic status (but not sex or grade) were significant predictors of frequency of purchasing discretionary food from food outlets near school.

For every additional top-ranking fast-food chain (McDonald's, KFC, Hungry Jack's, Red Rooster) within 400 m, 800 m, and 1 km of a secondary school, there was a significant increase in the frequency of student purchasing of discretionary foods from an outlet

**Table 1**  
Participant characteristics and frequency of discretionary food purchasing from food outlets near secondary schools

Characteristic	Total	Frequency of discretionary food purchases from food outlets near schools				P*
		Never	Monthly or less	Weekly	Everyday	
Sex						0.054
Female	1338 (56)	144 (12)	514 (41)	517 (42)	62 (5)	
Male	1051 (44)	153 (16)	392 (40)	385 (39)	51 (5)	
Grade level (average age, y)						0.624
Year 7 (12)	592 (25)	91 (15)	238 (41)	227 (39)	30 (5)	
Year 8 (13)	578 (24)	75 (14)	220 (41)	210 (40)	27 (5)	
Year 9 (14)	482 (20)	55 (12)	183 (39)	205 (44)	26 (5)	
Year 10 (15)	428 (18)	45 (12)	164 (42)	154 (40)	22 (6)	
Year 11 (16)	187 (8)	19 (13)	65 (45)	55 (38)	5 (4)	
Year 12 (17)	122 (5)	12 (12)	36 (35)	51 (50)	3 (3)	
Family affluence						0.002
Low	511 (21)	78 (15)	205 (40)	198 (39)	33 (6)	
Middle	978 (41)	125 (14)	402 (45)	333 (37)	38 (4)	
High	900 (38)	95 (12)	29 (37)	371 (46)	42 (5)	
School socioeconomic status						<0.001
High	1482 (62)	201 (16)	535 (44)	460 (38)	28 (2)	
Low	907 (38)	96 (10)	371 (37)	442 (44)	85 (9)	
Frequency of discretionary food purchases from food outlets near school						
Never	333 (14)					
Monthly or less	984 (41)					
Weekly	955 (40)					
Everyday	117 (5)					

All values are expressed as  $n$  (%)

\* $\chi^2$  test on the cross-tabulation of each demographic variable with purchase frequency.

**Table 2**

Effect of density (count) of food outlets by type within 400 m, 800 m, and 1 km of secondary schools on the frequency of discretionary food purchases from food outlets near school

Outlet type	OR (95% CI)	P
<b>Within 400 m of school</b>		
Fast-food outlets	1.03 (0.97–1.03)	0.396
Top-ranking fast-food chains	1.26 (1.05–1.53)	0.015*
Supermarkets	1.07 (0.83–1.39)	0.579
Convenience stores	0.96 (0.73–1.26)	0.788
Other snack/beverage stores	0.99 (0.97–1.00)	0.179
Fruit and vegetable outlets	1.13 (0.92–1.39)	0.239
<b>Within 800 m of school</b>		
Fast-food outlets	1.00 (0.98–1.01)	0.818
Top-ranking fast-food chains	1.14 (1.01–1.28)	0.033*
Supermarkets	1.09 (0.95–1.26)	0.198
Convenience stores	0.99 (0.84–1.17)	0.937
Other snack/beverage stores	1.00 (0.99–1.00)	0.314
Fruit and vegetable outlets	1.10 (0.98–1.24)	0.102
<b>Within 1 km of school</b>		
Fast-food outlets	1.00 (0.99–1.02)	0.896
Top-ranking fast-food chains	1.17 (1.02–1.34)	0.025*
Supermarkets	1.07 (0.96–1.19)	0.218
Convenience stores	0.95 (0.85–1.06)	0.379
Other snack/beverage stores	1.00 (0.99–1.01)	0.419
Fruit and vegetable outlets	1.03 (0.98–1.09)	0.267

CI, confidence interval; OR, odds ratio

\* $P < 0.05$ .

near their school ( $P < 0.05$ ; Table 2). There was no evidence that the number of fast-food outlets, supermarkets, convenience stores, other snack/beverage stores, and fruit and vegetable outlets within 400 m, 800 m, or 1 km of secondary schools were associated with discretionary food purchasing.

## Discussion

This study found that almost half of students purchased discretionary foods from outlets near their secondary school on a weekly-or-more basis. This is consistent with research conducted outside of Australia, which has found the school-fringe environment to be a frequent source of unhealthy food purchases [14,15].

The frequency of discretionary food purchases from food outlets near secondary schools was significantly associated with the availability of top-ranking fast-food chain outlets (McDonald's, Hungry Jack's, Red Rooster, KFC) but not with other fast-food outlets, supermarkets, convenience stores, other snack/beverage stores, or fruit and vegetable outlets. Thus, the presence of top-ranking fast-food chains appears to be a key driver of students' discretionary food purchasing from food outlets near secondary schools. This might be related to the increased marketing spend of top-ranking fast-food chains, but it may also be that many of these chains provide seating areas that allow students to gather and socialize. However, it is also plausible that other fast-food outlets and other food/beverage outlets also offer seating areas; thus future research would benefit from conducting an audit of seating provision and including a measure of this in analyses.

Urban planning measures which restrict the availability of fast-food chains near secondary schools may help curtail the consumption of discretionary foods by adolescents. Such regulatory approaches have been implemented in several jurisdictions around the world, including the United States [16], the UK [17], Ireland [18], South Korea [19], and the Philippines [20]. Distances considered in zoning measures aimed at limiting or restricting the number or type of food businesses near schools should be ones that are most appropriate to the local context. For example, in dense urban living contexts such as London, exclusion zones restricting hot-

food takeaways near schools have been implemented with distances ranging from 400 to 800 m [17]. Quezon City in the Philippines prohibits the selling and promotion of junk food and soft drinks within 100 m of schools [20], and South Korea has implemented "Green Food Zones" within 200 m of some schools [19]. The findings from the present study suggest that for Perth, Western Australia, even greater distances (up to 1 km) should be considered in urban planning measures aiming to curtail discretionary food purchasing by schoolchildren in secondary school from food outlets located near schools. Other policy and practice approaches could include reducing the appeal of these stores by placing restrictions on opening times and marketing promotions, providing increased food-literacy education and resources to enable students to make healthier choices in fast-food retail settings, and ensuring that school canteens offer food which is affordable, tasty, nutritious, and appealing to schoolchildren [21]. Future research should evaluate such approaches and assess their effect on children's food purchases, dietary intakes, and weight status.

Strengths of this study include the large sample size, the use of food-business data sourced from local governments, and the inclusion of a large range of food retail/service outlets. Although our outcome measure assessed the frequency of discretionary food purchasing from food outlets near secondary schools, we were unable to determine the specific outlets that students used when making these purchases and whether these purchases were made before, during, or after school, or from outlets located outside of a 1-km radial zone from the school boundary. There may also have been other potential confounding variables we were not able to adjust for in our analyses.

## Conclusions

This study found that the secondary-school fringe environment was a frequent source of discretionary food purchases. The availability of top-ranking fast-food chains was significantly associated with discretionary food purchases from food outlets near secondary schools. Interventions that restrict the availability of fast-food chains near secondary schools may help curtail adolescent consumption of discretionary foods.

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