

Availability of food and beverage items on school canteen menus and association with items purchased by children of primary-school age

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Abstract

Objective: To (i) describe the proportion of foods and beverages available on school canteen menus classified as having high ('green'), moderate ('amber') or low ('red') nutritional value; (ii) describe the proportion of these items purchased by students; and (iii) examine the association between food and beverage availability on school canteen menus and food and beverage purchasing by students.

Design: A cross-sectional study was conducted as part of a larger randomised controlled trial (RCT).

Setting: A nested sample of fifty randomly selected government schools from the Hunter New England region of New South Wales, Australia, who had participated in an RCT of an intervention to improve the availability of healthy foods sold from school canteens, was approached to participate.

Subjects: School principals, canteen managers and students.

Results: The average proportion of green, amber and red items available on menus was 47.9, 47.4 and 4.7%, respectively. The average proportion of green, amber and red items purchased by students was 30.1, 61.8 and 8.1%, respectively. There was a significant positive relationship between the availability and purchasing of green ($R^2 = 0.66$), amber ($R^2 = 0.57$) and red menu items ($R^2 = 0.61$). In each case, a 1% increase in the availability of items in these categories was associated with a 1.21, 1.35 and 1.67% increase in purchasing of items of high, moderate and low nutritional value, respectively.

Conclusions: The findings provide support for school-based policies to improve the relative availability of healthy foods for sale in these settings.

Keywords
Obesity
Canteen
Availability
Purchasing
School

Dietary risk factors are a leading cause of death and disability globally⁽¹⁾. National surveys indicate that children and adults in high-income countries such as the USA, the UK and Australia continue to consume foods high in fat, sugar and/or salt that contribute to excessive energy intake^(2–4). Given that dietary behaviours in childhood track into adulthood and are predictive of future chronic disease^(5,6), improving child nutrition has been identified as a public health priority⁽⁷⁾.

The WHO recommends the implementation of food and beverage policies as a strategy to improve the nutrition of children⁽⁸⁾. These include policies which restrict the availability of foods and beverages with little nutritional value and

increase the availability of foods and beverages with high nutritional value in settings frequented by children. Schools represent an attractive setting for such policies. Children consume almost 40% of their recommended energy intake while at school and schools provide centralised access to the majority of children each day⁽⁹⁾. As such, policies to influence the availability of foods and beverages at school food services, or for sale at canteens, kiosks or vending machines, have been introduced by countries including the USA⁽¹⁰⁾, Australia⁽¹¹⁾, New Zealand⁽¹²⁾ and Canada⁽¹³⁾.

Systematic reviews suggest that altering the availability of foods and beverages in community settings such as schools

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can have an impact on students' purchasing and consumption⁽¹⁴⁾. However, there is considerable variability in school-based guidelines and policy recommendations regarding the proportional availability of foods of different nutritional value^(11,15,16). Some policies or guidelines ban specified food or beverage products (e.g. soft drinks) from sale⁽¹⁷⁾, while others restrict the proportion of foods available with low nutritional value (e.g. deep-fried foods), for example, to no more than 20% of all available products⁽¹⁸⁾.

Little is known about how food purchases change with relative increases in the availability of foods of high or low nutritional value^(14,17). Such information is important when establishing public health nutrition policies regarding the availability of foods in settings such as schools. As a first step to understand the relationship between food availability and students' purchasing of unhealthy and healthy foods, we sought to describe their association in a cross-sectional sample.

Specifically, the aims of the present study were to:

1. describe the proportion of foods and beverages available on school canteen menus classified as having high nutritional value, moderate nutritional value or low nutritional value;
2. describe the proportion of foods and beverages purchased by students as having high nutritional value, moderate nutritional value or low nutritional value; and
3. examine the association between food and beverage availability on school canteen menus and food and beverage purchasing by students.

Methods

Context

The study was conducted in the Hunter New England region of New South Wales (NSW), Australia. All

government schools in the region were required to adopt the NSW Fresh Tastes @ School (FT@S) Healthy School Canteen Strategy⁽¹¹⁾ released by the NSW Department of Education in 2005. FT@S classifies foods and beverages sold in school canteens as 'green' (high nutritional value), 'amber' (moderate nutritional value) or 'red' (low nutritional value) based on their nutritional content (Tables 1 and 2). FT@S recommends school canteens should 'fill their menu' with green foods (interpreted by the research team as $\geq 50\%$ of menu items), not allow amber items dominate their menu and remove items classified as 'red' from regular sale.

Design

The study employed a cross-sectional design.

Sample and recruitment

A nested sample of fifty government primary schools was randomly selected from a sample of seventy schools participating in a larger randomised controlled trial. The larger randomised controlled trial was conducted from 2013 to 2015 and aimed to improve canteen compliance with FT@S⁽¹⁹⁾. Full details of the larger trial have been previously reported⁽¹⁹⁾. Primary schools were eligible to participate in the broader trial if they: (i) enrolled children aged 5–12 years; and (ii) had an operational canteen in February 2015 (i.e. southern hemisphere summer). Schools that enrolled both primary and secondary students, exclusively catered for children with special needs or were currently compliant with FT@S were excluded (<20% of schools). Catholic and Independent schools were also excluded, as the FT@S policy is not mandated in these schools. There were no additional eligibility inclusion criteria for participation in the present study. Principals of the fifty randomly selected schools received

Table 1 Food and beverage* classifications according to the Fresh Tastes @ School (FT@S) criteria⁽¹¹⁾

Green	Amber	Red
(Good source of nutrients: contain less saturated fat and/or sugar and/or salt; help avoid excess kilojoule intake)	(Some nutritional value: moderate levels of saturated fat and/or sugar and/or salt)	(Lack adequate nutritional value: high in saturated fat and/or sugar and/or salt; contribute excess kilojoules)
<ul style="list-style-type: none"> • High-fibre, low-fat, low-sugar breakfast cereals, pasta and noodles • Breads • Fruits including frozen, canned, dried • Vegetables • Legumes • Reduced-fat dairy products • Lean meat, fish, poultry, meat alternatives • Water • Fruit juice <200 ml 	<ul style="list-style-type: none"> • Breakfast cereals with high levels of sugar • Some savoury commercial products • Spreads, sauces or gravy high in saturated oil or salt • Some savoury snack foods and biscuits • Small servings of un-iced cakes, muffins or biscuits • Full-fat dairy foods • Small servings of un-coated ice creams, milk-based ice confections, dairy desserts • Processed meats • Diet soft drinks • Fruit juice > 200 ml 	<ul style="list-style-type: none"> • Deep-fried foods • Large servings of cakes, muffins, sweet pastries, slices • Confectionery • Chocolate-coated ice creams • Sugar-sweetened drinks†

*Combination foods such as sandwiches or hot meals were classified according to a 'ready reckoner' within the FT@S.

†Sugar-sweetened drinks that meet the nutritional criteria for 'red' foods outlined in the FT@S Canteen Menu Planning Guide are classed as 'banned' and not permitted for sale in school canteens or school vending machines at any time.

Table 2 The occasional food criteria for determining if a food is red⁽¹¹⁾

Hot foods assessed per 100 g	Energy (kJ) per 100 g	Saturated fat (g) per 100 g	Na (mg) per 100 g	
Savoury pastries, pasta, pizzas, oven-baked potato products, spring rolls, fried rice and noodles	>1000	>5	>400	
Crumbed & coated foods (e.g. patties, chicken products, frankfurters)	>1000	>5	>700	
Snack foods and drinks assessed per serving	Energy (kJ) per serving	Saturated fat (g) per serving	Na (mg) per serving	Fibre (g) per serving
Snack food bars, sweet biscuits	>600	>3		< 1.0
Savoury snack foods, biscuits	>600	>3	>200	
Ice creams, milk-based ice confections	>600	>3		
Cakes, muffins, sweet pastries	>900	>3		< 1.5

If the item has more than the number specified in the energy, saturated fat or Na column, or less than the number in the fibre column, it is a red food.

an information letter inviting their school to participate in the study and informing them of the study procedures.

Measures and data collection

School characteristics

Principals of participating schools completed a computer-assisted telephone interview conducted by a trained research assistant. Principals completed items used in previous surveys of school principals^(20–22) to assess school characteristics, including school size (number of students enrolled) and school location (postcode area).

Canteen characteristics

School canteen managers participated in a computer-assisted telephone interview and completed items assessing the operational characteristics of canteens, including days of operation and whether the canteen manager and staff were volunteers, paid employees or both.

Food and beverage availability on school canteen menus

All canteen managers were asked to provide a copy of their canteen menu for Term 1, 2015 (i.e. their summer canteen menu). Managers were prompted with a reminder call if menus had not been received within one week. Menus were independently audited by two dietitians, blinded to group allocation, based on validated procedures for menu review previously described elsewhere^(11,23,24) and using published FT@S resources to classify menu items as 'green', 'amber' or 'red' according to the FT@S criteria⁽¹¹⁾. If classification of an item could not be determined from the menu alone, canteen managers were contacted to provide additional information (e.g. brand, serving size). Discrepancies in menu item classification between dietitians were resolved through discussion and consensus or with a third dietitian if agreement could not be reached.

Environmental characteristics

One dietitian reviewed each school's Term 1, 2015 menu to assess the presence of menu-labelling strategies. Use of

any of the following strategies to indicate the nutritional value of any menu item was sufficient to be classified as 'implementing' menu-labelling practices: traffic-light symbols (green, amber or red), graphical symbols (e.g. a smiley face, tick or shape immediately adjacent to the item name), kilojoule content or other (e.g. descriptive terms such as 'light', 'low-fat'). The same dietitian used the school's menu to identify whether healthy foods were promoted through use of 'meal deals' (defined as two or more food or beverage products, at least one of which was classified as 'healthy' (green), and at a discounted price when purchased together). Schools were classified as 'implementing' this practice if all the meal deals listed on their menu contained at least one 'green' item. Canteen managers were asked in the computer-assisted telephone interview whether they positioned healthy foods prominently in their canteen. Specifically, schools were classified as 'implementing' this practice if the canteen manager reported that fruit and vegetables were positioned on the counter or at eye level.

Student purchasing of foods and beverages from school canteens

Student purchasing data were collected during a one-day field observation at participating school canteens. Research assistants (with dietetic qualifications) conducted observations using data collection tools and procedures designed specifically for the present study and pre-piloted in two canteens. All research assistants attended a one-day (7.5 h) intensive training course in the data collection procedures. The training incorporated a quality assurance component which required research assistants to achieve 100% accuracy in recording of students' purchases using the observation tool in a simulated canteen setting.

Depending on the size of the canteen and number of service lines, two or three trained research assistants attended each school and observed canteen practices from two hours before the morning break until the end of the food service period (i.e. after the lunch break). Each research assistant kept a tally of canteen purchases including those made at each meal break by each student. Data checks were

performed in 20% of schools where each individual student's purchase was recorded by two independent observers (i.e. an additional one or two research assistants per school). Agreement between observers in the products recorded per student purchase was 95%.

All data were re-identifiable to enable matching by the statistician conducting the analysis. After data entry and matching were complete, all identifying information was removed.

Statistical analysis

Statistical analyses were performed using the statistical software package SAS version 9.3. Descriptive statistics were used to describe the characteristics of the schools and canteens participating in the study. NSW Department of Education School Directory⁽²⁵⁾ classifications were used to classify schools as small (<160 students enrolled) and medium/large (\geq 160 students enrolled). The median value assigned to postcodes of the Socio-Economic Indexes for Areas (SEIFA)⁽²⁶⁾ was used to classify schools as located in a higher or lower socio-economic region. Consistent with definitions and classification criteria used by FT@S, items classified as 'green' were defined as foods and beverages of 'high nutritional value'; those classified as 'amber' were defined as foods and beverages with 'moderate nutritional value'; and those classified as 'red' were defined as foods and beverages with 'low nutritional value'. Separate general linear models were used to describe the association between availability of green, amber and red items, and student purchasing of these items, respectively, while controlling for school group allocation of the larger randomised controlled trial, school size, socio-economic status of the region where the school was located and other prognostic factors such as presence of menu labelling, promotion and position of menu items within the school food environment. The R^2 statistic was used to report the proportion of variance explained by the model. Alpha was set at 0.05. An analysis to describe the school characteristics and environmental characteristics of schools of high and low availability (dichotomised at the median) of green and red items was also undertaken.

Results

Of the fifty eligible schools that were randomly selected, 76% (n 38) consented and participated in the present study. There were no significant differences among schools that did and did not consent to participate in baseline school characteristics ($P > 0.05$). The characteristics of participating schools and canteens can be seen in Table 3.

Average proportion of foods and beverages available on menus

Green items represented on average 47.9% of all canteen items (range: 36.0–69.0%) across schools. The availability

Table 3 Characteristics of the participating government primary schools and canteens (n 38) from the Hunter New England region of New South Wales, Australia, Term 1, 2015

Characteristic	n	%
School size		
Medium/large (\geq 160)	27	71
Small (<160)	11	29
Socio-economic region*		
Higher (socio-economically advantaged)	22	58
Lower (socio-economically disadvantaged)	16	42
Days of canteen operation		
5 d/week	19	50
<5 d/week	19	50
Type of canteen manager		
Paid	25	66
Volunteer	13	34
Type of canteen staff		
Both paid and volunteers	19	50
Volunteers only	19	50

*Status was determined based on the postcode of the school locality and the Socio-Economic Indexes for Areas 2011.

of amber items on canteen menus represented on average 47.4% of all canteen items (range: 31.0–59.0%) across schools. Red items represented on average 4.7% of all canteen items (range: 0–17.0%). There were few differences in school and environmental characteristics of schools with high and low availability of green and red, except for labelling and promotion which appeared to be associated with a higher availability of green (labelling and promotion) and lower availability of red (labelling); however, such differences did not reach statistical significance (see online supplementary material, Supplemental Table 1).

Average proportion of items purchased by students

Green items represented on average 30.1% of all items purchased by students (range: 6.5–65.0%) across schools. Amber items were the most frequently purchased and represented on average 61.8% (range: 30.4–89.3%) of all purchased items across schools. Red items represented 8.1% of all items purchased (range: 0–34.7%) across schools.

Association between food and beverage availability on menus and purchasing by students

Results from the general linear models predicted that, as the availability of green items on a canteen menu increased, so did the purchasing of these items (Fig. 1). For students to have the majority of their purchases consist of healthier foods (\geq 50%), the menu would need to consist of over 70% green items. Despite the similar average availability of amber items on menus compared with green items (47.9 and 47.4%, respectively), the purchasing of amber items occurred at a much higher rate (Fig. 2). For example, having only 40% of amber items available would result in approximately 50% of students' purchases being amber items. As with green and amber items, higher rates

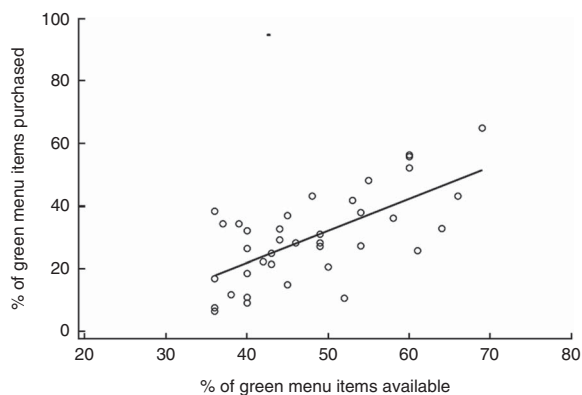


Fig. 1 Association between availability and purchasing of green menu items by students in randomly selected government primary-school canteens (*n* 38) from the Hunter New England region of New South Wales, Australia, Term 1, 2015

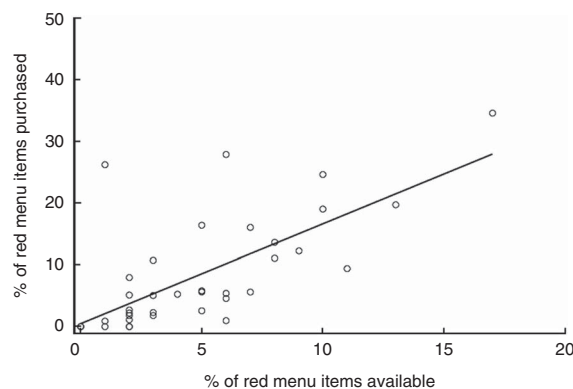


Fig. 3 Association between availability and purchasing of red menu items by students in randomly selected government primary-school canteens (*n* 38) from the Hunter New England region of New South Wales, Australia, Term 1, 2015

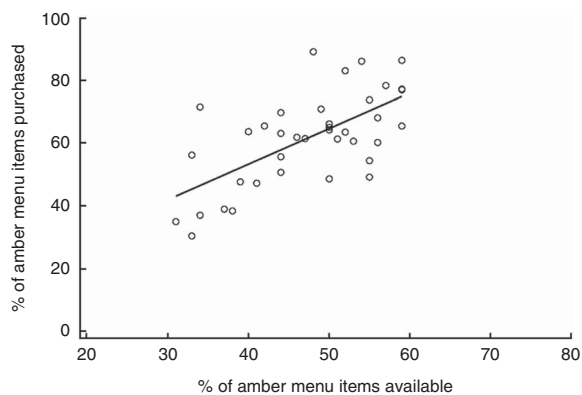


Fig. 2 Association between availability and purchasing of amber menu items by students in randomly selected government primary-school canteens (*n* 38) from the Hunter New England region of New South Wales, Australia, Term 1, 2015

of red item purchasing increased as red item availability increased (Fig. 3). For example, even with only 5% of red items available on a menu, approximately 10% of students' purchases would contain red items. The positive associations described above were found to be significant for the availability and purchasing of green items ($R^2=0.66$), amber items ($R^2=0.57$) and red items ($R^2=0.61$). In each case, a 1% increase in availability of items in these categories was associated with an increase of between 1.21 and 1.67% in the purchasing of these products (Table 4).

Discussion

The present study sought to describe the association between food and beverage availability at school canteens and student food and beverage purchasing. The study found a significant positive relationship between food and

beverage availability and purchasing across items classified as having high nutritional value (green), moderate nutritional value (amber) or low nutritional value (red). In each case, a 1% increase in the availability of these foods and beverages corresponded to an increase in student purchasing of such foods of between approximately 1.0 and 1.7%. The models predicted that greater restrictions on the availability of products with low nutritional value, or an increase in the availability of foods and beverages with high nutritional value, may have a significant impact on purchasing behaviours and, in turn, improve child nutrition.

These findings are consistent with a previous systematic review which demonstrated that initiatives to alter the availability of foods and beverages may have an impact on the foods and beverages purchased or consumed by children⁽¹⁷⁾. For example, in one US study of over 10 000 children from more than 2000 schools, it was reported that 24% of children purchased at least one sweetened beverage in schools with a policy permitting sweetened beverages, compared with only 8% of children in schools with a policy that banned the availability of such beverages⁽²⁷⁾. Similarly, in sports settings, an increase in the availability of healthy items at food outlets from 9.1 to 25.0% corresponded with a significant increase in healthy item purchases, predominantly by children, of 7.7–22.7%⁽²⁸⁾. A positive association between food availability and child consumption has also been demonstrated in the home environment⁽²⁹⁾.

While the absolute increases in the availability of green, amber and red items were associated with similar absolute changes in students' purchase of these products, there was variation between these categories in the underlying likelihood of children selecting such products. In many jurisdictions in Australia, school food policies recommend that school canteens increase the proportion of menu items classified as green to at least 51%, reduce the proportion of items classified as amber and remove items classified as red^(11,30–32). However, modelling in the present study suggests that a higher percentage of green items

Table 4 Association between the availability of menu items and purchasing by students in randomly selected government primary-school canteens (*n* 38) from the Hunter New England region of New South Wales, Australia, Term 1, 2015*

Availability	Estimate†			SE	<i>t</i>	<i>P</i>
	Green item purchase (%)	Amber item purchase (%)	Red item purchase (%)			
Green item availability	1.21	–	–	0.21	5.78	<0.001
Amber item availability	–	1.35	–	0.24	5.67	<0.001
Red item availability	–	–	1.67	0.31	5.45	<0.001

*Data were analysed using separate general linear models while controlling for group allocation, school size, socio-economic status of the region, presence of menu labelling, promotion and position of menu items within the school food environment.

†The estimate represents the mean increase in purchase (%) for every increase in availability of 1%.

on the canteen menu is required (>70%) to ensure the majority ($\geq 50\%$) of students' purchases include green items. This was compared with the much lower threshold for the proportion of amber foods available on the menu (40%) required to achieve $\geq 50\%$ of sales from this category. The findings have important implications for policy makers, suggesting that the availability of foods with lower nutritional value in school canteens disproportionately impacts students' purchases relative to foods of higher nutritional value. Given current barriers to healthier food provision in school canteens^(33–35), further increasing the availability of healthier foods to ensure that the majority of purchases are for healthy foods represents a considerable challenge. Identification of strategies to support schools in the implementation of healthy canteen policies may be required. Revision of policy recommendations regarding the proportion of green items on canteen menus may also be required in Australian jurisdictions.

Previous studies of availability and child purchasing in schools^(27,36,37) have relied on self-report data. The strengths of the present study include its use of objective observation data for students' purchases and the rigorous assessment of canteen menus to classify menu items, based on a randomly selected sample of schools within one region of NSW. Nevertheless, the findings of the study should be interpreted in the context of a number of methodological characteristics. Primarily, the distribution of the availability of items in each category (red, amber, green) was limited. This was particularly the case for items categorised as 'red' where availability ranged from 0 to 17%. The capacity of the study to describe the association between availability across a broader distribution was therefore limited. Furthermore, the cross-sectional design of the study does not permit causal attribution of the relationship between food availability and students' purchases as it does not account for secular (temporal) changes in purchasing behaviour or other confounding factors. However, the analyses controlled for a number of prognostic factors (e.g. school socio-economic status, size, school allocation and environmental characteristics). Nevertheless, the study would be strengthened by use of a prospective study design, with a greater number of participating schools and repeated observations of student purchasing across the week.

Conclusions

The present study demonstrated a significant positive association between the availability of green, amber and red items, and their purchasing by students in school canteens. The results indicate that to achieve a majority of purchases from green items, the proportion of green items available on the menu needs to increase to at least 70%. The identification of strategies to support schools to ensure that a greater availability of green items is achievable may assist in the implementation of this policy and improve student nutrition.

Supplementary material

To view supplementary material for this article, please visit <https://doi.org/10.1017/S1368980018001726>

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R.W., L.J., T.D., C.L. and K.R. contributed to the study method, design and intervention development. T.C.-M., L.J., T.R., A.G., T.D. and L.W. contributed to manuscript development. All authors reviewed, edited and approved the final manuscript. *Ethics of human subject participation*: This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving human subjects were approved by the Human Research Ethics Committees of the University of Newcastle (approval number H-2008-0343) and the Hunter New England Local Health District (06/07/26/4.04). The project was also approved by the NSW Department of Education and Communities (DEC; #2012277) and the State Education Research Applications Process (SERAP). Written informed consent was obtained from all participants.

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