Beverages and snacks available in vending machines from a subset of Ontario secondary schools: Do offerings align with provincial nutrition standards?

Taryn Orava, PhD,[1] Steve Manske, EdD,[1,2] Rhona Hanning, PhD[1]

ABSTRACT

OBJECTIVES: As part of an evaluation of Ontario's School Food and Beverage Policy (P/PM 150) in a populous Ontario region, this research aimed to: 1) identify, describe and categorize beverages and snacks available for purchase in secondary school vending machines according to P/PM 150 standards; and 2) compare the number and percentage of beverages and snacks within P/PM 150 categories (*Sell Most*, *Sell Less*, *Not Permitted*) from Time I (2012/2013) to Time II (2014).

METHODS: Representatives from consenting secondary schools assisted researchers in completing a Food Environmental Scan checklist in Times I and II. Sourced nutritional content information (calories, fats, sodium, sugars, ingredients and % daily values) was used to categorize products. The number and percentage of products in P/PM 150 categories were compared between Times by paired *t*-tests.

RESULTS: Of 26 secondary schools participating in total, 19 participated in both Time periods and were included in the study. There were 75 beverages identified (59 Time I, 45 Time II), mostly water, juices and milk-based beverages; and 132 types of snacks (87 Time I, 103 Time II), mostly grain-based snacks, vegetable/fruit chips, and baked goods. A majority of schools offered one or more Not Permitted beverages (47% Time I, 58% Time II) or snacks (74% Time I, 53% Time II). Significantly more schools met P/PM 150 standards for snacks ($p = 0.02$) but not beverages in Time II.

CONCLUSION: Full P/PM 150 compliance was achieved by few schools, indicating that schools, school boards, public health, and food services need to continue to collaborate to ensure nutrient-poor products are not sold to students in school settings.

KEY WORDS: Food dispensers; automatic; nutrition policy; schools; public health

La traduction du résumé se trouve à la fin de l'article.

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In order to combat the rising incidence of childhood obesity, global (i.e., World Health Organization [WHO]), national (i.e., Public Health Agency of Canada) and provincial (i.e., Ontario Healthy Kids Panel) health promotion agencies have recommended prevention strategies within school food environments.[1–3] A majority of children in westernized countries consume approximately one third of their daily caloric intake at school, some of which derives from foods and beverages purchased from school vending machines.[4,5] The stocking of energy-dense, nutrient-poor foods within vending machines may lead to increased consumption of such foods and defer consumption of nutrient-rich fruits and vegetables.[6–9] Schools are highly influential on the development of health behaviours, including healthy eating, which may continue into adulthood.[10–12]

Based upon the Social Ecological Model, the Comprehensive School Health framework recognizes the school's role in promoting, effecting and sustaining student health behaviour change through support of four pillars (Social and Physical Environment, Teaching and Learning, Partnerships and Services, and Healthy School Policy).[13,14] This article focusses on how the implementation of a school nutrition policy affected the quality of foods available in the school physical environment. In 2011, the Ontario Ministry of Education mandated the Ontario School Food and Beverage Policy (i.e., P/PM 150), a set of nutritional standards for foods and beverages offered for sale in publicly-funded elementary and secondary school food venues, at events and through snack/meal programs.[15] *Sell Most*, *Sell Less* and *Not Permitted for Sale* categories differentiate the quality of foods sold according to nutritional content, specifically calories, fat, sodium, carbohydrates and, in some cases, calcium.[15] *Sell Most* products have the highest nutrient quality and must comprise ≥80% of a food venue's offerings, *Sell Less* products are of modest nutrient quality and may comprise ≤20%, and *Not Permitted for Sale* products are prohibited.[15] Therefore, policy adherence is achieved if 100% of products sold are *Sell Most* or meet the 80–20, *Sell Most-Sell Less* rule.[15]

Author Affiliations

1. School of Public Health and Health Systems, University of Waterloo, Waterloo, ON
2. Propel Centre for Population Health Impact, Waterloo, ON

Correspondence: Rhona Hanning, PhD, School of Public Health and Health Systems, University of Waterloo, 200 University Avenue West, Waterloo, ON N2L 3G1, Tel: 519-888-4567, ext. 35685, E-mail: RHanning@uwaterloo.ca

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School stakeholders have faced several challenges in implementing P/PM 150 and have raised concerns that not all foods available for purchase in school food venues are compliant.[16,17] Studies to date, though valuable, have not clearly identified the types of beverages or snacks that are non-compliant, nor conducted an audit of school vending machines in Ontario secondary schools. Furthermore, compliance, which typically takes years to achieve successfully, has not been tracked over time.[9,18,19]

The public health department of a populous region in Ontario partnered with the University of Waterloo to examine P/PM 150 implementation within regional schools. This comprehensive process evaluation included surveillance of student behaviours, interviews and focus groups with school stakeholders, an evaluation of food retail density around schools and an investigation of the school food environment. As part of the food environment investigation, the primary objective of the current study was to identify, describe and categorize beverages and snacks available for purchase in school vending machines according to P/PM 150 nutritional standards. The secondary objective was to compare the number and percentage of beverages and snacks within P/PM 150 categories between two time points across early years of implementation.

METHODS

Study design

Policy implementation is an ongoing process, not a static event. Consequently, the audit was conducted at two time points during early P/PM 150 implementation: Time I (winter/spring 2012 and winter/spring 2013) and Time II (winter/spring 2014). Timelines were influenced by protocols outlined by school board research ethics committees, school representative availability and the political climate.

Setting

This research took place in a large, ethnically diverse region of Ontario. Representatives from the regional public health unit, university research team and school boards formed an advisory board to oversee all aspects of the project. Ethics approval was received from the Office of Research Ethics at the University of Waterloo and the research advisory committees of participating school boards.

Participants

Only data from secondary schools are included, due to the greater availability of vending machines at that level than at the elementary school level. All regional secondary schools ($N = 60$) were eligible and invited to participate. Following consent for school participation, the administrator nominated a representative (e.g., administrator, teacher and/or staff member) to facilitate data collection.

Instruments

A Food Environmental Scan (FES) checklist enabled systematic documentation of products offered for sale within all school food/beverage vending machines. The FES was designed by the university research team based on a review of existing literature, expert review by the advisory board and pre-testing within another region of Ontario in 2010. Box 1 outlines the protocol. Time II procedures remained consistent with Time I; vending machine food service personnel were unaware of the site visit date.

Data management

FES close-ended questions were entered into Microsoft Excel, from which descriptive statistics were calculated. Product photographs were entered into QSR International NVivo 10 qualitative analysis software (Burlington, MA) and underwent coding for identification, classification and categorization guided by the P/PM 150 Resource Guide:[20]

Step 1: Calculate trans fat (grams) and compare to Trans Fat Standards;[20]

Step 2: Identify P/PM 150 subgroup for type of snack or beverage;[20]

Step 3: Compare nutritional content information (appropriate to serving size) to P/PM 150 standards for the applicable subgroup and categorize as *Sell Most*, *Sell Less* or *Not Permitted for Sale*.[20]

Comparison Over Time

Means and standard deviations across schools were calculated in order to describe the number and variety of products within food and beverage subgroups and P/PM 150 categories in Time I and Time II. Paired *t*-tests were used to compare the number and percentage of products within P/PM 150 categories within schools across time ($p \leq 0.05$).

Box 1. FES checklist description

The Food Environmental Scan checklist

Protocol: Conducted by two research assistants (RA) with Master's degrees; Time I RA was trained by tool developers during pre-test; Time II RA was trained by Time I RA. The elected school representative accompanied the RA on a physical walkabout of the school to locate vending machines.

Questions: Using an electronic survey platform (FormConnect® for IPad), the RA asked the school representative a series of close-ended questions:

- Are there vending machines?
- If so, how many?
- How many vending machines sell beverages?
- How many vending machines sell snacks?
- How many vending machines sell both beverages and snacks?

Photographs: During the physical walkabout, the RA took photographs of each product offered for sale in all school vending machines. Products were captured once per vending machine and counted once per school. For example, if a vending machine sold the same water product in multiple slots, it would be counted as one product within the school, and one product within the global food venue of "vending machines".

RESULTS

Although 26 secondary schools participated in total (42% response rate), only the 19 schools that participated in both Times I and II are included. Participating schools reflected the region in urban–rural distribution (95%–5% participating schools; 93%–7% regionally respectively) and public–Catholic schools (58%–42% participating schools; 57%–43% regionally respectively). The mean household income for participating schools was $91,175 (min $60,414, max $164,603), which was above the regional mean household income of $88,576 (min $50,109, max $194,480).[21]

In Time I, 18/19 schools offered beverages and 15/19 offered snacks. A total of 56 vending machines were identified in Time I (31 offering beverages, 17 offering snacks, 8 offering a combination of beverages and snacks), with an average of 3 vending machines per school (range: 0–6). In Time II, 19/19 schools offered beverages and 12/19 offered snacks. A total of 53 vending machines were identified (35 offering beverages, 14 offering snacks, 4 offering a combination of beverages and snacks), with an average of 3 vending machines per school (range: 0–5).

Description of beverages

This audit identified 8 P/PM 150 beverage subgroups in both time periods (Table 1). A total of 75 different beverage products were recorded: 59 in Time I (11 ± 6.27 beverages/school) and 45 in Time II (8 ± 4.09 beverages/school).

Beverage offerings appeared to remain consistent between the two time points, with a slight increase in the number of schools offering flavoured water (2 schools Time I, 5 schools Time II) and a reduction in the number of juice/juice blends offered (24 products Time I, 12 products Time II). Based upon P/PM 150 standards, all water, milk, yogurt drinks and soy beverages were considered *Sell Most* due to low levels of fat (≤5 g) and high levels of calcium (≥25% daily value) per container. Soft drinks and flavoured waters automatically fell within *Sell Less* as long as they were ≤40 calories per container and caffeine-free. Many milk-based beverages (6 Time I, 6 Time II) and juice/juice blends (8 Time I, 2 Time II) were high in sugar (≥28 g per serving) and considered *Not Permitted for Sale*.

Ten schools in Time I (53%) met P/PM 150 beverage standards: 6 schools met the 80–20 guideline, 3 schools offered exclusively *Sell Most* beverages and 1 school offered no beverages. In Time II, 7 schools (42%) met P/PM 150 standards: 5 schools met the 80–20 guideline and 2 schools offered exclusively *Sell Most* beverages. One school in Time I offered more *Sell Less* products than *Sell Most*. Nine schools in Time I (47%) and 11 schools in Time II (58%) included one or more *Not Permitted for Sale* beverages (most often a sugary milk-based beverage). No significant differences were identified between Time I and Time II for the number and/or percentage of *Sell Most*, *Sell Less* or *Not Permitted* beverages.

Description of snacks

The audit identified 8 subgroups for snacks in Time I and 7 subgroups in Time II (Table 2). A total of 132 different snacks were recorded: 87 in Time I (14 ± 9.56 snacks/school) and 103 in Time II (18 ± 13.18 snacks/school).

Between data collection periods, fewer schools offered baked goods (11 schools Time I, 9 schools Time II) and grain-based snacks (15 schools Time I, 8 schools Time II), yet more product varieties were offered (25 baked goods Time I, 38 baked goods Time II; 15 grain-based snacks Time I, 17 grain-based snacks Time II). Products within cheese, yogurt, dried meat categories and a majority of fruit snacks/leathers were all categorized as *Sell Most*. Baked goods, grain-based snacks and vegetable/fruit chips within *Not Permitted for Sale* categories were often categorized as such due to high contents of fat per serving (≥5 g for baked goods; ≥3 g for grain-based snacks and fruit/vegetable chips) or low levels of fibre (≤2 g for baked goods). Confectionaries are strictly *Not Permitted for Sale* within all provincial schools.

Four schools in Time I (21%) met P/PM 150 standards for snacks because these schools offered no snacks at all. In Time II, 9 schools (47%) met P/PM 150 standards, 2 offering exclusively *Sell Most* snacks and 7 offering no snacks. Alternatively, 1 school in Time I (5%) offered more *Sell Less* items than *Sell Most*. Fourteen schools in Time I (74%) and 10 schools in Time II (53%) offered *Not Permitted for Sale* snacks. No significant differences were reported between the number and/or percentage of *Sell Most*, *Sell Less* or *Not Permitted for Sale* snacks between Times I and II.

Reaching full P/PM 150 compliance

Only 3 schools (16%) met P/PM 150 standards for beverages and snacks in both Times I and II: 1 school provided exclusively *Sell Most* beverages and no snacks; the other 2 met the 80–20 guideline. A majority of schools ($n = 16$, 84%) offered one or more *Not Permitted for Sale* products in Time(s) I and/or II, with 3 schools (16%) failing to meet P/PM 150 standards in both Times for beverages and snacks. There was no significant difference in the number of schools meeting P/PM 150 standards for beverages between Times; however, significantly more schools in Time II ($p = 0.02$) met P/PM 150 standards for snacks (0.47 ± 0.51) compared to Time I schools (0.21 ± 0.42; 95% CI, −0.48 to −0.05).

DISCUSSION

In the Comprehensive School Health framework, P/PM 150 falls within the Healthy School Policy pillar, impacting the Social and Physical Environment pillar, as it attempts to make healthy beverages and snacks available to students.[14] This research identified 207 products (75 beverages, 132 snacks) with varying degrees of P/PM 150 compatibility within secondary school vending machines. Findings demonstrated that *Sell Most* products were generally available to students and policy compliance was possible for a small percentage of schools.

Although healthy products were available in both data collection periods, no significant differences were found between the number or percentage of products within the P/PM 150 categories over time. Some companies have adapted their products to better meet P/PM 150 standards, such as using alternative preparation methods (e.g., baked chips), adjusted product formulation (e.g., low fat yogurt) and altered serving sizes (e.g., ≤100 calories per pouch of cookies). Not all companies have made adjustments nor have all schools included healthier alternatives in vending machines, perhaps because specific non-compliant foods lead to larger profits and/or due to a misinterpretation of P/PM 150 standards. Regardless, there is a need for regional public health to continue to work with school stakeholders to improve the nutritional quality of products available for sale.

Table 1. Description and P/PM 150 classification of beverages within school vending machines

P/PM 150 beverage subgroup* and beverage subgroup description	Time I (n = 19)				Time II (n = 19)			
	Number of schools offering beverage subgroup (range of products per school)	Number of *Sell Most* products across schools	Number of *Sell Less* products across schools	Number of *Not Permitted for Sale* products across schools	Number of schools offering beverage subgroup (range of products per school)	Number of *Sell Most* products across schools	Number of *Sell Less* products across schools	Number of *Not Permitted for Sale* products across schools
Water: Plain water with no additives	17 (1–1)	2	–	–	18 (1–2)	3	–	–
Milk: 2%, 1% and skim white milk	6 (1–3)	5	–	–	7 (1–1)	2	–	–
Milk-based beverages: Flavoured milk including milk-based sports drinks	9 (2–9)	4	–	6	11 (3–9)	9	–	6
Yogurt drinks: Yogurt-based beverages	3 (1–3)	4	–	–	2 (1–2)	3	–	–
Soy beverages: Chocolate or vanilla soy milk	3 (1–2)	2	–	–	3 (1–1)	2	–	–
Juice and juice blends: 100% juices and from fruit/vegetable concentrate	18 (2–9)	16	–	8	18 (1–6)	10	–	2
Soft drinks: Regular, diet and caffeine-free soft drinks	10 (1–4)	–	6	2	10 (1–2)	–	3	–
Flavoured water: Fruit-flavoured water, vitamin and carbonated waters	2 (2–3)	–	4	–	5 (1–3)	–	4	1
TOTAL	18 (3–28)	33	10	16	19 (3–14)	29	7	9

* Subgroups determined by P/PM 150 Resource Guide 15.

Table 2. Description and P/PM 150 classification of snacks within school vending machines

P/PM 150 snack subgroup* and snack subgroup description	Time I (n = 19)				Time II (n = 19)			
	Number of schools offering snack subgroup (range of products per school)	Number of *Sell Most* products across schools	Number of *Sell Less* products across schools	Number of *Not Permitted for Sale* products across schools	Number of schools offering snack subgroup (range of products per school)	Number of *Sell Most* products across schools	Number of *Sell Less* products across schools	Number of *Not Permitted for Sale* products across schools
Fruit snacks and leathers: Made from 100% juice or concentrate, gummies and fruit leathers	6 (1–6)	11	–	–	9 (1–5)	8	–	1
Vegetables and fruit chips: Potato chips, but also chips made from other vegetables	11 (1–9)	3	4	6	10 (1–11)	4	4	9
***Baked goods*†:** Cereal bars and cookies	11 (2–10)	12	2	11	9 (2–20)	15	2	18
***Grain-based snacks*†:** Crackers, pita chips, pretzels, popcorn and other snack mixes	15 (1–7)	3	9	3	8 (2–7)	3	11	2
Cheese: Single serve cheese snacks	2 (1–1)	1	–	–	–	–	–	–
Yogurt: Variety of yogurt flavours such as blueberry, strawberry and vanilla	3 (1–5)	5	–	–	2 (1–2)	1	–	–
Dried meat: Beef jerky	3 (1–1)	1	–	–	4 (1–1)	1	–	–
Confectionary: Sugary snacks	6 (1–7)	–	–	16	6 (1–9)	–	–	19
TOTAL	15 (1–31)	36	15	36	12 (1–43)	33	17	49

* Subgroups determined by P/PM 150 Resource Guide 15.

† The P/PM 150 category could not be calculated for three baked-good products and one grain-based product in Time II as the product did not have a label (i.e., homemade cookie, homemade loaf, cereal square wrapped in plastic wrap, popcorn with no label or brand name).

There were significantly more schools achieving P/PM 150 standards for snacks in Time II compared to Time I, although this change may be attributed to a decline in the number of schools offering snacks in Time II. No significant difference was identified in the number of schools meeting P/PM 150 standards for beverages, underlining the need for continued improvement. Schools should be acknowledged, however, for their work to date as no school offered energy drinks, regular soft drinks, chocolate bars or deep fried potato chips in vending machines. The removal of such products demonstrates that schools have made progress, though research has indicated that it can take months to years to improve the nutritional quality of products offered for sale in vending machines.[9,16,22,23] The ability to make and sustain changes also requires ongoing support, a weakness identified in all evaluations of P/PM 150.[18,19]

The Ontario Ministry of Education-mandated P/PM 150 entrusted dissemination to regional school boards and left implementation to schools. This tiered structure led to confusion at the school level with regard to accountability for ongoing monitoring of the policy. The literature suggests that when school representatives are engaged with and concerned about the healthiness of vending machine products, their school is better able to achieve policy adherence.[15] If schools are held responsible for monitoring P/PM 150, regional public health units, school boards and the Ministry should encourage routine audits and celebrate the continued efforts of school stakeholders as they commit to making school food environments healthier for students.

In future iterations of the policy, the Ministry should consider the inconsistency of product categorization based upon sugar. While P/PM 150 standards attempt to limit the amount of sugary products available to students, this research identified a high prevalence of sugary *Not Permitted for Sale* milk-based beverages (with up to 38 g of sugar, not including lactose) and sugary *Sell Most* juice/juice blends (mean 31 g/container, range 14–57 g). The consumption of sugary milks or juices with 40 g of free sugar would contribute approximately 4%–5% of daily caloric intake for boys and girls respectively.[24] The WHO has strongly advised adults and children to limit their daily intake of free sugars to less than 10%, ideally below 5%, of their total daily energy intake, as a means of preventing dental caries and excess body weight.[25] Sugar intakes are highest during adolescence (9–18 years), with an estimated one quarter of total daily calories coming from products such as regular soft drinks, milk, fruit, confectionaries and fruit juice.[26] P/PM 150 restricts beverage container sizes to ≤250 ml for elementary schools but places no restriction for secondary schools. While the association between consumption of sugary beverages and weight does not prove causation, the Ministry should consider limiting the volume of juice/juice blends within the *Sell Most* category across all school levels.[27] Further, Canadian adolescent girls and boys often do not meet the daily minimum recommended servings of vegetables and fruits and should be encouraged to do so.[28] While juices contribute micronutrients and phytochemicals, their low fibre content and high glycemic index suggest other choices are preferred. The Ministry should encourage the provision of fresh vegetables and fruits as snacks in vending machines; none were identified in the current audit, although some were available in school cafeterias.

There is general public belief that foods sold in Ontario schools are aligned with P/PM 150 standards; however, this study identified that many products offered for sale are high in fat, sodium or sugar and low in fibre. The inclusion of *Not Permitted for Sale* and even *Sell Less* beverages and snacks may be misleading to students in the absence of an educational component encouraging students to select *Sell Most* items. A student may only be aware of the nutrient composition of a product once purchased, as not all food labels are visible within vending machines. In order to bring awareness of what constitutes a healthy snack, a range of stakeholders should be consulted (e.g., students, parents, educators, food service and government); product companies should align nutrition facts tables to container size and P/PM 150 standards to allow for quick interpretation; public health officials should partner with all stakeholders to promote the sale/purchase of *Sell Most* products; and policy-makers should consider lower prices for healthier options to help make the healthy choice accessible and affordable.

Strengths of this research included the consistency of product categories across two Times, having a trained research team conduct the FES and the reliability of sourced nutritional content information directly from product manufacturers. Nevertheless, products offered on the day of site visits may not reflect the full range of products offered across the school year. Additionally, the presence of products within vending machines does not reflect what was purchased by students. Research from randomized control trials indicate that offering healthier options in vending machines increases the sale of such items, without loss in the volume of products sold and/or loss of profits.[29] The current research concurs that audits should be repeated at multiple times during the school year to evaluate the consistency of products offered.[17] In addition, audit tools should build on the strength of the FES (e.g., inclusion of accessibility, availability, package size and healthfulness in relation to standards) through collecting price, promotion and promotion data using consistent approaches, as recommended by Matthews and Horacek (2015).[30]

School nutrition policies across Canada aim to enhance the healthfulness of foods offered to students. Yet evaluating adherence to policy and its effectiveness remains a challenge. The current evaluation of vending machine offerings over the early years of provincial policy implementation provides insight into the opportunities and challenges of school nutrition policies. Ultimately, this research can be used to enhance policy and its evaluation and contribute to improved student nutrition and health.

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RÉSUMÉ

OBJECTIFS : Dans le cadre de notre évaluation de la Politique concernant les aliments et les boissons dans les écoles de l'Ontario (note P/PM 150) dans une région densément peuplée de la province, nous avons cherché à : 1) identifier, décrire et catégoriser les boissons et collations en vente dans les distributeurs automatiques des écoles secondaires selon les normes de la note P/PM 150; et 2) comparer le nombre et le pourcentage de boissons et collations dans les catégories de la note P/PM 150 (*Vendre le plus*, *Vendre moins*, *Vente non permise*) entre la Période I (2012-2013) et la Période II (2014).

MÉTHODE : Les représentants des écoles secondaires consentantes ont aidé nos chercheurs à remplir une « analyse de l'environnement alimentaire » au cours des périodes I et II. Des informations d'autres sources sur la valeur nutritive (calories, matières grasses, sodium, sucres, ingrédients et % des valeurs quotidiennes) ont servi à catégoriser les produits. Le nombre et le pourcentage de produits dans les catégories de la note P/PM 150 entre les deux périodes ont été comparés à l'aide de tests *t* jumelés.

RÉSULTATS : Sur les 26 écoles secondaires participantes, 19 ont participé aux deux périodes et ont été incluses dans l'étude. Elles ont identifié 75 boissons (59 Période I, 45 Période II), principalement de l'eau, des jus et des boissons lactées; et 132 types de collations (87 Période I, 103 Période II), principalement des collations à base de céréales, des croustilles de légumes ou de fruits, et des produits de boulangerie. La majorité des écoles offraient une ou plusieurs boissons (47 % Période I, 58 % Période II) ou collations (74 % Période I, 53 % Période II) dont la vente n'était pas permise. Un nombre considérablement plus élevé d'écoles a respecté les normes de la note P/PM 150 pour les collations ($p = 0,02$), mais non pour les boissons, durant la Période II.

CONCLUSION : Peu d'écoles affichaient une conformité totale à la note P/PM 150, ce qui montre que les écoles, les conseils scolaires, la santé publique et les services alimentaires doivent poursuivre leur collaboration pour que des produits pauvres en éléments nutritifs ne soient pas vendus aux élèves en milieu scolaire.

MOTS CLÉS : distributeur automatique nourriture; politique nutritionnelle; école santé publique