

Measuring the Food Service Environment: Development and Implementation of Assessment Tools

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ABSTRACT

Objective: The food environment is increasingly being implicated in the obesity epidemic, though few reported measures of it exist. In order to assess the impact of the food environment on food intake, valid measures must be developed and tested. The current study describes the development of a food service environment assessment tool and its implementation in a community setting.

Methods: A descriptive study with mixed qualitative and quantitative methods at a large, North American university campus was undertaken. Measures were developed on the basis of a conceptual model of nutrition environments. Measures of community nutrition environment were the number, type and hours of operation of each food service outlet on campus. Measures of consumer nutrition environment were food availability, food affordability, food promotion and nutrition information availability. Seventy-five food service outlets within the geographic boundaries were assessed.

Results: Assessment tools could be implemented in a reasonable amount of time and showed good face and content validity. The food environments were described and measures were grouped so that food service outlet types could be compared in terms of purchasing convenience, cost/value, healthy food promotion and health. Food service outlet types that scored higher in purchasing convenience and cost/value tended to score lower in healthy food promotion and health.

Conclusion: This study adds evidence that food service outlet types that are convenient to consumers and supply high value (in terms of calories per dollar) tend to be less health-promoting. Results from this study also suggest the possibility of characterizing the food environment according to the type of food service outlet observed.

Key words: Food environment; food choice; instrument development; built environment

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

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The obesity epidemic is influenced by social, cultural, economic and physical contexts.¹⁻⁴ The accessibility, availability and affordability of foods have an impact on food purchasing and consumption behaviours. Access to healthy foods has been related to certain neighbourhood characteristics. Specifically, access to healthy foods is increased in higher-income neighbourhoods.^{5,6} Conversely, lower-income neighbourhoods may have increased access to fast food restaurants.^{7,8} Residents' diets have been found to correlate with their food environment, particularly in lower income and minority populations.^{5,6,9,10} There are few published conceptual models of the food environment^{3,11} and, until recently, even fewer tools to assess it.¹²⁻¹⁴ This paper describes the development and implementation of food environment assessment tools.

METHODS

Setting

Data were collected between January and May 2006 at the University of Alberta, which covers 50 square city blocks in a city of approximately one million people. The campus is workplace, school or home to at least 45,000 people and thus was deemed an appropriate setting in which to conduct the current study.

All food service outlets, defined as outlets preparing and serving food for immediate consumption, within the geographic boundaries of the campus were defined as the sample. Convenience stores (n=10) were excluded from the sample as the primary purpose of most convenience stores was not service of prepared meals. There were no grocery stores in the geographic area of study.

Measures

Measures were based on Glanz and colleagues' conceptual model of community nutrition environments.³

Community Nutrition Environment

Measures included the type and number of each food outlet in the community and reflected the accessibility of food service outlets.

Food outlet types were defined as Asian, burger outlets, cafeterias, coffee shops, pizza places, sandwich shops (main products are "subs", pitas or sandwiches), sit-down restaurants and smoothies outlets (i.e., outlets serving mostly dairy-based beverages blended with fruit or juice). The number of outlets in each category was tallied.

Consumer Nutrition Environment

Food availability: The number of healthy and unhealthy options of main meals, snacks and beverages were assessed for each type of food outlet type described above. "Healthy" and "unhealthy" foods were defined using the 2005 British Columbia Ministry of Education and Ministry of Health food classifications,¹⁵ as at the time of the study these were the only publicly accessible Canadian food classification guidelines available for educational institutions. Classifications are based on total energy (kcal) per serving, amount of processing and key nutrients (including saturated fat,

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Table 1. Convenience of Accessing Food from Different Outlet Types

Type of Outlet	Number	Proportion of Total (%)	Mean Number of Weekday Hours (SD)	Weekday Hour Range	Mean Wait Time in Minutes (SD)	Wait Time Range (min)
Asian outlet	8	10.7	53 (13.1)	33-75	3.5 (3.3)	1-8
Burger outlet	5	6.7	65 (12.3)*	53-86	2.7 (1.8)	1-4
Cafeteria	13	17.3	39 (14.1)	18-64	5.9 (4.0)	1-11
Coffee shop	12	16.0	67 (20.3)*	38-120	2.8 (3.1)†	0-8
Pizza place	8	10.7	55 (14.8)*	25-75	3.8 (4.3)	0-11
Sandwich shop	18	24.0	55 (18.1)*	20-80	4.2 (2.4)	1-10
Sit-down restaurant	6	8.0	65 (10.3)*	55-81	n/a	n/a
Smoothies outlet	5	6.7	34 (17.0)	30-70	2.3 (1.7)	0-4

* Indicates statistically significantly ($p \leq 0.05$) longer mean number of hours of operation than cafeterias, using regression analysis with categorical independent variables.

† Indicates statistically significantly ($p \leq 0.05$) shorter mean wait time than cafeterias, using regression analysis.

trans fat, sodium and sugar). Healthy foods and beverages were considered those in the “Choose Most” or “Choose Sometimes” categories.

Convenience: Wait times at each establishment and hours of operation were recorded as measures of convenience. Wait times were measured by calculating the difference between the time a customer entered a line-up during the lunch hour and the time the customer was handed his or her food. Wait times of sit-down restaurants were not assessed; for these, we assumed a slower service and lower convenience than fast-food outlets.

Additionally, the mean number and range of weekday and weekend hours of operation were calculated. Other indicators of convenience, such as parking and drive-thru service, were not measured, as the setting of this community (a university) precluded meaningful assessment. Specifically, the vast majority of outlets were located within main buildings on campus and thus had neither parking nor drive-thru service.

Food affordability: “Typical” foods, those predominantly advertised within an outlet or that were observed as commonly ordered items, were selected by the first author. Food price, food weight (g) and energy content were used to determine the energy density (kilocalories per gram) and energy cost (\$Cdn/100 kcal).¹⁶ Details of these methods, analyses and results are reported elsewhere (unpublished data: Minaker, Raine, Cash, 2007).

Food promotion: The number and subject of promotions within each outlet were assessed. Promotions were coded into one of the following categories: unhealthy, healthy and overeating. The previous definitions of healthy and unhealthy were used to code the promotions.¹⁵ In addition, promoting healthier preparation options (defined as any alternative method of preparing the same food to have a higher nutritional value or be lower in salt, fat or sugar) also counted as a “healthy” promotion. Advertising “sizing up” for value (e.g., “Super-size”, “Jumbo”, or “All you can eat” options) was classified as promoting overeating. Each advertisement was coded in up to two categories (e.g., Super-size options for burger and fries combinations were coded as both unhealthy and overeating).

Nutrition information: Nutrition information, information about the nutritional content of the food, was considered “available” if it could be found online or within the food outlet. The number of items with health-related labels on the menu was also recorded.

Analysis

Quantitative data were analysed using SPSS 12.0 for Windows (SPSS Inc., Chicago, IL, 2003). For each inferential statistical test, a p-value of ≤ 0.05 represented statistical significance.

Consumer Nutrition Environment

Food availability: Means and ranges of food availability data were reported where appropriate. In addition, the mean proportions of healthy main meals, snacks and beverages and specific food availability were regressed on categorical “dummy” variables representing each outlet type minus one “base case” that was varied to provide a complete set of pairwise comparisons. This form of dummy variable regression is equivalent to the use of a one-way ANOVA comparing all outlet types.

Convenience: To establish whether the hours of operation differed across outlet type, linear regressions were performed between weekday or weekend hours of operation and outlet type. Wait times were also regressed on outlet type.

Food promotion within food outlets: The number of advertisements and the corresponding proportion of each advertisement type were calculated. The mean proportions of the subject matter categories were regressed on outlet type.

Nutrition information: The proportions of outlets with health-related menu labels, the mean proportion of items labelled and the proportion of outlets with available nutrition information were each regressed on outlet type.

Composite rankings: To assess how these different food outlets were related to food choice constructs at an environmental level, measures developed to assess the nutrition environment were grouped into categories reflecting overall convenience, cost/value, health and health-promoting food advertising within outlets. Because of the diverse units of measurement used for the various observed measures, outlet types were ranked in each category. Ranks of each column were averaged to obtain the final rank of each outlet type. Where averages were identical, the same rank was given. Measures related to convenience were the number of outlets, hours of operation and wait times, and they were ranked such that the most convenient situations were ranked before less convenient situations. Measures in the cost/value grouping were super-size options, mean energy cost and mean energy density of typical foods. Outlets were ranked such that situations of higher value (in terms of energy) for the dollar were ranked before lower value situations. Measures related to health were the proportion of healthy food options available, healthier preparation options, specific healthy item availability, health-related food labels and availability of nutrition information; these were ranked such that healthier situations were ranked before less healthy situations. Finally, outlet types were ranked according to the three categories of promotions found within food outlets. Outlets were ranked such that more healthful promotions were ranked before less healthful promotions. Spearman’s rho was used to formally investigate this hypothesis.

Table 2. Proportion of Healthy Meals, Sides and Beverages by Type of Outlet

Type of Outlet	Number*	Mean % Healthy Main Meals	Number†	Mean % Healthy Sides or Snacks	Number‡	Mean % Healthy Beverages
Asian outlet	8	68	7	15	7	28
Burger outlet	5	9	5	14	4	28
Cafeteria	10	65	7	20	8	53
Coffee shop	5	47	12	11	12	32
Pizza place	7	12	5	21	6	22
Sandwich shop	18	53	16	32	17	29
Sit-down restaurant	5	47	5	27	5	24
Smoothies outlet	3	96	4	23	4	45

* Includes all establishments that serve main meals.

† Includes all establishments that serve sides or snacks.

‡ Includes all establishments that serve beverages.

Table 3. Number and Proportion of Different Advertisement Types* by Type of Outlet

Type of Outlet	Number of Ads	% Unhealthy Ads†	% Healthy Ads‡	% Overeating Ads§
Asian outlets	40	65	20	10
Burger outlets	44	64	2	18
Cafeterias	141	60	25	1
Coffee shop	63	48	10	2
Pizza place	35	86	3	6
Sandwich shop	114	50	25	5
Sit-down restaurants	7	29	14	0
Smoothies outlets	55	25	47	0

* The percentage of each type of advertisement may not add up to 100% because the subject matter of some ads fell beyond the scope of the four categories (e.g., ads for a contest). Alternatively, the percentage of each type of ad may add up to more than 100% because the subject matter of some ads was coded in up to two groups (e.g., 12 ads focused on both unhealthy food and overeating).

† All outlets had a statistically significantly lower mean proportion of unhealthy ads than pizza places; except for sit-down restaurants, all outlets had a statistically significantly higher mean proportion of unhealthy ads than smoothies outlets.

‡ All outlets had a statistically significantly lower mean proportion of healthy ads than smoothies outlets; except for sit-down restaurants, all outlets had a statistically significantly higher mean proportion of healthy ads than burger outlets and pizza places; coffee shops had a statistically significantly lower mean proportion of healthy ads than cafeterias and sandwich shops.

§ All outlets had a statistically significantly lower mean proportion of overeating ads than burger outlets; cafeterias, coffee shops and smoothies outlets had a statistically significantly lower mean proportion of overeating ads than Asian outlets.

RESULTS

Community Nutrition Environment

There were 75 food outlets within the geographic boundaries. Table 1 shows the number and proportion of total for each outlet type.

Consumer Nutrition Environment

Food availability: Seven of 75 food outlets offered super-size options. Burger outlets were significantly more likely to super-size than all other types of outlet (data not shown). Burger outlets and pizza places had lower proportions of healthy main meals than all other outlet types (range: $p=0.000$ when compared with Asian outlets to $p=0.015$ when compared with sit-down restaurants). Smoothies outlets had a higher mean proportion of healthy main meals than coffee shops ($p=0.006$), sandwich shops ($p=0.006$), and sit-down restaurants ($p=0.008$) (see Table 2 for number of outlets offering healthy main meals and proportion of healthy items assessed).

Sandwich shops had a higher mean proportion of healthy sides and snacks than coffee shops ($p=0.034$). All other comparisons were not statistically significant (see Table 2). Of the 18 sandwich shops, 12 (67%) allowed whole-wheat bread choices instead of white bread, and did so at no extra cost. Of the 10 cafeterias, 4 (40%) allowed whole-wheat bread choices instead of white bread. One of

Table 4. Summary of Outlet Type Characteristics*

Outlet Type	Convenience	Cost/Value	Health	Healthy Food Promotion
Asian outlet	3	4	7	6
Burger outlet	2	1	8	7
Cafeteria	5	6	4	3
Coffee outlet	1	2	5	5
Pizza place	3	3	6	6
Sandwich outlet	3	5	1	4
Sit-down restaurant	4	4	3	2
Smoothies outlet	3	7	2	1

* Rankings as noted in the text

the five burger shops offered baked potatoes instead of French fries for no additional cost. No other healthier preparation options were found on campus (data not shown).

Convenience: Table 1 describes the mean wait times and hours of operation associated with each outlet type. Cafeterias had longer wait times than coffee shops ($p=0.035$). All other comparisons were non-significant.

Food promotion within food service outlets: Table 3 compares advertisements by food outlet types. All overeating advertisements also advertised unhealthy foods. Pizza places had higher proportions of unhealthy advertisements than all other outlet types. Smoothies outlets had a lower mean proportion of unhealthy advertisements and a higher mean proportion of healthy advertisements than all other outlet types. Burger outlets had more overeating advertisements than all other outlet types.

Nutrition information: Smoothies outlets were more likely to label food on menus according to health or food content than Asian outlets ($p=0.002$), burger outlets ($p=0.021$), cafeterias ($p=0.019$), pizza places ($p=0.012$) and sit-down restaurants ($p=0.017$) (data not shown). Burger outlets were more likely to provide nutrition information than Asian outlets ($p=0.025$), cafeterias ($p=0.001$), coffee shops ($p=0.030$) and sit-down restaurants ($p=0.003$). Sandwich shops were more likely to provide nutrition information than were cafeterias ($p=0.000$) and sit-down restaurants ($p=0.005$). Pizza places were more likely to provide nutrition information than sit-down restaurants ($p=0.032$) and cafeterias ($p=0.009$). All other comparisons were not significant (data not shown).

Composite rankings: As presented in Table 4, composite rankings of outlet types that ranked higher in convenience and cost/value tended to rank lower in health and healthy food promotions. There was a positive correlation between convenience measures and cost/value measures ($r=0.67$, $n=8$, $p<0.10$). There was a negative correlation between cost/value measures and health ($r=-0.74$, $n=8$, $p<0.05$) and between cost/value measures and healthy food promotions ($r=-0.80$, $n=8$, $p<0.05$).

DISCUSSION

The measures developed, based on the literature to date and consistent with recently published nutrition environment measures,¹² yielded results consistent with expected outcomes, with some limitations (discussed below). The logic of the findings suggests both face and content validity. Future research is necessary to refine instruments, to address identified limitations (minor) and to assess reliability.

The most common reasons why frequent patrons of fast-food restaurants choose to patronize these restaurants are that they are quick, convenient, inexpensive and sell tasty food.¹⁷ People may also consider health when making food choices, even when eating out.^{18,19} The vast majority of the food outlets in the current study were fast-food restaurants – a broad category under which all outlet types in the current study other than cafeterias and sit-down restaurants fell. Although the current study did not address the “tastiness” of the food across outlet types, other reasons given by consumers in making food outlet choices were evaluated, including convenience, cost and health. Using composite rankings of convenience, cost and health, this study is the first to our knowledge to empirically show the relations among convenience, cost and health for different types of food outlet.

The current study distinguished between types of fast-food outlet with respect to the “health” of the outlets’ food environments. In other studies¹² fast-food outlets have been thought to represent unhealthy food environments, and living in proximity to such outlets has been related to obesity²⁰ and cardiovascular outcomes.²¹ Although the assumption that fast-food outlets represent unhealthy food environments is reasonable, based on the evidence that fast-food consumption is related to increased body mass index,²²⁻²⁴ the current study indicates that fast-food outlets are variable in the health of their food environments. For example, burger outlets ranked low in measures of health and healthy food promotions and higher in convenience and cost/value. On the other hand, fast-food smoothies outlets and sandwich shops ranked highly in health and healthy food promotions and lower in convenience and cost/value. To further illustrate the difference between types of fast-food outlets, burger outlets had the lowest mean proportion of healthy main meal options (9%) and smoothies outlets had the highest (96%). To include all types of fast-food outlets under one definition or construct may be less precise than specifying the type of fast-food outlet.

Following completion of this research, in 2007, the BC guidelines used to define healthy vs. unhealthy foods (the key measure used in assessing food availability within the consumer nutrition environment) were revised to reflect the updated Canada’s Food Guide. Major revisions include further restricting the sodium and fat content of many foods. This revision would likely alter the findings of this study slightly by reclassifying certain foods as unhealthy rather than healthy. Our findings could, therefore, be conservative.

Two measures developed in the current study – observing the availability of super-size options and nutrition information – may be less meaningful than originally thought. Every outlet that offered super-size options (eight outlets) and/or nutrition information (26 outlets) were corporate franchises. The availability of nutrition information may be more indicative of the company’s resources to have the nutrition content of food products evaluated than of whether the foods served are healthy. Larger chains may be under more external pressure to provide nutrition information.

Assessing the availability of nutrition information may not be a useful expenditure of time or resources when assessing the food environment, particularly given recent findings indicating that consumers may not use or even understand nutrition information.^{25,26} Future research to refine the scoring system could address these limitations.

Unhealthy food promotion was far more prevalent than healthy food promotion. Of all outlet types, smoothies outlets advertised unhealthy items least (25% of advertisements) and healthy items most (47% of advertisements). Conversely, pizza places advertised unhealthy options more (86% of advertisements) and healthy options very infrequently (only 3% of advertisements). Advertisements in food outlets may merely reflect the food sold within the outlets. Indeed, it seems intuitive that the proportion of healthy advertisements would reflect the proportion of healthy items available. This measure may therefore be considered redundant and thus a limitation in the scoring system. Alternatively, it could be an easily applied proxy for the overall healthfulness of the outlet. Further, it is possible that despite the availability of healthy foods at fast food outlets, the promotion of even healthy foods could contribute to over-consumption. Further research could investigate the context of people’s food choices in a variety of food service settings.

This study attempted to comprehensively evaluate the food service environment of a small community. It appeared that the current tool had some redundancies and that certain components of the tool were less useful than others. More research is needed to evaluate the worth of each of the tools described here and to explicate the relation between the food environment and residents’ diets.

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RÉSUMÉ

Objectif : L'environnement alimentaire est de plus en plus impliqué dans l'épidémie d'obésité, mais il a été peu mesuré. Afin d'évaluer l'incidence de cet environnement sur la consommation d'aliments, il faut créer et éprouver des mesures valides. Nous décrivons ici la création d'un outil d'évaluation de l'environnement des services d'alimentation et sa mise en œuvre en milieu communautaire.

Méthode : Nous avons mené une étude descriptive combinant des méthodes qualitatives et quantitatives sur un vaste campus universitaire nord-américain. Nos mesures reposaient sur un modèle théorique des environnements alimentaires. Nous en avons défini pour l'environnement de nutrition de la communauté (nombre, type et heures d'ouverture des débits de restauration sur le campus) et pour l'environnement de nutrition du consommateur (disponibilité alimentaire, abordabilité des aliments, promotion des aliments et disponibilité de renseignements nutritionnels). Nous avons évalué 75 débits de restauration dans les limites géographiques de l'étude.

Résultats : Les outils d'évaluation ont pu être mis en œuvre assez rapidement; leur validité apparente et leur validité de contenu étaient bonnes. Nous avons décrit les environnements alimentaires et regroupé les mesures de manière à pouvoir comparer les types de débits de restauration selon les heures d'ouverture, le prix, la promotion des aliments sains et la santé. Les types de débits de restauration qui ont obtenu les meilleures notes pour les heures d'ouverture et le prix avaient tendance à obtenir de moins bonnes notes au chapitre de la promotion des aliments sains et de la santé.

Conclusion : Cette étude confirme que les types de débits de restauration qui sont pratiques pour le consommateur et qui vendent des produits à fort rapport économique (nombre de calories par dollar) ont tendance à être moins favorables à la santé. L'étude montre aussi qu'il est possible de caractériser l'environnement alimentaire selon le type de débits de restauration qu'on y trouve.

Mots clés : environnement alimentaire; choix alimentaires; élaboration d'instruments; milieu bâti

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