Restaurant Menus
Calories, Caloric Density, and Serving Size

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Background: The increasing trend toward eating out, rather than at home, along with concerns about the adverse nutritional profile of restaurant foods has prompted the introduction of calorie labeling. However, the calorie content in food from sit-down and fast-food restaurants has not been analyzed.

Purpose: The calorie content of restaurant foods was analyzed in order to better understand how factors that determine calorie content may potentially influence the effectiveness of calorie labeling.

Methods: Nutritional information was collected from the websites of major (N=85) sit-down and fast-food restaurants across Canada in 2010. A total of 4178 side dishes, entrées, and individual items were analyzed in 2011.

Results: There was substantial variation in calories both within and across food categories. In all food categories, sit-down restaurants had higher calorie counts compared to fast-food restaurants ($p<0.05$). Both serving size and caloric density were positively correlated with calories; however, serving size was more strongly correlated ($r = 0.62$) compared to caloric density ($r = 0.29$). On average, items that were higher in calories had a larger serving size compared to items that were lower in calories ($p<0.05$); however, they were often not different in terms of caloric density.

Conclusions: Variation in calories per serving was seen when comparing various types of food, types of establishments, and the specific establishments that provided the foods. Compared to caloric density, serving size was shown to be a more important driver of calories per serving in restaurant foods.

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Introduction

Over the past 30 years, the prevalence of food consumed outside the home has increased, while obesity rates have risen simultaneously.[1,2] Presently in Canada, on any given day, 17.7 million people (approximately half the population) visit 80,800 foodservice establishments.[3] Eating outside the home has been associated with increased caloric intake[4,5] as well as increased risk for insulin resistance and obesity.[6–8] Currently, 24.1% of Canadians are obese, whereas 34.4% of Americans are obese.[9]

In light of these concerns, mandatory calorie labeling on menus, menu boards, and drive-through displays has been introduced as a policy option to address this situation. Menu labeling was included in the 2010 U.S. Health Reform legislation (although it is yet to be implemented nationally)[10] and was proposed recently in Ontario, Canada.[11] Although one study[12] showed that calorie labeling decreased calorie intake at certain chains and another[13] suggested that calorie labeling could decrease calories ordered for children, others[14–16] have shown no effects. Although studies[17,18] have demonstrated the prevalence of large portion sizes and their role in increasing energy intakes in the restaurant sector, to date, the relative role of serving size and caloric density as determinants of total calories in restaurant foods, as well as the impact of other factors that may influence calorie content, has not been investigated.

The objective of the current study was to use the company-provided nutrition data on chain-restaurant websites to analyze the calories in restaurant foods. Specifically, the aim of the present study was to (1) compare how calories, caloric density, and serving size vary according to the type of food and the type of establishment that a

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food is from; (2) determine if the average calories in sit-down restaurants differ among chains; (3) determine the relative role of serving size and caloric density as determinants of calories; and (4) compare the serving size and caloric density of items that are high in calories versus items that are low in calories.

It was hypothesized that calorie content is not only influenced by the type of food, serving size, and caloric density but also the type of establishment (whether it is a sit-down restaurant or fast-food restaurant) and the specific establishment that provides a food. Exploring these topics may provide insight into the potential usefulness of calorie labeling as a means to compare the calories in menu items and thus promote the consumption of lower-calorie items.

Methods

Data Collection

The study consisted of a systematic survey of Canadian sit-down and fast-food restaurants. A database containing nutrition information (including serving size and the 13 nutrients commonly found on food labels) for more than 9000 items from 85 chains across Canada was constructed. Any establishment that provided publicly available Canadian nutrition information online or in-store and that had ≥20 outlets in Canada (according to the *2010 Directory of Restaurant and Fast Food Chains in Canada*) was included.[19] Data were collected from September to December 2010 (with the exception of four establishments for which data were retrieved in early 2011). Data were analyzed and verified in 2011.

Construction of the Database

Establishments were categorized according to whether they were sit-down or fast-food restaurants, with sit-down restaurants distinguished by the presence of table service. Foods were categorized by food type and subcategorized according to various characteristics (i.e., salads with dressing/without dressing). Foods were further subcategorized according to whether they were considered side dishes, main entrées including side dishes, main entrées without sides, or single items that could be purchased individually. All categorizations were based on the data provided by establishments on their websites. When necessary, establishments were contacted via phone and/or e-mail to verify categorizations.

To ensure that the data were entered accurately, all serving sizes, calories, sodium, and trans-fat information were confirmed using the original website sources. Sort and rank procedures and Atwater calculations were utilized to check for outliers. When necessary, establishments were contacted to confirm suspicious data. A random sample of 5% of the data was checked against the original sources by a third party. When establishments could not be contacted regarding errors detected in the original website source, the data in question were not included in the analysis. When necessary, data were combined to avoid inconsistencies (e.g., salad dressing was added to salads, and sandwich components were compiled if establishments did not provide the data in this format).

Inclusion Criteria

Only categories containing >20 items and with representation from two or more establishments were analyzed; 28 food categories met the inclusion criteria. Eleven were represented in both sit-down and fast-food restaurants and seven in either sit-down or fast-food restaurants. Ten side-dish categories that combined sit-down and fast-food restaurant data (because of the small sample size) were included. The number of items in each category and a description of each category can be found in Appendix A (available online at www.ajpmonline.org).

Exclusion Criteria

Beverages; combination meals (that combined entrées and side dishes); and condiments were not included in this analysis. When multiple serving sizes for the exact same item were present, only the medium/regular-sized items were included in the analysis. If two sizes were provided, the larger option was analyzed.

Statistical Analysis

Mean serving size, calories, and caloric density were calculated for each food category. Differences among similar meal items found in both sit-down and fast-food restaurants were tested using Wilcoxon rank-sum tests. Differences in calories among different establishment and food categories and side dishes were compared using box-plots, relative SD, Kruskal-Wallis ANOVA, and post hoc multiple comparisons. Simple linear regression was performed using serving size and caloric density as predictors of calories. Spearman's correlation was used to examine relationships between calories, caloric density, and serving size.

In order to further explore these relationships, all items were categorized into 100-calorie intervals. The mean caloric density and serving size were plotted and compared using Kruskal-Wallis ANOVA and post hoc multiple comparison analysis. All statistical analyses were performed using Statistica, version 10. A p-value <0.05 was considered significant.

Results

A total 4178 meal items, side dishes, and single items that can be purchased individually, from 20 sit-down restaurants and 65 fast-food restaurants (Appendix B, available online at www.ajpmonline.org) met the inclusion criteria and were analyzed. Within all sit-down restaurant establishments, calories per serving ranged from 61 kcal to 2486 kcal (Figure 1). The minimum calories in sit-down restaurants were fairly consistent across establishments. All establishments had items exceeding 1000 calories per serving; however, the number of items exceeding this threshold as well as the maximum calories differed depending on the restaurant.

Sit-down restaurants had higher calories per serving in all food categories when compared to fast-food restaurants ($p<0.05$ to $p<0.001$ depending on the category; Table 1). For hamburgers, pasta, and fries, both calories and serving size were higher in sit-down compared to fast-food restaurants. In salads with meat, sandwiches/wraps, and stir fry entrées, the calories, serving size, and

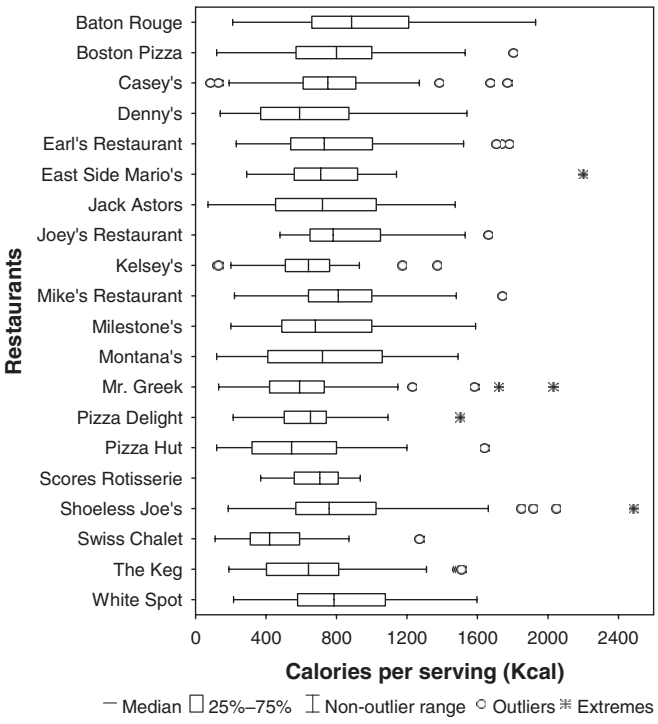

Figure 1. Median and range of calories per serving in menu items (including main items and side dishes, excluding desserts) from sit-down restaurants

Note: Values do not depict the caloric content of an entire meal. Bars represent the interquartile range and lines represent the minimum and maximum values. Kruskal-Wallis ANOVA was significant ($p<0.001$); multiple comparisons confirmed differences between establishments.

caloric density were higher in sit-down compared to fast-food restaurants. In salads, tacos/burritos, and soup, differences in calories and caloric density between sit-down and fast-food restaurants were significant, yet there was no difference in serving size. Breakfast and chicken items from sit-down restaurants had lower caloric density compared to fast-food restaurants; nevertheless, they still had a larger serving size and more calories.

Overall, even though some categories contained more calories per serving compared to others, there was vast variation in calories per serving within all food categories. Among sit-down restaurant items, relative SDs ranged from 30% in stir-fry dishes to 58% in soups. In sit-down restaurants, sandwiches/wraps, breakfast items, pasta entrées, hamburgers, stir-fry dishes, meat/seafood dishes, and ribs were higher in calories per serving compared to salad entrées, chicken, and seafood ($p<0.05$; Figure 2a). However, because of the variation in calories per serving within food categories, at least 50% of salads, chicken, and seafood entrées contained more calories per serving compared to the lowest-calorie sandwiches/wraps, breakfast, pasta, stir-fry, meat/seafood, and rib dishes. Further, immense variation was seen when comparing the difference between the minimum and maximum calories per serving within a single food category. For example, the range of calories per serving within sit-down restaurant categories varied from 595 for tacos/burritos (2.5-fold different in calories per serving) to 2156 for rib entrées (7.5-fold difference).

In fast-food restaurants, pasta, sandwiches/wraps, tacos/burritos, stir-fry entrées and hamburgers were higher in calories per serving compared to pizza, chicken, salads and breakfast items ($p<0.05$; Figure 2b). Among fast-food restaurant items, relative SDs ranged from 35% in sandwiches/wraps to 57% in soups. Nevertheless, because of the variation within categories, at least 50% of pizza, chicken, salads, and breakfast items contained more calories per serving than the lowest-ranking pasta, sandwiches/wraps, tacos/burritos, stir-fry meals, and hamburgers. The range of calories per serving in fast-food restaurants varied from 380 in sushi (2.6-fold difference) to 1145 in breakfast items (25-fold difference).

Within side dishes, onion rings; fries (from sit-down and fast-food restaurants); baked potatoes with toppings; and fries with toppings were higher in calories per serving compared to vegetables; coleslaw; and soup ($p<0.05$; Figure 2). The smallest range of calories within side-dish categories was among baked potatoes (250 calories per serving, a 2.2-fold difference), whereas the largest range was found in sit-down restaurant fries (690 calories per serving, a 3.7- fold difference).

All food categories exhibited immense variation in serving size (Table 1), with relative SDs ranging from 21% in fast-food restaurant salads with meat to 59% in fast-food restaurant tacos/burritos. Among sit-down restaurant sandwiches/wraps, there was a sevenfold difference in serving size, whereas in hamburgers there was an almost eightfold difference. Pearson's correlation showed that both serving size and caloric density were positively correlated with calories ($p<0.05$). However, serving size was more strongly correlated ($r = 0.62$) compared to caloric density ($r = 0.29$).

To further examine the relative effects of caloric density and serving size on calories per serving, foods were grouped according to intervals of 100 calories. The serving size and caloric density of each calorie grouping (Figure 3) illustrates that as calories increased, serving sizes markedly increased, whereas caloric density did not (with the exception of the first and second intervals). When comparing calorie intervals containing 600 to ≥1000 calories, there were differences in serving size (with higher-calorie intervals having larger serving sizes compared to lower-calorie intervals); however, there were no differences in caloric density. For example, items with ≥1000 calories were 62% larger than items containing 600–700 calories ($p<0.001$) but were not different with respect to caloric density. Similar results were found when comparing mean serving size and caloric density

Table 1. Comparison of serving size, calories per serving, and caloric density in sit-down and fast-food restaurants[a]

Meal items	Restaurant type	*n*	Serving size (g)		Calories per serving (kcal)	Caloric density (calories/100 g)
			M±SD	Range	M±SD	M±SD
Breakfast	Sit-down	108	453±156	85–865	850±299	195±528
	Fast-food	232 (176)[b]	155±81***	35–658	357±163***	247±74***
Chicken	Sit-down	39 (31)	269±129	115–665	509±287	195±83
	Fast-food	55 (51)	129±61***	41–368	279±143***	223±68*
Hamburgers	Sit-down	65 (59)	372±132	99–770	926±284	281±123
	Fast-food	81 (71)	235±83***	80–481	635±229***	263±25
Pasta entrées	Sit-down	140 (128)	548±155	215–1096	946±322	171±43
	Fast-food	30 (26)	297±127***	100–420	448±178***	162±43
Salad entrées	Sit-down	44 (36)	272±100	71–612	425±180	166±66
	Fast-food	53 (39)	281±93	56–479	297±141***	116±62***
Salad entrées with meat	Sit-down	93 (83)	423±126	170–691	584±230	138±60
	Fast-food	118 (89)	378±80**	221–602	453±188***	114±46***
Sandwiches/wraps	Sit-down	159 (122)	391±131	114–810	756±260	202±64
	Fast-food	513 (356)	254±87***	85–555	469±163***	189±59*
Stir-fry	Sit-down	25 (24)	678±109	469–869	1017±308	145±36
	Fast-food	39	468±57***	342–543	500±109***	107±23***
Tacos/burritos	Sit-down	10	311±79	190–410	687±227	220±36
	Fast-food	116 (115)	304±178	78–662	507±278*	172±57***
Sides						
Fries	Sit-down	22 (19)	232±57	142–341	558±180	240±66
	Fast-food	17 (16)	173±66**	113–312	425±161*	255±59
Soups	Sit-down	98 (79)	280±50	223–454	197±115	67±34
	Fast-food	204 (175)	308±172	100–964	162±93**	52±20***

[a]Only categories with ten or more items in both sit-down and fast-food restaurants were included in the table.
[b](*n*) represents the *n* for caloric density and serving size, because some establishments did not provide serving-size data.
*$p<0.05$; **$p<0.01$; ***$p<0.001$ between sit-down and fast-food restaurants

among items within the 200–700 calorie–interval range, as those containing 600–700 calories were larger than all intervals containing 200–500 calories ($p<0.001$), but were not different in terms of caloric density.

Discussion

The most important finding from the present study is that there is tremendous variation in calories per serving between and within food categories, restaurant establishments, and types of establishments. Further, serving size, rather than caloric density, is the main factor influencing the calories per serving in restaurant foods. This variation among food choices within these restaurants indicates that customers are faced with a wide range of calorie options when making food selections, and that following general rules for healthy eating does not guarantee that a customer will be able to make the lowest-calorie choice. For example, although salads are perceived as containing fewer calories, and on average would be expected to contain fewer calories compared to a stir-fry or rib meal, 50% of salads contained more calories per serving than the lowest-ranking stir-fry or rib meals.

Further, because of the strong influence of serving size on calorie content, the introduction of calorie labeling may prompt restaurants to reduce the size of their items as a means to decrease calories and thus make their menu items appear healthier. This would be a positive change because of the aforementioned prevalence of large serv-

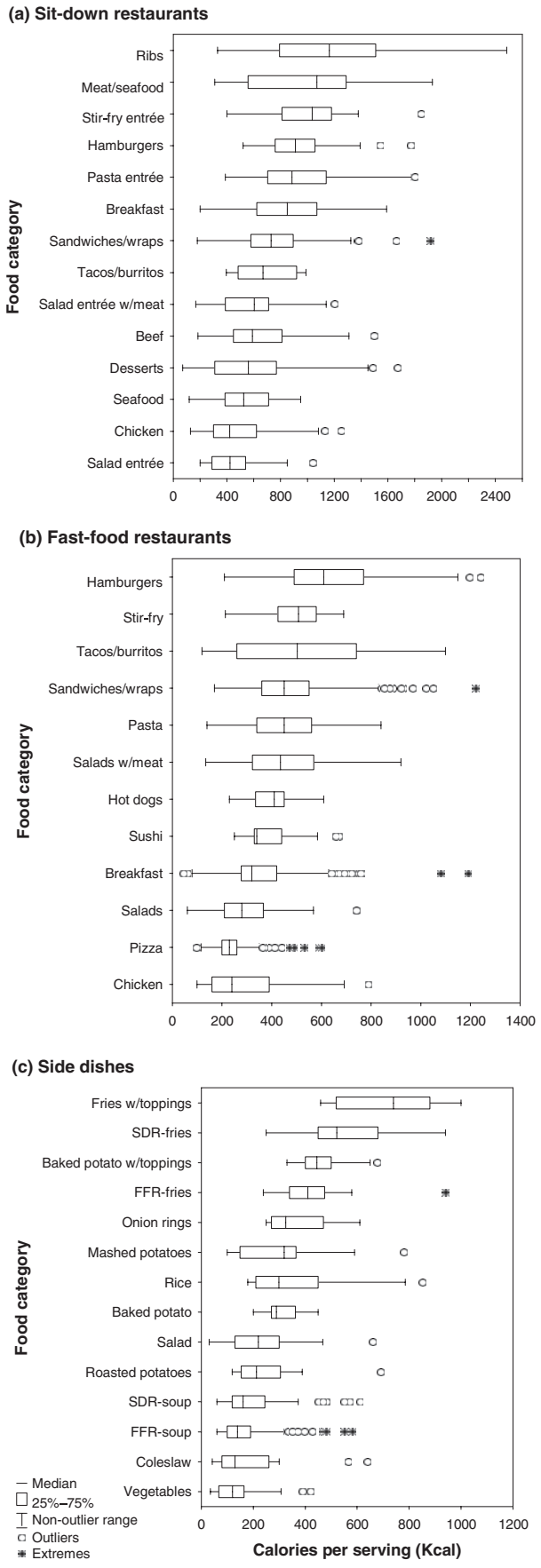

Figure 2. Median and range of calories in various food categories, from (a) sit-down restaurants, (b) fast-food restaurants, and (c) side dishes, arranged in increasing order by median calorie content

Note: Bars represent the interquartile range and the lines represent the minimum and maximum values. Kruskal-Wallis ANOVA was significant ($p<0.001$); multiple comparisons confirmed differences between food categories.

FFR, fast-food restaurants; SDR, sit-down restaurants

ing sizes[17,18] and the fact that large serving sizes in restaurants have been shown to contribute to excess energy intake.[20] The data from the current study show that many lower-calorie foods in restaurants contain fewer calories compared to higher-calorie foods by virtue of their size. Therefore, the results of this study demonstrate that the most feasible approach to decreasing calories in restaurant foods would be to decrease serving sizes as serving size, not caloric density, is the largest determinant of differences in calories. In addition, these results suggest that including serving-size information alongside calorie labeling may be useful, as it would indicate why one item is higher in calories than another; and in some circumstances, it would help customers decide among items that are similar in calories but different in terms of serving size.

Although these data suggest that reducing serving size is necessary to decrease calories in the restaurant sector, focusing only on reducing serving size as a means to decrease calories could be potentially problematic, as it neglects the fact that calories are not the only determinant of the healthfulness of a food. Additionally, a potentially negative consequence of reductions in serving size is that it could fuel the prevalence of small, calorie-dense meal items. This is worrisome because consuming a smaller portion of an energy-dense food, so as to consume fewer calories, is not the most effective strategy for weight loss. Studies have shown that a diet consisting of low–energy density foods is advantageous because it enables the consumption of larger satisfying portions.[21] Thus, these cautionary observations suggest that in some circumstances reducing serving size could undermine weight-loss/weight-maintenance efforts.

Limitations

There are a few limitations of the present study, such as the lack of data for independent/privately owned restaurants and incomplete information for some establishments. It also should be noted that the accuracy of the findings presented in the current study are dependent on the accuracy of the data provided by the establishments. However, a recent study by Urban et al.[22] provides some justification for the accuracy of the calorie data, as they showed that despite the existence of substantial inaccuracies for some items, stated

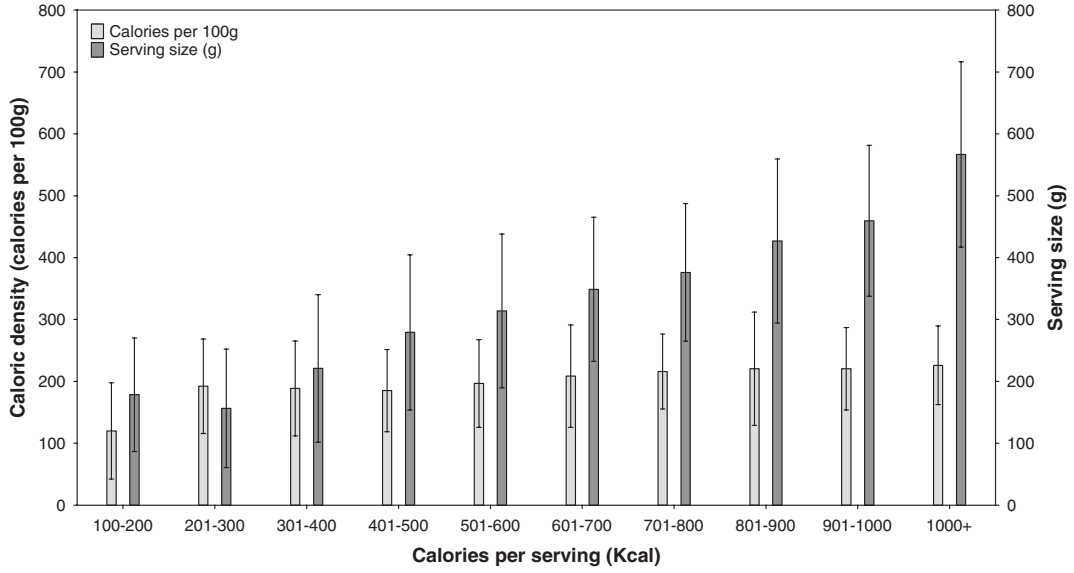

Figure 3. Mean serving size and caloric density of menu items and side dishes grouped according to 100-calorie intervals
Note: Kruskal-Wallis ANOVA was significant ($p<0.001$); multiple comparisons confirmed some differences in serving size and caloric density among calorie intervals.

energy content of restaurant foods was accurate overall, when compared to analyzed data.

It is also important to address the caloric differences that were detected between sit-down and fast-food restaurants. Although the data presented in Table 1 suggest that meal items from fast-food restaurants are lower in calories, this may not necessarily be the case for all choices. Many sit-down restaurant categories, particularly those that were low in calories, such as seafood and beef entrées, were not included in the comparison between sit-down and fast-food restaurants, because comparable items were not sold in fast-food restaurants. Finally, the present study only analyzed the calorie content of foods, irrespective of other healthy or unhealthy nutrients. More research is needed to assess the overall nutritional profile of restaurant meals and to test whether a lower calorie content has any predictive value in identifying healthier, more nutritious foods.

Conclusion

Overall, there was immense variation in the caloric content of menu items among and within food categories, restaurant establishments, and types of establishments. In addition, serving size was found to be the most important contributor to variation in calories per serving in foods from sit-down and fast-food restaurants. If calorie labeling encourages restaurants to reduce the calorie content of their menu items, the results of the present study demonstrate that decreasing serving size is an important strategy for decreasing calories in the restaurant sector. Nevertheless, because calories are not the only determinant of the healthfulness of a food item, more research is needed to investigate other methods of menu labeling that incorporate information beyond just calories. Thus, even though calories are not a foolproof indicator of the healthiest items in sit-down and fast-food restaurants, the variation demonstrated in the current study indicates that calorie labeling is a major first step toward informing customers of the wide range of calories available when dining outside the home.

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Appendix

Supplementary data

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.amepre.2012.05.018.