RESEARCH ARTICLE

Assessing the Early Impact of Menu-Labeling on Calories in Chain Restaurants in Ontario, Canada

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Introduction: The objective of this study is to investigate the early impact of Canada's first provincewide mandatory menu-labeling legislation on calorie levels in foods offered on chain restaurant menus before, leading up to, and at the point-of-implementation.

Methods: Data were obtained from Menu-FLIP, a database of publicly available nutrition data from chain restaurants in Canada. Data were collected in 2010, 2013, 2016, and 2017. Core food products, newly introduced products, discontinued products, and full menus were compared before (2010, 2013, 2016) and at the point-of-implementation (2017) of the policy. Calories and serving sizes of 2,988 unique foods (excluding beverages) from 28 chains were analyzed using mixed models comparing time points while controlling for covariates. Sub-analyses were stratified by restaurant type.

Results: Full menu mean calories and serving sizes increased between 2010 and 2017 (>40 calories and 17 grams, respectively). There were no significant changes in mean calories or serving sizes among core menu items (*p*=0.47). New products in 2013 and 2017 were significantly higher in calories and serving size versus discontinued foods and foods already on the menu. Discontinued foods did not differ in calories or serving size compared with foods already on the menu; however, in 2017, the calories of discontinued foods in sit-down restaurants were higher than foods discontinued in 2013 (*p*=0.02).

Conclusions: The results of this investigation show that at the point-of-implementation of the Ontario Healthy Menu Choices Act supply-side calories in core food products, new products, or full menus evaluated in this study did not significantly change.
Am J Prev Med 2019;56(6):e195−e203. © 2019 American Journal of Preventive Medicine. Published by Elsevier Inc. All rights reserved.

INTRODUCTION

In Canada, each day one quarter of the population purchases food from a fast-food outlet with an additional 21% purchasing food from a sit-down restaurant, cafeteria, or other food venue.[1−3] As of 2012−2013, one quarter of Canadians adults are obese, and more than one third are overweight.[4] Numerous ecologic and cross-sectional studies have demonstrated associations between eating out and obesity.[5−10] Therefore, policy options such as menu labeling are being explored in several jurisdictions to support healthier food environments outside the home.[11,12]

Menu labeling was first introduced in New York City in 2008,[11] was subsequently implemented in several jurisdictions in the U.S., and as of 2018 is required nationally in all chain restaurants with 20 or more locations.[11,13−18] In Canada, since 2003, numerous menu labeling bills have been proposed nationally,[19,20] and provincially in Ontario.[21−26] On May 29, 2015, the first menu labeling legislation in Canada, Bill 45 The Making

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Healthier Choices Act, which includes the Healthy Menu Choices Act, was passed.[12] The Healthy Menu Choices Act, which came into force in January 2017, requires the disclosure of calories and a statement about daily calorie needs in all food service venues across Ontario that have 20 or more locations. The objective of the Act is to help Ontarians make healthier food and beverage choices when dining out and to raise public awareness about the calorie content of food and beverages eaten outside the home.[27]

There are a number of ways that calorie labeling could improve public health.[28] Consumers underestimate the calorie content of restaurant foods.[29] As a result, lack of awareness has been part of the rationale for calorie labeling in many jurisdictions,[30−35] including Ontario.[35] Menu labeling could motivate consumers to purchase and consume fewer calories when eating foods prepared outside the home.[36−41] However, preliminary findings from natural experiments in New York City have shown inconsistent effects on calories purchased.[42−46] Beyond the direct effects, calorie labeling could lead consumers to compensate by reducing calorie intakes at other meals before or after eating foods prepared outside the home.[47] Furthermore, calorie labeling could motivate the restaurant industry to reformulate products to contain fewer calories. This was observed in King County, Washington, where menu labeling led to a mean decrease of 41 (SD=156) kcal in entrées between 6 and 18 months post-implementation of a menu labeling policy.[15]

The objective of this study is to investigate the early effect of menu labeling legislation on supply-side changes in calories of foods on chain restaurant menus. Furthermore, this is the first study to investigate this in Ontario. The primary goal is to compare calories per serving and per 100 grams in food products offered on menus before, leading up to, and at the point-of-implementation of Canada's first provincewide menu-labeling legislation. The secondary goal is to compare changes in calories by restaurant type.

METHODS

Study Sample
All data were derived from the Menu-FLIP database.[48] Menu-FLIP was created in 2010 using publicly available nutrition information provided online by all restaurant chains that had ≥20 locations nationally.[49] Of the 172 restaurant chains that had ≥20 locations nationally, 95 provided nutrition information online on their websites. Data for >9,000 à la carte entrées, side dishes, beverages, and condiments were collected and compiled into the database. The data collected from each restaurant chain included the 13 core nutrients found on a Nutrition Facts table plus serving size. Foods were categorized according to the type of restaurant, fast-food versus sit-down, as defined by the presence of table

service; the restaurant chain (e.g., McDonalds, Subway); and the food category (e.g., entrée, side dish). In addition, each food product had a unique identifier, referred to as the product ID. Additional details describing the database can be found elsewhere.[48] After excluding condiments, beverages, and other miscellaneous products, 2010 data included 4,178 entrées, pizza slices, side dishes, desserts/baked goods, and kids' menu items from 85 chains.

In May 2013, restaurant websites were revisited and 2013 data were collected.[50] When available, the updated nutrient information collected was matched to the existing product data from 2010. When previous data were not collected for a particular food product, the food was labeled as being a new product. Foods that were in the database from 2010, but not matched in 2013, were labeled as being discontinued products. In 2013, data for 61 chains were available and collected. A total of 24 chains were excluded from entry for the following reasons: no longer provided nutrition information online (*n*=4); did not provide serving size data (*n*=8); changed the format of the information provided (*n*=2); only provided American information (*n*=7); and did not provide sodium information (*n*=3). In May 2016, this process was repeated for 54 restaurant chains.

In January 2017, the websites of chain restaurants that were subject to the menu-labeling policy (those with ≥20 locations in Ontario, *n*=90) were searched for nutrition information. Chains subject to the policy were verified using the 2016 Directory of Restaurant and Fast Food Chains in Canada.[51] When available, 2017 nutrition information was captured as in previous cycles. Of the 90 Ontario chains required to label calories, 55 had provided nutrition information and thus were included in Menu-FLIP; however, 27 of those were excluded from this analysis for various reasons (Appendix Figure 1, available online). This resulted in a final sample of 28 restaurant chains.

Measures
In 2010, data entry was performed by one individual. In 2013, 2016, and 2017 data entry was performed by one individual, and checked by a second individual. At each time point, range and logic checks were conducted to ensure plausibility, and a random sample of 10% of the data set was verified by an external data checker.

All new products that met inclusion criteria were verified by searching the database to ensure that the food product had not been available at a previous time point. All online restaurant menus were checked to ensure that food products that met inclusion criteria and were labeled as being discontinued were no longer available at the restaurants.

All foods were categorized into entrées (hamburgers, sandwiches, meat/fish/chicken); pizza slices; breakfast foods (eggs, bagels, breakfast sandwiches/wraps); side dishes (fries, salads, soups); baked goods/desserts (muffins, donuts, tea biscuits, pie/cake slices); and kids' foods (hamburgers, chicken fingers, pizza). Foods were excluded if they could not be classified into one of these categories (this included condiments, sauces, beverages, ice creams, salad dressings, meals whose nutrient information for entrées and side dishes were combined, and meals that were intended to be shared, such as whole pizzas and appetizers; Appendix Figure 2, available online). Foods that did not provide serving size, calorie, or sodium information were excluded. When

food products were available in multiple sizes, duplicate sizes were excluded and only the medium size was analyzed. When items were available in two sizes, only the larger size was included. Beverages were excluded because most restaurants disclosed standard nutrition information for classic beverage products. Therefore, analysis of beverages would not reflect changes in the restaurant sector, but rather changes in the overall food supply. Further details can be found elsewhere.[48,50,52]

Four data sets were created using Menu-FLIP. The four data sets consisted of (1) the full menu (all food products available on the menu in 2010, 2013, 2016, and 2017); (2) core food products (foods present on restaurant menus at all time points); (3) new products (foods newly introduced to restaurant menus in 2013, 2016, and 2017); and (4) discontinued products (foods that were removed from restaurant menus in 2013, 2016, and 2017).

Menu items were considered as being core foods if they had the same product name at all time points. If products with similar but slightly different product names were suspected of being core products, or if the appropriate match was uncertain, the product description, serving size, and nutrient information were checked to determine if items were in fact a match.

Statistical Analysis

Analyses included descriptive statistics and mixed models comparing calories per serving and per 100 grams and serving size across time points within each of the four data sets. In addition to each mixed model, multiple comparisons of least-squared means were also computed using Tukey−Kramer adjustments accounting for covariates.

Within each of the four data sets, analyses were conducted two ways (overall and by restaurant type). First, calories per serving and per 100 grams were compared via mixed models using the entire data set, which is subsequently referred to as the overall analysis. In addition, each of the four data sets was stratified by type of restaurant (fast-food versus sit-down). This is subsequently referred to as the restaurant type analysis.

In the analyses of the core food products, the same foods were compared across four time points using mixed models controlling for product ID and food category. This enabled a balanced design; hence, unadjusted means and SDs were reported. The covariates used in all mixed models included in this study varied depending on the data set and how it was stratified. The covariates (food category or restaurant or product ID) included in each model are summarized in Appendix Table 1 (available online). In the analysis of the core food products, the product ID variable enabled a pairwise-matched comparison of products and made other covariates obsolete as the model was over-specified when these extra predictors were included alongside product ID.

In the analyses of new and discontinued products, different foods were compared across time points using mixed models controlling for food category and restaurant. This produced an unbalanced design. Therefore, least-squared means and SEs, which were adjusted for covariates (restaurant type and food category, detailed in Appendix Table 1, available online) were reported. Unadjusted analyses of new and discontinued products were also calculated and are reported in Appendix Table 4 and Appendix Table 6, respectively (both available online). These numbers represent the actual mean nutrient levels in new and discontinued foods in chain restaurants.

In the analyses of full menus, a mixed model (controlling for food category and restaurant) was used to compare all of the products on the menu in each year, in comparison to the new and discontinued products in that year, while controlling for covariates restaurant type and food category. Finally, the full menu at each time point was also compared using a mixed model. Beverages were excluded from all analyses. All statistical analyses were conducted in 2017 using SAS, version 9.3 software.

RESULTS

The analytic sample consisted of 2,988 unique foods (core and new products and discontinued products) from 28 restaurant chains. These 28 restaurant chains represent an estimated 6,074 outlets across Ontario accounting for 65% of the outlets required to comply with the regulations of the Ontario Healthy Menu Choices Act (Appendix Tables 7 and 8, available online). Of the 2,988 unique foods, 827 were core foods matched across the four time points (totalling 3,308 foods); 1,271 were new food products (*n*=367 newly introduced in 2013, *n*=492 in 2016, and *n*=412 in 2017); and 890 were discontinued food products (*n*=286 discontinued in 2013, *n*=337 in 2016, and *n*=267 in 2017). There were on average 30 (SD=28) core foods; 15 (SD=12) new products; and 11 (SD=9) discontinued foods per restaurant.

When adjusted for covariates, the average calories per serving on restaurant menus increased from 306 (SD=6) kcal to 346 (SD=6) kcal, between 2010 and 2017 (*p*<0.001; Figure 1A). The increase in calories per serving was primarily due to an increase in serving size, from 155 (SD=3) to 172 (SD=3) grams, between 2010 and 2017 (*p*<0.001; Figure 1C). Calorie density (kcal per 100 grams) did not significantly differ between 2010 and 2017 (Figure 1B). The significant increases in calories per serving (between 2010 and 2017) were observed in both fast-food and sit-down restaurants (*p*<0.001).

There were no significant changes in calories per serving or calorie density (kcal per 100 grams) of core food products overall, or by restaurant type (Figure 2A and Appendix Table 1, available online). When stratified by restaurant type, there was a statistically significant decrease in serving sizes in fast-food restaurants of 3 grams per serving between 2010 and 2017 (*p*=0.02) and a significant increase in serving sizes among sit-down restaurants of 12 grams per serving between 2010 and 2017 (*p*=0.001; Figure 2B).

Overall, new foods introduced in 2017 were significantly higher in calories per serving compared with those introduced in 2016 (*p*=0.02) but were not significantly higher than those introduced in 2013 (*p*=0.12; Appendix Table 3, available online). This trend was present in both fast-food (*p*<0.001) and sit-down restaurants
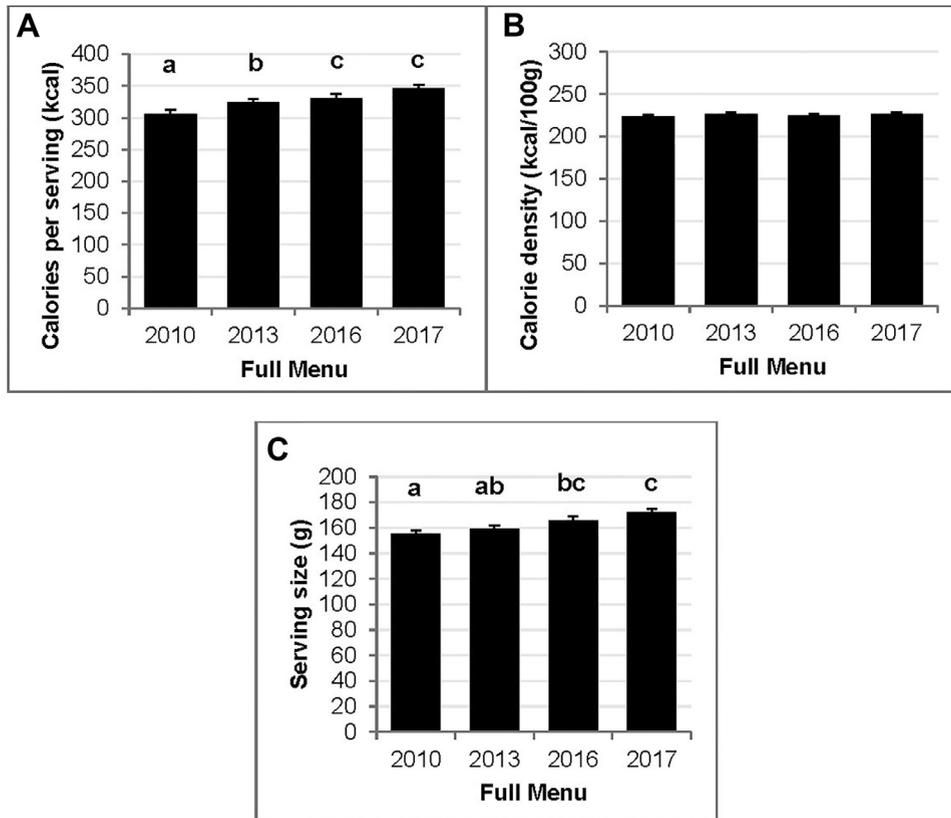
Figure 1. Differences in mean calories per serving (A), calorie density (B), and serving sizes (C) of full menus from 2010, 2013, 2016, and 2017.

Note: Means are adjusted least-square means ± SE. Different letters indicate statistical differences (*p*<0.05) across years according to mixed models with Tukey-Kramer least squares means adjusted for restaurant and food category. Shared letters indicate no difference. For example, mean calories per serving was significantly different in 2010 (letter a) compared to 2017 (letter b), but not different from 2013 (letters ab) or 2016 (letter a). Mean calories per serving in 2016 (letter ab) was not statistically different from 2010 (letter a), 2016 (letter a), or 2017 (letter b). 2017 represents the "point of implementation."

kcal, kilocalorie.

(*p*<0.001). Similarly, within fast-food restaurants, new foods introduced in 2017 had significantly higher serving sizes compared with new foods in 2013 and 2016 (*p*<0.001). There were no significant differences in calorie density among new foods overall, or by restaurant type.

In both 2013 and 2017, new foods were significantly higher in calories per serving and serving size relative to the full menu (Table 1). In 2013, new foods were on average 47 kcal (13%) and 22 grams (12%) higher per serving compared with the full menu (both *p*=0.01). In 2017, new foods were on average 40 kcal (11%) and 22 grams (11%) higher per serving compared with the full menu (*p*=0.01 and *p*=0.005, respectively). In 2016, there were no significant differences between new foods and the full menu (*p*=0.76).

In 2016, the calories per serving of discontinued foods were significantly higher than those discontinued in 2013 (*p*=0.02; Figure 3). This trend seems to be driven

by sit-down restaurants, where foods discontinued in 2016 and at the point-of-implementation in 2017 had higher calorie levels than foods that were discontinued in 2013 (*p*=0.01).

When comparing discontinued foods to the full menu at all time points, discontinued foods were not significantly different in calories per serving and serving size when compared with foods still offered on the menu (Table 1). When compared with new products, discontinued products were significantly lower in calories per serving and serving size in 2013 (*p*<0.001) and 2017 (*p*=0.01). A similar trend was evident, but not significant in 2016.

DISCUSSION

The results of this investigation show that at the point-of-implementation of the Ontario Healthy Menu Choices Act, supply-side calories did not profoundly
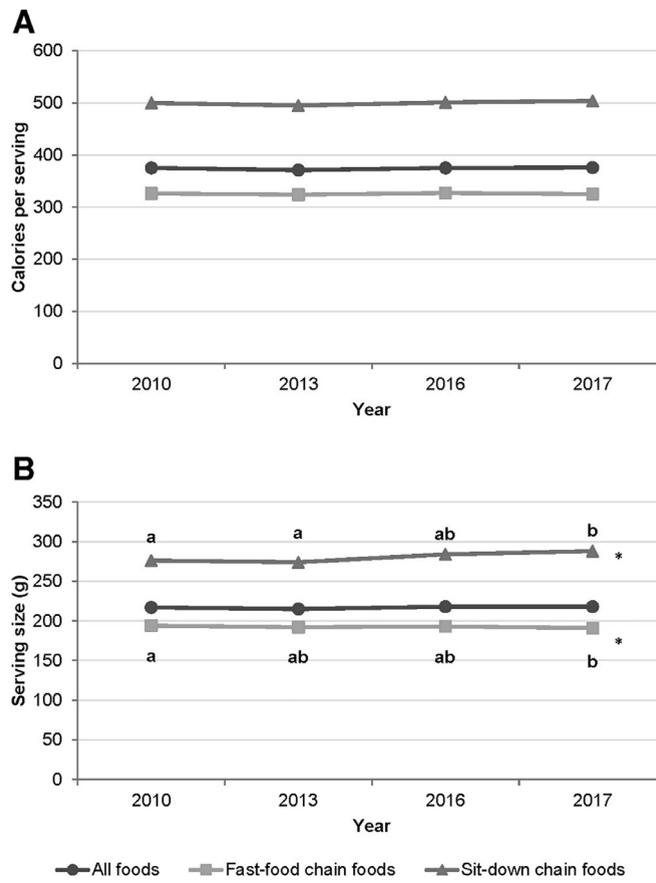
Figure 2. Mean calories per serving (A) and serving size (B) of all core foods in all restaurant chains (*n*=827 foods); fast food restaurant chains (*n*=596 foods); and sit-down restaurant chains (*n*=231 foods).
Note: Means are adjusted least-square means of core foods (i.e., the same foods) compared at each time point. Different letters indicate statistical differences (*p*<0.05) across years according to mixed models with Tukey-Kramer least squared means adjusted for food category and product ID, whereas shared letters indicate no difference. 2017 represents the "point of implementation."

change in the core food products, new products, or full menus in restaurant chains evaluated in this study. There have been small but statistically significant increases in mean calories per serving and serving sizes on the menus of restaurant chains followed from 2010 to 2017 in Menu-FLIP. New foods being introduced to menus appear to be more caloric per serving and have larger serving sizes compared with foods already on the menu and foods being discontinued. Foods discontinued leading up to (2016) and immediately following implementation of the menu-labeling policy (2017) were higher in calories per serving compared with foods discontinued in 2013.

The findings in this study differed from analyses of national chains in the U.S., which suggest that (1) calories per serving of foods on the full menu declined overall[53,54]; (2) calories per serving of new products introduced in restaurants after the announcement of menu labeling legislation declined relative to new products introduced prior[55];

(3) new products added to the menus were significantly lower in calories relative to discontinued products removed from the menus[56]; and (4) items dropped from chain restaurant menus were significantly higher in calories compared with items that remained on the menu.[57] There are important differences between the Ontario and U.S. context. Menu labeling has been implemented in smaller jurisdictions in the U.S. including New York City and King County, Washington, since 2008 and was passed nationally as part of the Patient Protection and Affordable Care Act in 2010. Ontario's menu-labeling legislation passed in 2015 and was implemented in January 2017, and to the authors' knowledge, there are no current plans for other Canadian jurisdictions to follow. Therefore, U.S. restaurant chains have had more time, and stronger incentive to reformulate. Another important difference is that U.S. studies included items like beverages and toppings/ingredients, which were excluded from this analysis.[55]
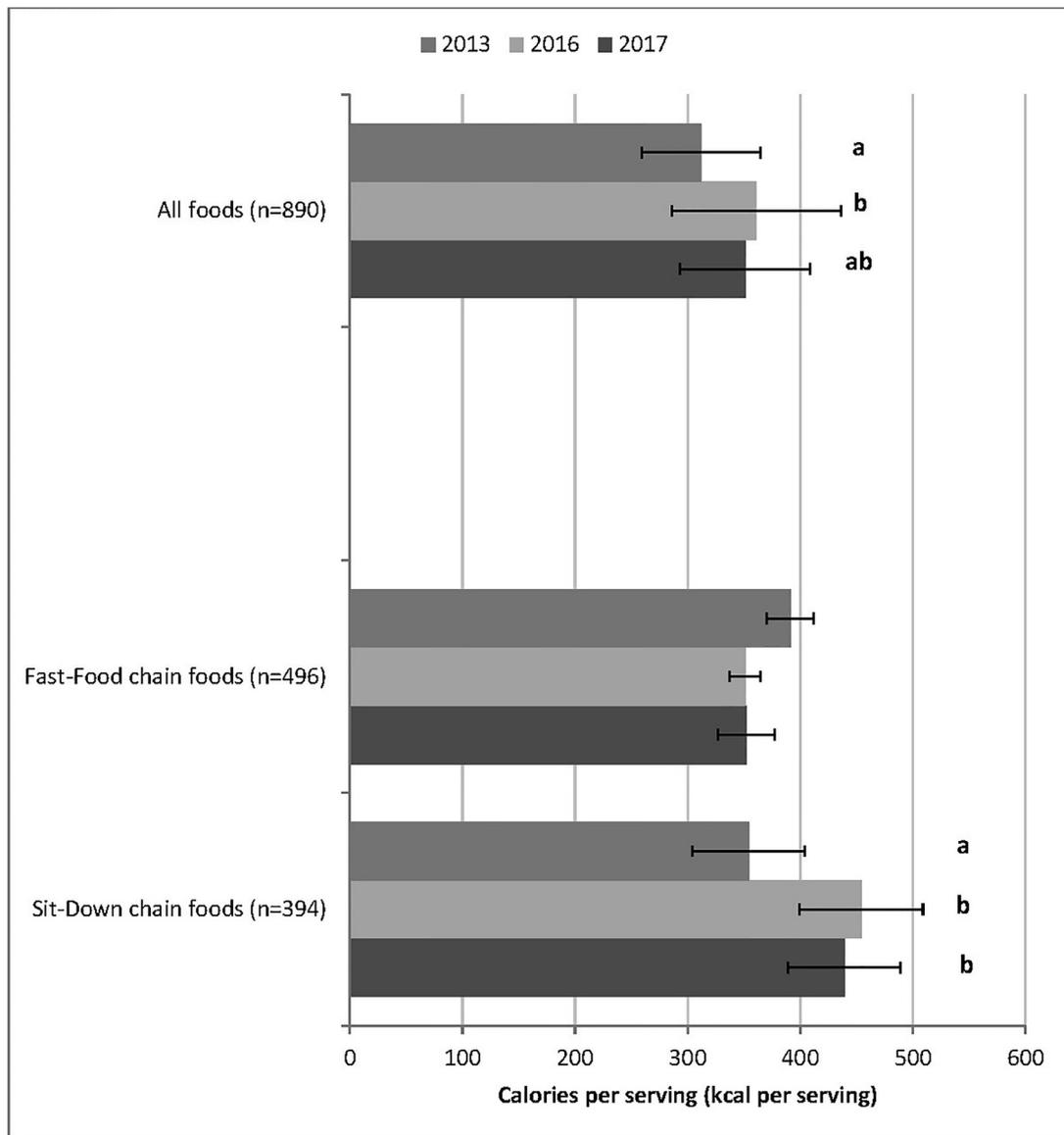
Figure 3. Differences in mean calories per serving of discontinued foods in 2013, 2016, and 2017 (*n*=890 foods).
Note: Means are least squares adjusted. Bars with different letters (a, b, c) are significantly different (*p*<0.05) according to mixed models comparing calorie levels are each time point with Tukey-Kramer least squares means adjusting for covariates: restaurant type and food category. Shared letters indicate no difference. 2017 represents the "point of implementation."
kcal, kilocalorie.

In addition, it should be noted that previous longitudinal analyses of the nutritional quality of restaurant foods in the U.S. have found that both increases and decreases in calories per serving, sodium per serving, and fats of menu offerings occur simultaneously.[58,59] Therefore, the observed increases and decreases in calories at various time points are not uncommon, and may or may not represent intentional responses to policy. Whether restaurant chains in Ontario will substantially reformulate their menu offerings in response to the policy remains to be seen. Given that King Country,

Washington, saw reformulation in the form of decreased calories and sodium between 6 and 18 months post-implementation,[15] future evaluations in Ontario will be important to answer this question.

The data in this study illustrate nutrient levels in the food environment but do not represent the nutrient levels of consumer purchases. Future research should evaluate market-share weighted means to better reflect actual purchase patterns in relation to average calories ordered. Additional outcomes should be examined including changes in consumer awareness, actual purchases, and

Table 1. Comparison of Full Menus in 2010, 2013, 2016, and 2017.

All foods	n	Mean ± SE calories (kcal per serving)			Mean ± SE calorie density (kcal per 100g)			Mean ± SE serving size (g)		
		Full menu	New products	Discontinued products	Full menu	New products	Discontinued products	Full menu	New products	Discontinued products
2010[c]	1,715	391±6	—	—	203±2	—	—	226±4	—	—
2013	1,876	**353±9**[a]	**400±14**[b]	**321±16**[a]**	**225±3**[b]	209±5[a]	**202±5**[a]*	**180±5**[a]	**202±7**[b]	**171±8**[a]**
2016	1,981	374±9	365±13	348±14	223±3	217±4	223±5	191±5	181±6	173±7
2017[d]	1,942	**371±9**[a]	**411±13**[b]	**361±15**[a]*	218±3	214±4	208±5	**196±4**[a]	**218±7**[b]	**194±8**[a]*

Note: Boldface indicates statistical significance (*p*<0.05; *p<0.01 where superscripts are unique; **p<0.001 where superscripts are unique) of the "food status" (full menu versus new products versus discontinued products) as a predictor of nutrient level in mixed models that controlled for restaurant and food category.
[a,b]Different superscripts indicate significant differences based on multiple comparisons of least squares means (adjusted for matched pairs and food categories) with Tukey-Kramer adjustments.
Superscripts were only used when significance was detected.
[c]2010 was baseline; therefore, there were no "new products" or "discontinued products" in that year.
[d]2017 represents the "point of implementation."
kcal, kilocalorie.

consumption. If the improved or new, lower calorie products become popular, benefits of menu labeling that were not observed in this study could be seen in consumer studies.

Limitations

These results should be interpreted with caution as this analysis included incomplete menus from a small number of restaurant chains. Although this sample contains data from approximately 65% of outlets subject to the menu-labeling legislation in 2017, the current results may not reflect changes when considering all restaurant chains in Ontario.

In addition, many foods were not matched and lost to follow-up because of the incompatible manner in which nutrition information was disclosed during different data collection cycles. In this analysis, statistical adjustments may have masked the fact that some restaurants introduced/discontinued more new products than others. In addition, it should be noted that many statistical tests were computed in this study. Therefore, caution should be taken when interpreting the significance of *p*<0.05 as there is a high probability of type I errors (false-positives).

CONCLUSIONS

This assessment showed that between 2010 and 2017, there were few differences in the calories of foods offered in chain restaurants in Ontario. To more fully evaluate the impact of this legislation, a longer time period post-implementation is necessary, alongside a more representative sample of restaurant chains and their menu offerings.

ACKNOWLEDGMENTS

SUPPLEMENTAL MATERIAL

Supplemental materials associated with this article can be found in the online version at https://doi.org/10.1016/j.amepre.2019.01.017.

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