Restaurant menu labelling: Is it worth adding sodium to the label?

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ABSTRACT

OBJECTIVE: Several provincial and federal bills have recommended various forms of menu labelling that would require information beyond just calories; however, the additional benefit of including sodium information is unknown. The objective of this study was to determine whether sodium information on menus helps consumers make lower-sodium choices and to understand what other factors influence the effect of menu labelling on consumers' meal choices.

METHODS: A total of 3,080 Canadian consumers completed an online survey that included a repeated measures experiment in which consumers were asked to select what they would typically order from four mock-restaurant menus. Subsequently, consumers were randomly allocated to see one of three menu-labelling treatments (calories; calories and sodium; or calories, sodium and serving size) and were given the option to change their order.

RESULTS: There was a significant difference in the proportion of consumers who changed their order, varying from 17% to 30%, depending on the restaurant type. After participants had seen menu labelling, sodium levels decreased in all treatments ($p<0.0001$). However, in three of the four restaurant types, consumers who saw calorie and sodium information ordered meals with significantly less sodium than consumers who saw only calorie information ($p<0.01$). Consumers who saw sodium labelling decreased the sodium level of their meal by an average of 171-384 mg, depending on the restaurant. In the subset of consumers who saw sodium information and chose to change their order, sodium levels decreased by an average of 681-1,360 mg, depending on the restaurant. Sex, intent to lose weight and the amount of calories ordered at baseline were the most important predictors of who used menu labelling. Eighty percent of survey panelists wanted to see nutrition information when dining out.

CONCLUSION: Including sodium information alongside calorie information may result in a larger decrease in the amount of sodium ordered by restaurant-goers.

KEY WORDS: Restaurants; fast foods; food labelling; sodium

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

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In response to the growing obesity epidemic[1] and the prevalence of eating outside the home,[2] restaurant menu labelling is a policy being explored as a means to enable healthier choices when people are eating out. In the United States, several jurisdictions have enacted menu-labelling laws.[3] Meanwhile, in Canada there have been several unsuccessful bills at both the provincial and federal level.[4,5] Recently, Toronto Public Health recommended legislation requiring the mandatory disclosure of calorie and sodium information in large restaurant chains.[6]

Toronto Public Health's recommendation differs from the menu-labelling laws enacted in New York City and proposed in the *Patient Protection and Affordable Care Act* (which includes the US's federal menu-labelling legislation),[3] because it calls for the disclosure of sodium levels in addition to calorie information. To date, only one county in Washington has a menu-labelling law that includes information beyond calories, by also requiring the disclosure of saturated fat, carbohydrate and sodium content,[7] while another county has a similar, voluntary program.[8]

The inclusion of sodium information is important because research on the nutritional quality of restaurant foods has demonstrated that sodium levels are alarmingly high, and there is a wide range of sodium levels among similar foods.[9,10] Because of this variation, there is no way for the consumer to determine which foods are higher or lower in sodium. This is a concern as dietary sodium is the leading preventable risk factor for hypertension,[11] which is the leading risk factor for death worldwide.[12]

Studies have shown that people prefer forms of menu labelling that include information beyond just calories. For example, Mackison et al. found that 61% of consumers wanted to see sodium information on menus.[13]

To date, there is no published research investigating the effect of including sodium or serving size information on menus. Using a randomized controlled experiment embedded within an online survey, this study sought to answer the following research questions:

1) Does the inclusion of sodium information on restaurant menus result in lower-sodium choices?

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2) Does the inclusion of serving size information result in the choice of meals with a lower calorie density (calories per 100 g) and/or a lower sodium density (sodium per 100 g)?
3) What factors (demographic factors, as well as the calorie and sodium content of consumers' meal choice) influence consumers' use of menu labelling?

METHODS

Participants

The Canadian Consumer Monitor (CCM) panel was used for this study. The CCM is a nationally representative consumer survey panel. It was recruited by a professional recruiting company to reflect the Canadian population (according to 2006 Census data) for age, sex, education and region. Initially, 31,223 Canadian adults were contacted by e-mail. Survey panelists were required to be the primary household grocery shopper. An initial invitation to participate was sent to all panelists to collect data on their demographic characteristics; 6,665 provided informed consent and completed the baseline questionnaire. Beginning in 2010, 15-minute surveys were administered to the CCM panel every 8-10 weeks.[14,15] Typically 2,500-7,000 consumers participated in each survey. Because of attrition, 3,080 consumers participated in this survey, which was administered in April 2012. Ethics approval was received from both the University of Toronto and the University of Guelph's research ethics boards. Before being administered to the CCM, the survey was pilot tested on a small panel of 255 consumers from Guelph, Ontario. The survey was administered using Snap 10 Professional Survey Software and Webhost (Snap Surveys, Portsmouth, NH).

Experimental design and survey structure

A repeated measures randomized controlled experiment was embedded within the survey. The experiment used a parallel within-subject design in which each consumer served as his or her own control. Each consumer was asked to make a selection from each of four different restaurant menus. After making a selection, consumers were randomly assigned to see one of three different types of menu labelling (referred to as treatments): 1) calorie labelling (kcal), 2) calorie (kcal) and sodium labelling (mg), 3) calorie (kcal), sodium (mg) and serving size labelling (g). Randomization was based on the timing within the minute when the panelist started the survey. After randomization, consumers were shown the same series of menus labelled with nutrition information according to the consumer's treatment allocation, and were given the option to change their order. This enabled pre-post comparisons, so that panelists who were influenced by the information and chose to change their order could be analyzed separately from those who did not change their order. Similar methods have been used in previous studies with separate analysis of consumers who reported using the information and those who reported not doing so.[16,17]

In addition, at the beginning of the survey, consumers were asked about their frequency of eating out and whether they were trying to lose weight. At the end of the survey, consumers were asked whether the nutrition information they saw influenced what they ordered (with the option of answering yes, somewhat or no) and were given an open-ended response field to explain why.

Table 1. Demographic characteristics of the panelists in the study

Sample characteristic*	Value
Sample size (*n*)	3080
Age range (years), *n* (%)	
20-29	199 (7)
30-39	472 (15)
40-49	761 (25)
50-59	891 (29)
60-69	737 (24)
Sex, *n* (%)	
M	1012 (33)
F	2058 (67)
Education, *n* (%)	
High school or less	622 (20)
Trades	306 (10)
College	1033 (34)
University	1099 (36)
Frequency of eating at fast-food restaurants, *n* (%)	
Never	161 (5)
Infrequently (once per month or less)	246 (8)
Semi-frequently (once per week)	778 (25)
Frequently (more than once per week)	1892 (61)
Frequency of eating at sit-down restaurants, *n* (%)	
Never	33 (1)
Infrequently (once per month or less)	321 (10)
Semi-frequently (once per week)	932 (30)
Frequently (more than once per week)	1787 (58)
Reported trying to lose weight, *n* (%)	1525 (50)

* Some demographic data were missing for certain variables (sex, 10 missing; education, 20; age, 20; frequency of eating fast food, 3; frequency of eating at sit-down restaurants, 7; trying to lose weight, 25. Only 9 people said that they never ate out at sit-down or fast-food restaurants.

Restaurant menus

Four restaurant scenarios were tested in the survey: a fast-food hamburger restaurant, a sit-down breakfast restaurant, a sub shop and a sit-down dinner restaurant (Supplemental Figure 1). The restaurant menus were adapted from actual Canadian chain restaurant menus and were selected because they had a large range of menu offerings, including both high- and low-calorie and sodium options. Multiple versions of each menu were created to reflect each of the treatments: no information; calorie labelling; calorie and sodium labelling; calorie, sodium and serving size labelling (Supplemental Figure 2). The calorie, sodium and serving size information on the menu was based on the restaurant's nutrition information disclosed online in 2010 and was retrieved from the University of Toronto's restaurant database; however, the restaurant's identity was not revealed to consumers.[18] The labelled menus also provided consumers with information about the daily recommended amount of calories (2,000 kcal) and the upper tolerable intake for sodium (2,300 mg), as previous research has demonstrated the added benefit of including contextual statements with daily reference amounts.[16]

Treatments

Three menu-labelling treatments were tested in this survey. Calorie labelling was tested because it is the most common form of menu labelling.[19,20] Calorie and sodium labelling was tested because Toronto Public Health has recently recommended the disclosure of calorie and sodium information on restaurant menus.[6] The third treatment, which includes calorie, sodium and serving size labelling, was used to determine whether the addition of serving size information helps consumers choose meals with a lower calorie and/or sodium density.

Data analysis

The primary outcome was the difference in nutrient levels among treatments before versus after labelling information had been seen.

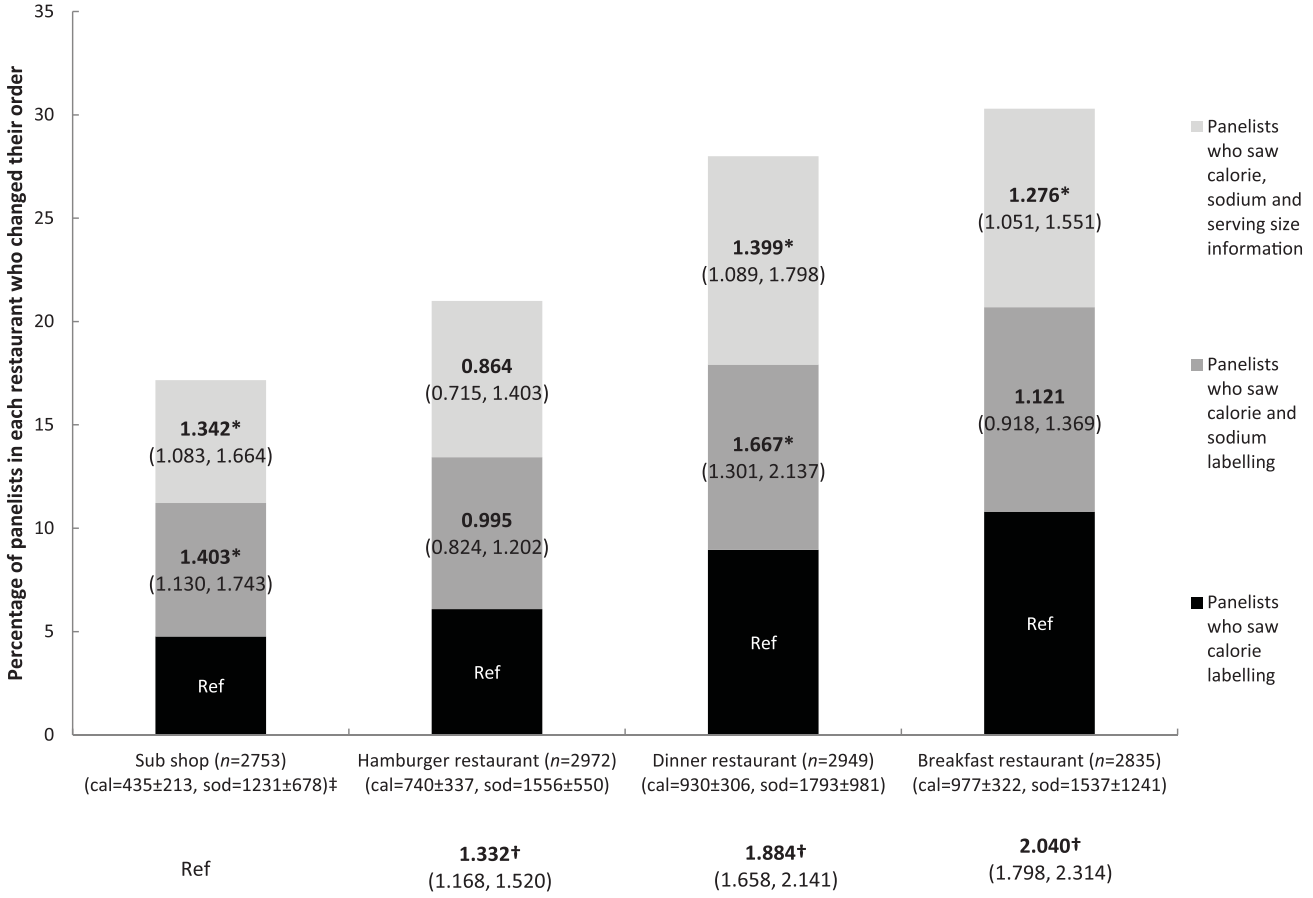

Figure 1. Proportion of panelists in each restaurant who changed their order after seeing menu labelling, and proportion of panelists from each treatment who changed their order

Each bar represents the percentage of consumers in each restaurant who changed their order. Within each bar, the percentage of consumers from each treatment is shown. Data are presented in two sets of odds ratios (95% confidence intervals). The odds ratios within the bars compare the proportion of consumers in each treatment who changed their order, the reference group being the calorie treatment; therefore, the odds ratios show the relative benefit of additionally including sodium information or including sodium and serving size information. * indicates when a group is significantly different from the reference group $p<0.05$. The odds ratios along the x axis compare the proportion of consumers in each restaurant who changed their order. † denotes when a restaurant is significantly different from the reference (sub shop) restaurant. ‡ Baseline calories (kcal) and sodium (mg) ordered by panelists before seeing menu labelling. Note: Less than 1% of panelists opted to change their order to a meal that was higher in calories and/or sodium. Cal=calories, Sod=sodium.

Secondary outcomes were differences in the subset of panelists who opted to change their order, the effect of serving size labelling on the nutrient density of meals ordered and demographic influences on menu labelling. The analysis included both complete and incomplete surveys. Mean±SE for calories, sodium and serving size of meals ordered by consumers before and after seeing menu labelling were calculated. Because the data were not normally distributed, Monte Carlo simulations of the exact *p* values were used to compare nutrient levels before and after seeing labelling. For the subset of panelists who changed their order, t-tests were used to compare treatment one and treatment two and paired t-tests were used to compare the levels before and after seeing menu labelling. Panelists did not necessarily change their order in all four restaurants. Therefore, data for the subset of panelists who changed their order is reported separately for each restaurant. Odds ratios were used to compare the proportion of consumers who changed their order in each restaurant and each treatment. Analysis of variance was used to compare the calorie density, sodium density and serving size of meals ordered by consumers in different treatments.

To explore the role of socio-demographic factors on the effect of menu labelling, the following predictors (age, sex, education, frequency of eating out, intent to lose weight, treatment and restaurant) were tested in a repeated measures logistic regression (using Proc Genmod). Separate models were constructed for each interaction term, and because there was interaction between the restaurant scenario and some demographic predictors, a separate model was constructed for each restaurant. An additional model was constructed that incorporated income and body mass index (BMI) data collected in the baseline questionnaire. Key themes in the open-ended questions were identified, and responses were coded and quantified. Some responses were classified as having more than one theme. Only themes mentioned by a minimum of 5% of consumers were reported. Statistical analyses were conducted using SAS version 9.3 software (SAS Institute Inc., Cary, North Carolina, 2010).

RESULTS

Participants

A total of 3,080 panelists participated in the survey; their baseline characteristics are reported in Table 1. More than 85% of respondents reported eating out at least once a week.

Table 2. Comparison of the calorie and sodium content of meals ordered by panelists who saw calorie or calorie and sodium labelling

	Restaurant	Type of labelling	*n*	Calories (kcal)			Sodium (mg)		
				Before seeing menu labelling (baseline)	After seeing menu labelling	Change: before vs. after seeing menu labelling	Before seeing menu labelling (baseline)	After seeing menu labelling	Change: before vs. after seeing menu labelling
				Mean±SE (Median)IQR	Mean±SE (Median)IQR		Mean±SE (Median)IQR	Mean±SE (Median)IQR	
All panelists	Hamburger	Calorie	1041	731±10 (656)505-920	657±10 (600)410-800	–74*	1545±17 (1495)1310-1750	1452±15 (1435)1195,1580	–93*‡
		Calorie + sodium	939	737±11 (690)510-940	653±11 (610)410-820	–84*	1531±18 (1510)1300-1750	1360±19 (1365)975-1575	–171*
	Breakfast	Calorie	998	968±10 (960)570-1232	793±10 (580)560-1110	–175*†	1504±38 (1300)770-1598	1249±33 (890)630-1598	–255*
		Calorie + sodium	899	980±11 (960)580-1232	828±11 (690)560-1190	–152*	1566±43 (1300)770-1598	1226±35 (890)600-1598	–340*
	Sub shop	Calorie	970	434±6 (370)282-532	402±6 (310)282-510	–32*	1247±22 (980)900-1520	1191±21 (980)900-1360	–56*§
		Calorie + sodium	868	432±7 (370)282-532	390±6 (310)280-480	–42*	1203±23 (970)820-1360	1069±21 (920)700-1260	–134*
	Dinner	Calorie	1034	937±9 (977)642-1170	816±9 (731)552-1094	–121*	1811±30 (1807)1039-2384	1521±30 (1482)637-2133	–290*†
		Calorie + sodium	933	917±10 (969)574-1143	798±10 (720)532-1090	–119*	1773±33 (1770)974-2360	1389±32 (1129)510-2021	–384*
Subset of panelists who changed their order after seeing labelled menus	Hamburger	Calorie	204	858±23 (840)580-1030	485±16 (415)350-615	–373*	1737±44 (1560)1370-1985	1266±27 (1335)1127-1535	–471*§
		Calorie + sodium	238	783±22 (720)540-990	447±14 (420)340-570	–336*	1637±34 (1560)1420-1915	956±28 (955)700-1300	–681*
	Breakfast	Calorie	369	1133±12 (1232)960-1232	659±14 (570)450-690	–474*	1820±69 (1598)1130-1598	1126±52 (890)630-1300	–694*
		Calorie + sodium	322	1115±15 (1232)950-1232	685±15 (570)560-740	–430*	1955±84 (1598)1110-1598	996±56 (630)600-890	–959*
	Sub shop	Calorie	136	591±19 (532)480-600	361±13 (290)280-375	–230*	1518±67 (1260)920-1830	1122±44 (980)900-1240	–396*§
		Calorie + sodium	188	527±17 (510)370-580	331±9 (310)280-310	–196*	1479±52 (1260)920-1830	853±31 (700)700-970	–626*
	Dinner	Calorie	282	1079±14 (1120)920-1193	636±12 (574)514-694	–443*	2181±47 (2133)1671-2921	1112±44 (974)510-1611	–1069*§
		Calorie + sodium	263	1034±16 (1093)900-1192	611±11 (553)514-678	–423*	2206±51 (2133)1611-2921	846±37 (541)475-1185	–1360*

* Indicates a *p* value that is less than the Bonferroni adjusted experiment-wise cut point of 0.0016.
† Indicates a significant difference between treatments, $p<0.01$; ‡ represents $p<0.001$; § represents $p<0.0001$.
IQR=interquartile range.
Data were analyzed using Monte Carlo simulations of exact *p* values for the analysis of all panelists on whom the data were skewed and using paired t tests for the evaluation of the subset of panelists who chose to change their order.
Note: Panelists did not necessarily change in all four restaurants. Therefore this table separately illustrates data for the panelists who changed their order in each restaurant. Data for treatment 3 (including calories, sodium and serving size data) were not reported here because in most cases the results were similar to those of treatment 2 with regard to the benefit of including sodium. Table 3 presents data from treatment 3 in relation to the research question it is meant to answer.

Table 3. Comparison of the serving size, calorie density and sodium density ordered after seeing menu labelling among those who opted to change their order

		Serving size				Calorie density				Sodium density			
		Menu-labelling condition Mean±SE (Median) Interquartile range				Menu-labelling condition Mean±SE (Median) Interquartile range				Menu-labelling condition Mean±SE (Median) Interquartile range			
	n	Cal*	Cal+Sod†	Cal+Sod+SS‡	*p*	Cal	Cal+Sod	Cal+Sod+SS	*p*	Cal	Cal+Sod	Cal+Sod+SS	*p*
Breakfast restaurant	988	455±6[a] (499)327-504	468±7[a] (449)406-504	472±7[a] (449)406-504	0.14	143±1[a] (137)125-166	144±1[a] (138)125-161	146±1[a] (138)125-161	0.25	230±7[a] (193)177-273	202±7[b] (177)134-193	205±7[b] (176)134-193	0.005
Sub shop	478	273±8[a] (233)226-255	246±6[a] (233)226-236	257±8[a] (233)226-236	0.04	132±1[a] (125)142-134	134±1[a] (133)125-136	133±1[a] (133)125-136	0.26	403±6[a] (429)398-442	337±6[b] (300)243-429	341±6[b] (300) 243-429	0.0001
Dinner restaurant	853	408±7[a] (403)319-483	404±7[a] (414)313-483	387±7[a] (383)273-483	0.09	164±3[a] (162)113-199	160±3[ab] (164)113-205	179±3[c] (191)129-218	0.0001	272±9[a] (260)108-394	207±8[b] (115)104-307	224±8[b] (174)108-311	0.0001

* Cal=calorie labelling treatment; † Cal+Sod=calorie and sodium labelling treatment; ‡ Cal+Sod+SS=calorie, sodium and serving size labelling treatment. The *n* represents only those who changed their order and it includes panelists from all three treatments.
[a,b,c] Values with different alphabetical superscripts are significantly different.
Note: A *p* value that is less than the Bonferroni adjusted experiment-wise cut point of 0.006 can be considered significant.
Hamburger restaurant data were not analyzed because the beverages offered prevented the proper calculation of calorie and sodium density.

Table 4. Key themes identified in open-ended questions that asked panelists to explain why the nutrition information on the menu influenced their decision, somewhat influenced their decision, or did not influence their decision

Panelists' responses	*n*	%
Yes, the nutrition information influenced my decision... (*n*=762)		
Sodium was too high, I tried to pick lower sodium meals (or any comment related to the sodium level of the meal)	331	67*
Calories were too high, I tried to pick lower calorie meals (or any comment related to the calorie content of the meal)	463	61
I was shocked or surprised by sodium level, I wasn't aware of how high the sodium content was	91	18*
I was shocked or surprised by calorie level, I wasn't aware of how high the calorie level was	129	17
The information helped me make a healthier choice, I changed something after seeing the information, I am trying to be healthier	58	8
The information increased my awareness, I didn't realize how unhealthy my choices were, it made me think more about what I was ordering	36	5
The information somewhat influenced my decision... (*n*=660)		
Sodium was too high, I tried to pick lower sodium meals (or any comment related to the sodium level of the meal)	160	41*
Calories were too high, I tried to pick lower calorie meals (or any comment related to the calorie content of the meal)	267	40
The information helped me make a healthier choice, I changed something after seeing the information, I am trying to be healthier	87	13
Shocked or surprised by sodium level, I wasn't aware of how high the sodium content was	41	11*
I rarely eat out, eating out is a treat	55	8
Shocked or surprised by the calorie level, I wasn't aware of how high the calorie content was	54	8*
Other	45	7
The information verified that I had already made a healthy choice	36	5
No, the information did not influence my decision... (*n*=528)		
I rarely eat out, eating out is a treat	187	35
I don't care about the information, I eat what I want to eat, I am not concerned about my weight	113	21
I already eat in a healthy manner, I already know which choices are healthy or unhealthy	90	17
The information verified that I had already made a healthy choice	52	10
Other	51	10
I have other dietary restrictions that govern my food choices (vegetarianism, veganism, gluten intolerance, etc.)	32	6

* This percentage was calculated with 496 as the denominator because only two thirds of panelists saw sodium information, therefore only those who were in treatment 2 or 3 were included in this percentage.

Proportion of consumers who changed their order after seeing nutrition information

Figure 1 shows the proportion of consumers, within each restaurant type, who changed their order after seeing labelled menus. There was a significant difference among restaurants, ranging from 17% in the sub shop to 30% in the breakfast restaurant. There was also a significant difference in the proportion of consumers in each treatment who changed their order. In the sub shop, dinner restaurant and breakfast restaurant scenarios, consumers who saw more information (serving size and/or sodium) were significantly ($p<0.05$) more likely to change their order than consumers who only saw calorie information.

Sodium level of meals ordered before versus after seeing labelled menus (all consumers)

Table 2 shows the average calorie and sodium level of meals ordered before and after seeing labelled menus. Sodium levels decreased in all treatments ($p<0.0001$). However, in three of the four restaurant scenarios, consumers who saw calorie and sodium information ordered meals with significantly less sodium than consumers who saw only calorie information ($p<0.01$). The average decrease in sodium ranged from 56 to 290 mg among panelists who saw calorie labelling and from 134 to 384 mg among panelists who saw calorie and sodium labelling.

Sodium level of meals ordered before versus after seeing labelled menus (subset of consumers who changed their order)

Table 2 shows the average calorie and sodium levels of meals ordered before and after panelists saw menu labelling in the subset who chose to change their order. In the hamburger, breakfast, sub and dinner restaurants, the average difference in sodium ordered before versus after seeing labelling was 471, 694, 396 and 1,069 mg respectively among consumers who saw only calorie information and 681, 959, 626 and 1,360 mg respectively among consumers who saw calorie and sodium information.

Effect of serving size information on the calorie and sodium density of consumers' choices

Consumers who saw serving size information did not order meals with a lower calorie or sodium density compared with consumers who did not see serving size information (Table 3).

Consumers' rationale for why the information influenced or did not influence their order

When asked "Did the information influence what you ordered", 32% of consumers answered "yes", 33% said it "somewhat influenced their order", and 35% said it did not influence their order. There was no significant difference in the proportion of consumers from each treatment who said that the information influenced their order. Table 4 shows that 67% of consumers who were influenced by the information specifically commented on sodium, with 18% expressing shock and disbelief regarding the high sodium levels. The most popular rationale for why consumers did not use the nutrition information was that they rarely eat out or they consider meals at restaurants to be a treat (35%); meanwhile, only 21% said that they do not care about the information. In addition, many consumers noted that they were already health conscious (17%), that the information verified that they had already made a healthy choice (10%), or that other dietary restrictions govern their food choices (6%).

Effect of demographic characteristics on the influence of consumers' decisions

Sex, intent to lose weight, and the amount of calories ordered at baseline were statistically significant predictors of who changed their order after seeing menu labelling (Table 5). Because of the significant interaction between restaurant and various demographic predictors, education, treatment and frequency of eating out were also statistically significant predictors at some restaurants (data not shown). In the secondary model that included income and BMI (data not shown), we found that neither of these additional predictors was significant.

Table 5. Odds ratios classified by restaurant and demographic predictor of who uses menu labelling

Restaurant			Odds ratios	95% CI	p value
Hamburger restaurant	Sex	Female vs. male	1.41	1.12-1.78	0.0037
	Intent to lose weight	Intent vs. no intent	2.18	1.77-2.68	0.0001
	Calories at baseline* (before seeing menu labelling)		1.11	1.06-1.16	0.0001
	Sodium at baseline† (before seeing menu labelling)		1.03	1.01-1.06	0.0165
Breakfast restaurant	Sex	Female vs. male	1.74	1.39-2.18	0.0001
	Intent to lose weight	Yes vs. no	1.91	1.57-2.32	0.0001
	Calories at baseline (before seeing menu labelling)		1.38	1.32-1.44	0.0001
	Sodium at baseline† (before seeing menu labelling)		0.99	0.98-1.02	0.4493
Sub shop	Sex	Female vs. male	1.80.	1.36-2.38	0.0001
	Intent to lose weight	Yes vs. no	1.75	1.38-2.21	0.0001
	Calories at baseline (before seeing menu labelling)		1.38	1.25-1.53	0.0001
	Sodium at baseline† (before seeing menu labelling)		1.01	0.97-1.04	0.653
Dinner restaurant	Sex	Female vs. male	1.45	1.15-1.84	0.0018
	Intent to lose weight	Yes vs. no	1.72	1.41-2.10	0.0001
	Calories at baseline (before seeing menu labelling)		1.23	1.18-1.29	0.0001
	Sodium at baseline† (before seeing menu labelling)		1.03	1.02-1.05	0.0001

* Calories at baseline refers to the amount of calories (kcal) in the meal ordered by the panelists before seeing menu labelling.
† Sodium at baseline refers to the amount of sodium (mg) in the meal ordered by the panelists before seeing menu labelling.
Because of the observed interaction between restaurant and various demographic predictors, education and treatment were also significant predictors in the hamburger restaurant; frequency of eating out and education were significant predictors in the breakfast restaurant; education and age were significant predictors in the sub shop; and treatment and frequency of eating out were significant predictors in the dinner restaurant.
Note: *p* values less than the Bonferroni adjusted experiment-wise cut point of 0.003 can be considered significant.

Proportion of consumers who want to see nutrition information

Of the surveyed consumers, 80% said that they would like to see nutrition information when dining out; specifically, 75% wanted to see calories; 71%, sodium; 49%, total fat; 47%, sugar; 46%, trans fat; and 43%, saturated fat information.

DISCUSSION

These results show that when sodium information was provided on restaurant menus, consumers ordered meals with significantly less sodium than did consumers who saw only calorie information. However, the magnitude of the decrease varied depending on the restaurant type.

Even when consumers saw only calorie information, the sodium content of their revised meal choices significantly declined. This is consistent with New York City's rationale for labelling only calories and not including sodium, as Farley et al. showed that calories and sodium are positively correlated.[21] However, our results confirm that despite the inadvertent decrease in sodium that automatically results from decreasing calories, the inclusion of sodium information led to an additional significant decrease in sodium.

In our study, 17-30% of consumers changed their order after seeing labelled menus. This proportion is slightly higher than the findings in New York City, where approximately 15% of customers use calorie information.[17,16] Meanwhile, other studies have shown that up to 34% of consumers use the information provided on the menu.[8,16,17]

One of the most important findings was the heterogeneous effect of menu labelling according to the type of restaurant and the sodium/calorie level of the meal. This is consistent with the findings of Burton et al., who showed that menu labelling is more likely to influence consumers' choices when the calorie content is less favourable than expected.[22] This has important methodological and policy implications, as it suggests that studies conducted in single settings, particularly if they are not high-calorie settings, may not be a reliable indicator of the potential benefit of menu labelling.

The results provide insight into the rationale for some consumers choosing not to use menu labelling. Often consumers' reasoning did not undermine the importance or relevance of this potential policy, and only a small percentage of consumers did not care or did not want to see the information. This was consistent with previous research showing that the public wants to see nutrition information on menus, even if they do not use it every time.[23-26]

In our study, 67% of consumers who saw sodium information (and answered the open-ended question) said that the sodium level of the meal influenced their decision. This was much higher than Pulos and Leng's findings that when consumers saw calories, fat, sodium and carbohydrate information, only 7.8% of patrons said that they chose their entrée because it was lower in sodium.[8] Previous research has shown that women, older and wealthier customers are more likely to use menu labelling.[17] Our results indicate that women were more likely to do so, but age and income were not significant predictors. Contrary to what might be expected, BMI was not a statistically significant predictor of the use of menu labelling, but this was due to the collinearity between intent to lose weight and BMI, as panelists who were trying to lose weight were more likely to be obese.

Strengths

The strengths of the study were the large sample and the repeated measures design, which enabled us to detect within-subject effects. Furthermore, the survey methodology enabled us to quantify the decrease in calories and sodium among consumers who actually used the information. This allowed us to measure the magnitude of the decrease at the level of the individual, which to date has not been considered in most of the natural experiments and interventions conducted in real-life settings.

Weaknesses

The applicability of these results to a real-life setting is unclear, as the study only evaluated purchase intentions as opposed to purchasing behaviours, which can be affected by many other factors. Additionally, our results may be subject to social desirability bias;[27] however, the use of online surveys has been shown to promote less bias than traditional interview methodologies.[28] Furthermore, our sample was slightly older, more female and more educated than the 2006 Canadian Census

data.[29,30] It might, therefore, have been biased toward individuals who were more likely to use labelling and thus may not be representative of the Canadian population. The results should be confirmed with a real-life intervention that takes into consideration factors such as cost.

In addition, our study investigated only one of the many potential mechanisms through which menu labelling can affect the nutritional content of consumers' purchases. A recent study showed that 18 months after the implementation of menu labelling, the calorie, saturated fat and sodium levels of restaurant meals were lowered.[31] Therefore, it is important to remember that in order to draw conclusions about the benefit of a policy such as menu labelling, we must consider all of its potential benefits, including its effect on promoting product reformulation and the introduction of new, healthier menu offerings.

CONCLUSION

These results suggest that menu labelling could have an impact on the nutrient content of meals ordered by some consumers when they are dining out. Additionally, they show that including sodium information may lead to lower-sodium choices compared with providing calorie information alone. Finally, this study shed light on the effect of context, and how the restaurant setting and the nutritional quality of the foods being offered have a large impact on the effect of menu labelling on consumer choices. Thus, given the prevalence of eating outside the home alongside the rising rates of diet-related disease, and the alarmingly high calorie and sodium content of restaurant meals, it is important that menu-labelling interventions be considered by policy-makers.

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RÉSUMÉ

OBJECTIF : Plusieurs projets de loi provinciaux et fédéraux recommandent diverses formes d'étiquetage nutritionnel des menus exigeant davantage d'information que la simple teneur en calories; on ignore cependant quel serait l'avantage supplémentaire d'inclure la teneur en sodium. Notre étude visait à déterminer si l'ajout de la teneur en sodium sur les menus aiderait les consommateurs à choisir des mets plus faibles en sodium; elle visait aussi à comprendre les autres facteurs qui modifient l'effet de l'étiquetage nutritionnel des menus sur les mets choisis par les consommateurs.

MÉTHODE : En tout, 3 080 consommateurs canadiens ont répondu à un sondage en ligne incluant une expérience à mesures répétées au cours de laquelle on leur a demandé de choisir ce qu'ils commanderaient d'habitude aux menus de quatre faux restaurants. Ensuite, les consommateurs ont été répartis de façon aléatoire en trois groupes, et on leur a présenté l'un de trois modes d'étiquetage nutritionnel des menus (calories; calories et sodium; ou calories, sodium et portion), et on leur a donné la possibilité de modifier leur commande.

RÉSULTATS : Il y avait un écart significatif dans la proportion de consommateurs ayant changé leur commande, soit de 17 % à 30 % selon le type de restaurant. Après que les participants ont vu l'étiquetage nutritionnel des menus, les niveaux de sodium ont diminué pour les trois modes d'étiquetage (p<0,0001). Toutefois, pour trois des quatre types de restaurants, les consommateurs qui ont vu la teneur en calories et en sodium ont commandé des mets contenant significativement moins de sodium que ceux qui n'ont vu que la teneur en calories (p<0,01). Les consommateurs ayant vu l'étiquetage sur le sodium ont réduit le niveau de sodium de leur repas de 171-384 mg en moyenne, selon le restaurant. Dans le sous-ensemble des consommateurs ayant vu la teneur en sodium et choisi de modifier leur commande, les niveaux de sodium ont diminué en moyenne de 681-1 360 mg, selon le restaurant. Le sexe, l'intention de perdre du poids et le nombre de calories des mets commandés à l'origine étaient les principaux prédicteurs des consommateurs ayant utilisé l'étiquetage nutritionnel des menus. Quatre-vingt p. cent des répondants voulaient voir de l'information nutritionnelle quand ils allaient au restaurant.

CONCLUSION : Inclure la teneur en sodium en plus de la teneur en calories pourrait entraîner une plus forte réduction de la quantité de sodium commandée par la clientèle des restaurants.

MOTS CLÉS : restaurant; aliments de restauration rapide; étiquetage aliments; sodium

Supplementary Figure 1A
Hamburger Restaurant Menu

		
HAMBURGERS Hamburger Cheeseburger Deluxe Burger Deluxe Cheeseburger Double Burger Double Cheeseburger Veggie Burger SANDWICHES Fried Chicken Sandwich Grilled Chicken Sandwich Fish Sandwich CHICKEN 4 Chicken Nuggets/Strips 6 Chicken Nuggets/Strips SALADS Chicken BLT Salad Chicken Caesar Salad	FRENCH FRIES Small Medium Large ONION RINGS Small Medium Large SIDE GARDEN SALAD Regular Dressing Light Dressing POUTINE MOZZARELLA STICKS APPLE SAUCE	SOFT DRINKS (any kind) Small Medium Large DIET SOFT DRINKS (any kind) Small Medium Large JUICE (any kind) Small Medium Large MILKSHAKE Small Medium Large COFFEE/TEA Cream Milk Sugar WATER

Supplementary Figure 1B
Breakfast Restaurant Menu

Breakfast Menu

Eggs Benedict

Classic Eggs Benedict
Two poached eggs and bacon on an English muffin, topped with hollandaise sauce.

Smoked Salmon Benedict
Salmon on an English muffin topped with two poached eggs and hollandaise sauce.

Florentine Benedict
Two poached eggs on pumpernickel Bread with cream cheese, spinach, smoked salmon and hollandaise sauce.

Asparagus and Brie Benedict
English muffin with two poached eggs, cheese, asparagus and hollandaise sauce.

French Toast

Multigrain French Toast
Two slices of multigrain bread, with cinnamon fresh mixed berries and maple syrup.

Loaded French Toast
French toast topped with fruit, caramel, candied pecans, vanilla frozen yogurt and pure maple syrup.

Waffles

Plain Waffle

Strawberry Waffle

Banana Waffle

Mixed Berry Waffle

Warm Apple Waffle

Omelettes (2 eggs)

Deli Omelette

Ham and Cheese

Spinach and Feta

Wild Mushroom

Veggie & Cheese

Avocado Omelette

Cheddar Cheese

Classic Items

Bacon, 2 Eggs, Toast & Potatoes

Steak, 2 Eggs, Toast & Potatoes

Granola Yogurt Parfait

Supplementary Figure 1C
Sub Shop Menu

The Sub Shop	
Black Forest Ham Sub Turkey Sub Veggie Sub Roast Beef Sub Tuna Sub Roasted Chicken Sub Sweet Onion Chicken Teriyaki Sub Turkey Breast & Black Forest Ham Sub Meatball and Tomato Sauce Sub Italian Salami, Pepperoni and Ham Sub Pepperoni Pizza Sub Italian Salami, Pepperoni and Cheese Sub Chicken Pizza Sub Steak & Cheese Sub Turkey, Roast Beef and Ham Sub Chicken, Cheese and Bacon Sub Turkey, Ham, Salami and Bologna Sub Turkey, Ham, Bacon and Cheese Sub	**Available in Two Sizes:** 6 Inch 12 Inch All sandwiches are served with your choice of lettuce, tomato, cucumber or onions

Supplementary Figure 1D
Dinner Restaurant Menu

Entrées

Salad Entrées
Caesar Salad
Chicken Caesar Salad
Warm Beet and Spinach Salad
Santa Fe Chicken Salad
Pasta Entrées
Penne Alfredo
Mediterranean Linguini w/ Chicken
Prawn and Scallop Linguini
International Entrées
Chicken Curry Rice w/ Naan Bread
Pad Thai
Spicy Thai Curry with Shrimp
Kung Pao Stir Fry
Seafood Entrées
Fish and Chips

The Following Items are Served with Your Choice of One Side Dish

Sandwiches***
Grilled Chicken on a Ciabatta
Roasted Chicken Quesadilla
Chicken Tacos
Steak Sandwich
Short Rib Beef Dip
Chicken***
Cajun Blackened Chicken
Roast Chicken with Dijon
Parmesan Pine Nut Chicken
Steak***
9oz Top Sirloin
9oz Top Sirloin w/Peppercorn Sauce
12 oz New York Striploin
12 oz Blackened New York Striploin
Seafood***
Cedar Planked Salmon

Side Dish Choices (pick one)
Fingerling Potatoes w/Garlic Butter
Garlic Mashed Potatoes
Potato Salad
Roast Potatoes
Penne Alfredo
Coleslaw
Mediterranean Vegetables
Mixed Green Salad with Vinaigrette
French Fries

Supplementary Figure 2A
Menu-labelling Treatment 1: Calorie Labelling

HAMBURGERS	Calories
Hamburger	300
Cheeseburger	340
Deluxe Burger	670
Deluxe Cheeseburger	760
Double Burger	910
Double Cheeseburger	1000
Veggie Burger	310
SANDWICHES	
Fried Chicken Sandwich	640
Grilled Chicken Sandwich	370
Fish Sandwich	500
CHICKEN	
4 Chicken Nuggets/Strips	160
6 Chicken Nuggets/Strips	250
SALADS	
Chicken BLT Salad	540
Chicken Caesar Salad	450

FRENCH FRIES	Calories
Small	270
Medium	350
Large	440
ONION RINGS	
Small	200
Medium	320
Large	380
SIDE GARDEN SALAD	
Regular Dressing	200
Light Dressing	40
POUTINE	740
MOZZARELLA STICKS	350
APPLE SAUCE	50

A 2000 calorie diet is used as the basis for general nutrition advice; however, individual calorie needs may vary.

SOFT DRINKS (any kind)	Calories
Small	160
Medium	230
Large	320
DIET SOFT DRINKS (any kind)	
Small	0
Medium	0
Large	0
JUICE (any kind)	
Small	180
Medium	260
Large	360
MILKSHAKE	
Small	440
Medium	640
Large	950
COFFEE/TEA	
Cream	22
Milk	5
Sugar	16
WATER	0

Supplementary Figure 2B
Menu-labelling Treatment 2: Calorie and Sodium Labelling

HAMBURGERS	Calories	Sodium
Hamburger	300	530
Cheeseburger	340	730
Deluxe Burger	670	910
Deluxe Cheeseburger	760	1320
Double Burger	910	980
Double Cheeseburger	1000	1390
Veggie Burger	310	770
SANDWICHES		
Fried Chicken Sandwich	640	1420
Grilled Chicken Sandwich	370	910
Fish Sandwich	500	860
CHICKEN		
4 Chicken Nuggets/Strips	160	310
6 Chicken Nuggets/Strips	250	470
SALADS		
Chicken BLT Salad	540	1490
Chicken Caesar Salad	450	1420

FRENCH FRIES	Calories	Sodium
Small	270	600
Medium	350	790
Large	440	1000
ONION RINGS		
Small	200	390
Medium	320	920
Large	380	740
SIDE GARDEN SALAD		
Regular Dressing	200	425
Light Dressing	40	665
POUTINE	740	2500
MOZZARELLA STICKS	350	930
APPLE SAUCE	50	0

A 2000 calorie diet, with no more than 2300 mg of sodium per day is used as the basis for general nutrition advice; however, individual needs may vary.

SOFT DRINKS (any kind)	Calories	Sodium
Small	160	35
Medium	230	50
Large	320	70
DIET SOFT DRINKS (any kind)		
Small	0	0
Medium	0	0
Large	0	0
JUICE (any kind)		
Small	180	70
Medium	260	100
Large	360	140
MILKSHAKE		
Small	440	300
Medium	640	400
Large	950	590
COFFEE/TEA		
Cream	22	4
Milk	5	5
Sugar	16	0
WATER	0	0

Supplementary Figure 2C
Menu-Labelling Treatment 3: Calorie, Sodium and Serving Size Labelling

HAMBURGERS	Serving Size (g)	Calories	Sodium
Hamburger	126	300	530
Cheeseburger	138	340	730
Deluxe Burger	290	670	910
Deluxe Cheeseburger	315	760	1320
Double Burger	373	910	980
Double Cheeseburger	398	1000	1390
Veggie Burger	175	310	770
SANDWICHES			
Fried Chicken Sandwich	235	640	1420
Grilled Chicken Sandwich	197	370	910
Fish Sandwich	180	500	860
CHICKEN			
4 Chicken Nuggets/ Strips	62	160	310
6 Chicken Nuggets/Strips	92	250	470
SALADS			
Chicken BLT Salad	416	540	1490
Chicken Caesar Salad	332	450	1420

FRENCH FRIES	Serving Size (g)	Calories	Sodium
Small	88	270	600
Medium	116	350	790
Large	147	440	1000
ONION RINGS			
Small	57	200	390
Medium	91	320	920
Large	108	380	740
SIDE GARDEN SALAD			
Regular Dressing	152	200	425
Light Dressing	152	40	665
POUTINE	330	740	2500
MOZZARELLA STICKS	98	350	930
APPLE SAUCE	111	50	0

SOFT DRINKS (any kind)	Serving Size (oz)	Calories	Sodium
Small	16	160	35
Medium	22	230	50
Large	32	320	70
DIET SOFT DRINKS (any kind)			
Small	16	0	0
Medium	22	0	0
Large	32	0	0
JUICE (any kind)			
Small	16	180	70
Medium	22	260	100
Large	32	360	140
MILKSHAKE			
Small	16	440	300
Medium	22	640	400
Large	32	950	590
COFFEE/TEA			
Cream		22	4
Milk		5	5
Sugar		16	0
WATER		0	0

A 2000 calorie diet with maximum 2300 mg of sodium per day is used as the basis for general nutrition advice; however, individual needs may vary.