

The Impact of Nutrition Labeling on Menus: A Naturalistic Cohort Study

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Objectives: To examine the impact of a calorie label intervention on cafeteria menus. **Methods:** Exit surveys were conducted in a university cafeteria. Participants were surveyed at baseline and one week after calorie labels were displayed. We assessed changes in noticing and use of nutrition information, the calorie content of food purchased, and estimated calorie consumption. **Results:** The intervention was associated with significant increases in noticing nutrition information (92.5% vs 39.6%; $p < .001$), and the use of nutrition information to guide

food purchases (28.9% vs 8.8%; $p < .001$). The calorie content of foods purchased decreased after calorie labels were posted ($B = -88.69$, $p = .013$), as did the estimated amount of calories consumed ($B = -95.20$, $p = .006$). **Conclusions:** Findings suggest that displaying calorie amounts on menus can help reduce excess energy intake.

Key words: nutrition labeling; food labeling; nutrition policy; diet; health communication

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Obesity is a primary risk factor for a range of health problems, including certain types of cancers and heart disease.¹ The prevalence of overweight and obesity in Canada has increased dramatically in recent decades. Currently, approximately one-fourth of Canadian adults are obese and an additional 37% are overweight.¹

Young adulthood is a particularly important time for establishing long-term dietary patterns and a period during which excess weight gain is common.^{2,3} For many individuals, young adulthood is a time of transition, including changes in household environments and greater responsibility for meal choices. This period is often characterized by undesirable dietary patterns, including a higher intake of unhealthy “snack” foods, the tendency to skip meals frequently, and greater intake of calories, fat, and sodium.⁴⁻⁶ Older adolescents and young adults are also more likely than other age groups to eat away from home.⁷⁻⁹ Eating food prepared outside the home has been associated with poor dietary quality, including increased calorie, fat, and sodium consumption, as well as increased weight

gain.^{8,10,11} In the United States, approximately one-third of calories are consumed away from home, almost twice the amount consumed in the 1970s.¹²

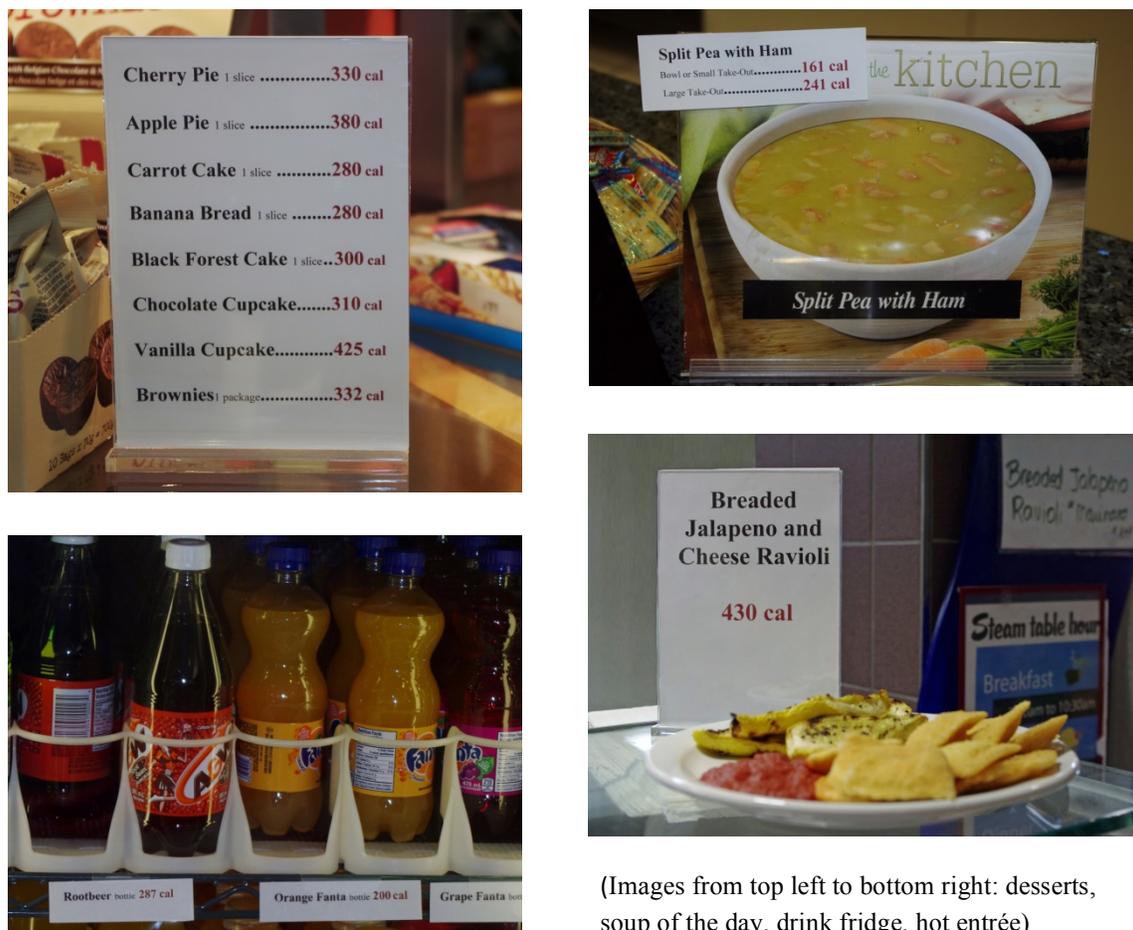
To reduce caloric intake outside the home, several US states and cities have mandated that calories be displayed on menus in chain restaurants. Starting in December 2015, the US Food and Drug Administration (FDA) will require calorie information to be displayed next to each item’s price on menus in all restaurants chains with more than 20 outlets, including cafeteria-style restaurants offering take-out, made-to-order sandwiches, and “serve yourself” foods.¹³ In Canada, the province of Ontario is considering legislation requiring large chain restaurants to post calories amounts on menus.¹⁴

To date, research on the effectiveness of calorie labeling is mixed, with some studies finding a decrease in consumption and others finding no effect.^{15,16} Studies examining actual purchasing in cafeteria settings generally have shown that calorie labels on menus are associated with the purchase of healthier items and/or fewer calories.¹⁷⁻²⁴

Six studies have examined the effect of menu labeling, specifically among university students. In studies that have assessed purchase intentions, providing calorie information was associated with increased intent to order lower-calorie meal items.²⁵⁻²⁹ This effect was particularly pronounced when the item is initially perceived as a healthy option (for example, a salad), but the calorie amount

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Figure 1
Images of Calorie Labeling in the Cafeteria during the Follow-up Period



(Images from top left to bottom right: desserts, soup of the day, drink fridge, hot entrée)

is higher than expected.²⁶ When actual ordering was examined among university samples, calorie labels seem to result in consumption of lower calorie meals, or selection of healthier food items,^{17,30,31} as well as a decrease in weight gain.³² Whereas one study found a decrease in calories consumed when labels were present, but only among those scoring higher in dietary restraint,³³ another study reported changes only for some food items.³⁴

Although several studies have assessed sales data for longitudinal changes, there is a lack of cohort data available to examine the behavioral mechanisms associated with the efficacy of menu labeling, including the extent to which interventions may impact the use of nutrition information and food selection. Presently, we sought to conduct a naturalistic cohort study of menu labeling by assessing consumer noticing and use of nutrition information before and after calorie labels were implemented in a student cafeteria. The study also examined changes in the calorie content

of meal selection, as well as differences by socio-demographic group.

METHODS

Protocol and Participants

A pre-post study of calorie labeling was conducted in a student residence cafeteria at a university in southwestern Ontario, Canada. Surveys were conducted over lunch (11:30 am - 2:30 pm) and dinner hours (5:00 pm - 8:00 pm) during a one-week baseline period for which no calorie labeling was displayed and during a one-week "follow-up" period where calorie labeling was displayed for food and beverage options. The baseline and follow-up periods were separated by 6 weeks, which was the cycle of the rotating menu in the cafeteria, so that the menu offerings were constant across the baseline and follow-up period. The study is described as a naturalistic cohort study, meaning a pre-post intervention study that occurs in a natural setting (ie, the student residence cafeteria) rather than in

Table 1
Sample Characteristics at Baseline
(N = 159)

	Percentage	N
Sex		
Men	48.4	77
Women	51.6	82
BMI		
Underweight	10.0	16
Normal weight	69.2	110
Overweight	13.2	21
Obese	1.9	3
Not stated	5.7	9
Race		
White	47.8	76
Other	52.2	83
General Health		
Poor	3.8	6
Fair	27.0	43
Good	43.4	69
Very good	19.5	31
Excellent	6.3	10
Weight Perception		
Overweight	15.1	24
Underweight	10.7	17
About right	74.2	118
Weight Aspiration		
Lose weight	30.8	49
Gain weight	13.9	22
Stay the same	24.5	39
Not trying to do anything	30.8	49

a laboratory, and is based on a prospective cohort of individuals who participated in both the baseline and follow-up assessments.

The cafeteria had multiple food stations including a hot entrée station, a salad bar, a sandwich bar, fountain beverages, drink fridges, and a desert area. During the one-week follow-up period, calorie labels were added to all cafeteria menu boards and food stations, either on the wall or in frames displayed on the counter. Food item descriptions were printed in black ink and calorie information was printed in red ink. Labels were prepared by research staff, and were checked daily for visibility and accuracy. The labeling was displayed during all hours of cafeteria operation. Follow-up surveys were conducted after the calorie labels had been on display for one week. Images of the calorie

labeling are shown in Figure 1.

The majority of the calorie values posted on the labels were provided by the food services department at the university. Missing nutritional values were calculated using the Canadian Nutrient File (CNF, version 2007) in the nutrient analysis software, The Food Processor (version 10.10.2), from ESHA Research. If the CNF food description did not match the cafeteria item, an alternate program file was used to obtain the values.

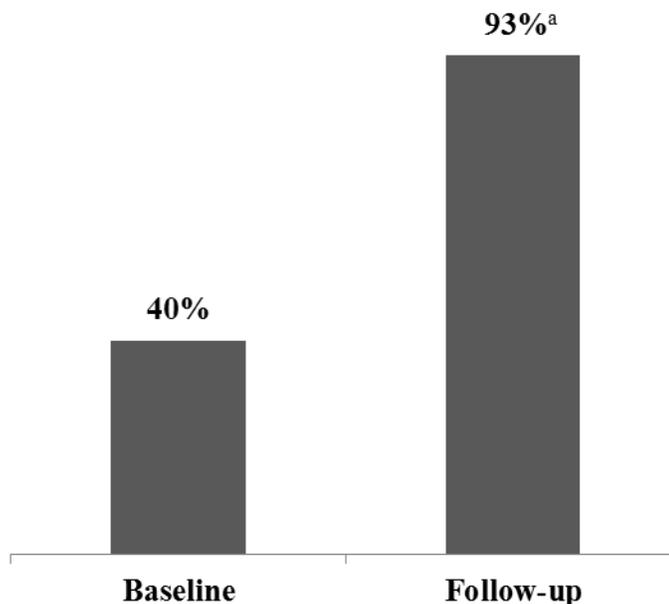
Cafeteria patrons were approached upon exiting the cafeteria using an intercept method and invited to complete a 10-minute interviewer-administered survey. To be eligible for the study, participants had to be at least 16 years of age, and had to have purchased food or drinks at the cafeteria during that particular cafeteria visit. Participants were only eligible to participate once during the baseline period, and once during the follow-up period. Participants were given \$5 as remuneration for their time. The final sample size was 879 respondents, of whom 323 only completed baseline, 397 only completed follow-up, and 159 completed both baseline and follow-up. The study response rate was 49.3% according to the American Association for Public Opinion Research’s (AAPOR) definitions for calculating response rates.³⁵ We based the present analyses on the cohort of 159 individuals who completed the questionnaire at both baseline and follow-up.

Measures

Demographic information included sex and race (white or other). Participants were asked to rate their overall health (poor, fair, good, very good, or excellent) using a measure adapted from the Canadian Community Health Survey.³⁶ Body Mass Index (BMI) was computed from self-reported height and weight and categorized as underweight, normal weight, overweight, and obese using the World Health Organization (WHO) guidelines.³⁷ Weight perceptions and aspirations were assessed using measures adapted from the National Health and Nutrition Examination Survey (NHANES).³⁸ To examine weight perceptions, participants were asked: “Do you consider yourself now to be: overweight, underweight, or about the right weight?” Identical question wording was used in NHANES. Weight aspirations were measured by asking: “Which of the following are you trying to do about your weight: lose weight, gain weight, stay the same weight, not trying to do anything about your weight?” This question was adapted from an NHANES measure that asked participants if they would like to weigh more, less, or stay about the same.

To examine noticing of nutrition information, participants were asked: “Did you notice any nutrition information anywhere in the restaurant?” (yes, no).^{22,39} Those who said “yes,” were then asked what type(s) of information they saw (eg, calories, fat), and when they saw it (before ordering, or at another time).²² To assess the use of the nutrition

Figure 2
Proportion of Respondents Noticing Calorie Information at
Baseline and Follow-up (N = 159)



Note.

a = Significant difference compared to baseline, adjusted for sex, BMI, race, general health, weight perception, and weight aspiration (OR = 22.45, $p < .001$).

information, participants who reported noticing nutrition information were asked whether it influenced what they ordered.²² Responses to the type of nutrition information were open-ended with no prompting to participants. Interviewers coded the responses into relevant pre-defined categories or under an “other” category.

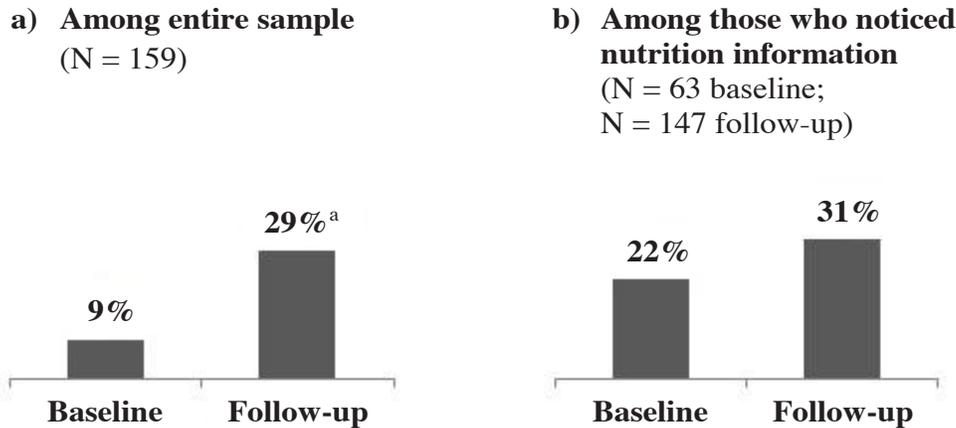
Interviewers collected information on all food and beverages that were purchased during the participants’ cafeteria visit, using pre-programmed lists of menu items, as well as open-ended questions about main entrées, sides, beverages, desserts, and any customizations. These questions were adapted from survey instruments used in previous menu labeling studies.^{22,39-41} The calorie content of the purchased food and beverages was calculated using the same values that were posted on the calorie labels, which, as described earlier, were obtained from the food services department, or calculated using nutrient analysis software. To estimate the amount of food consumed, participants who had dine-in meals were asked: “Did you eat all of your meal?”²² If the participant had not finished his/her entire meal, he/she was asked how much of each food or drink item he/she consumed (one-fourth, one-half, three-fourths, the entire item, or other).²² Calories consumed was calculated for

each participant by adjusting the number of calories in the food ordered by the amount the participant estimated he/she finished. Most meal items offered in the cafeteria were served in standardized portion sizes. For self-serve items (eg, salad bar, cereal), interviewers prompted participants to estimate serving sizes.

Analysis

Analyses were conducted using IBM SPSS Version 22.0. Generalized estimating equations (GEE models) were used to examine differences between baseline and follow-up in outcomes, including noticing nutrition information, using nutrition information to guide meal choice, calorie content of the cafeteria purchase, and estimated calorie consumption. Analyses included an indicator variable for survey wave, and were adjusted for sex, BMI, race, perceived general health, weight perception, and weight aspiration. Note that in models examining self-reported influence of menu labels, general health and BMI were excluded in the model because of quasi-complete separation of the data due to small cell sizes. GEE models were selected as they account for correlations in longitudinal data (ie, data from the same participants over time).⁴²

Figure 3
Proportion of Participants who Reported that the Nutrition Information Influenced their Meal Choice at Baseline and Follow-up



Note.

^a = Significant difference compared to baseline, adjusted for sex, race, weight perception, and weight aspiration (OR = 4.65, $p < .001$).

RESULTS

Sample Characteristics

Sample characteristics based on participant responses during the baseline survey are presented in Table 1.

Noticing Nutrition Information

Figure 2 shows the percentage of respondents who noticed calorie information in the cafeteria at baseline and at follow-up. Significantly more participants reported noticing nutrition information at follow-up than baseline (92.5% vs 39.6%; OR = 22.45, $p < .001$). Weight aspiration was also a significant predictor of noticing ($\chi^2 = 12.26$, $p = .007$); those who wanted to “lose weight” were more likely to notice nutrition information compared to those who wanted to “stay the same” weight and those who were “not trying to do anything” about their weight (OR = 2.91, $p = .011$; OR = 3.46, $p = .003$, respectively). Race ($p = .74$), sex ($p = .22$), BMI ($p = .06$), general health ($p = .78$), and weight perception ($p = .33$) were not associated with noticing nutrition information.

Among persons who reported noticing nutrition information, calories were the most common type of information noticed (74.6% at baseline; 99.3% at follow-up). The majority of participants who reported noticing nutrition information said they saw it “before ordering” (61.9% at baseline; 78.9% at follow-up).

Use of Nutrition Information to Guide Meal Choice

Figure 3 shows the proportion of participants

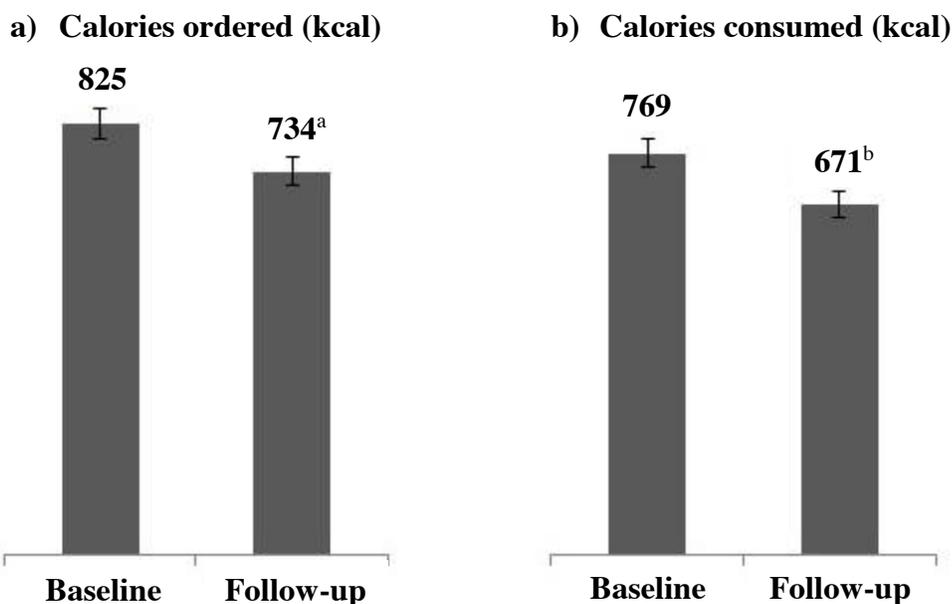
who reported that the nutrition information influenced their meal choice at baseline and follow-up among the entire sample (Figure 3a) and only among those who reported seeing nutrition information (Figure 3b). A GEE model found that participants at follow-up were more likely to report that the nutrition information influenced their meal choice compared to participants at baseline (28.9% vs 8.8%, OR = 4.65, $p < .001$). Those who identified themselves as any race other than “white” were more likely to report that nutrition information influenced their meal choice (OR = 2.35, $p = .023$). Sex ($p = .20$), weight perceptions ($p = .61$), and weight aspirations ($p = .09$) were not significant predictors.

Calorie Ordering and Consumption

Figure 4a shows the mean number of calories ordered by participants at each survey wave. At baseline, the mean number of calories ordered was 825 kcal (N = 149, SD = 336.23), and at follow-up, the mean number of calories ordered was 734 kcal (N = 156, SD = 330.58). A GEE model was conducted to test for differences in calories ordered between survey waves. There was a significant difference in calories ordered between the baseline and follow-up survey waves (B = -88.69, $p = .013$). Sex ($p = .20$), BMI ($p = .72$), race ($p = .82$), general health ($p = .35$), weight perceptions ($p = .38$), and weight aspirations ($p = .24$) were not associated with calories ordered.

Figure 4b shows the mean calorie consumption estimated for participants at each survey wave. At baseline, the mean calorie consumption was 769

Figure 4
Mean Calories Ordered and Consumed in Meal (N = 156)



Note.

a = Significant difference compared to baseline, adjusted for sex, BMI, race, general health, weight perception, and weight aspiration (B = -88.69, p = .013)

b = Significant difference compared to baseline, adjusted for sex, BMI, race, general health, weight perception, and weight aspiration (B = -95.20, p = .006)

kcal (N = 149, SD = 341.93) compared to the 671 kcal (N = 156, SD = 326.87) at follow-up. A GEE model was conducted to test for differences in calorie consumption between survey waves. There was a significant decrease in calorie consumption between the baseline and follow-up survey waves (B = -95.20, p = .006). In addition, women consumed fewer calories than men (B = -116.83, p = .014). BMI (p = .77), race (p = .48), general health (p = .49), weight perceptions (p = .39), and weight aspirations (p = .14) were not significant predictors of calorie consumption.

DISCUSSION

To our knowledge, this study represents the first naturalistic cohort study to examine behavioral outcomes from a menu labeling intervention. The findings indicate that calorie labeling in a cafeteria environment increased noticing and use of nutrition information, and decreased the amount of calories ordered and consumed. At baseline, approximately 40% of participants reported noticing nutrition information in the cafeteria. Following the display of calorie labels, virtually all respondents (93%) reported seeing nutrition information. Other studies have reported similar increases in awareness when nutrition information was dis-

played on or near menus in cafeteria settings.^{22,24,43} In our study, participants were also more likely to report seeing nutrition information prior to ordering when the calorie amounts were labeled on the menu boards or immediately beside food items. Collectively, these findings highlight the importance of menus in communicating nutrition information as broadly as possible and at the critical moment during which food decisions are being made.

Although no nutrition information was posted during the baseline period, a substantial proportion of participants (40%) reported noticing nutrition information at that time. Prior to the start of the study, the cafeteria had displayed some nutrition information that resembled a nutrition facts table beside meals in the hot entrée station. This information was removed approximately one week prior to our baseline data collection period; however, some carryover effects may have occurred.

Displaying calorie labels on menu boards or immediately beside food items more than tripled the proportion of patrons who reported using nutrition information to guide their food purchase, from 9% at baseline to 29% at follow-up. Most importantly, the calorie content of food purchases

decreased by 11% (91 calories) after labels were displayed. Likewise, the amount of calories consumed decreased by 13% or 98 calories from baseline to follow-up. The magnitude of this decline is somewhat less than the only previous naturalistic menu labeling intervention evaluated in Canada, although the nutrition labels in that study were accompanied by improvements in the menu offerings.²² The 11% decrease in calorie content was similar to reductions observed in an experimental study conducted with a general sample of Canadian adults.⁴³ The findings are also consistent with other studies using university samples,^{17,30,31,33} and other cafeteria-based studies showing that calorie labels on menus lead to the purchase of healthier items and/or fewer calories.^{18-21,23} Although our study only assessed consumer behavior during a one-week follow-up period, other research suggests that calorie labeling in cafeterias can have a sustained effect over time⁴⁴ and may help prevent rapid weight gain among university residents.³²

The effect of calorie labeling was relatively consistent across socio-demographic groups. Individuals seeking to lose weight were more likely to notice nutrition information, and individuals identifying with a “non-white” ethnicity were more likely to report using nutrition information to guide their selection. Consistent with previous findings,^{22,45} we also observed some sex-related effects; women reported consuming fewer calories than men. In general, however, the effects of the calorie labeling were consistent across socio-demographic groups. The lack of socio-demographic differences in the current study may reflect the relatively homogeneous nature of the sample in that all participants were university students. Evidence to date suggests mixed findings on socio-demographic differences in response to menu labeling; whereas some studies have found that socio-economic disparities in the efficacy of nutrition information persist in the presence of menu labeling,⁴⁶ others suggest that the display of calorie information on menus may reduce the magnitude of these disparities.^{22,47} It is possible that the relationship between socio-economic status and diet quality may be more important when nutrition information is less visible and consumers must be motivated to seek out this information. Providing this information directly on menu boards or immediately beside food items reduces the effort required to access this information and has the potential to reduce inequities in the use of nutrition information.^{45,48}

The prevalence of overweight and obese BMI in the current sample (13.2% and 1.9%, respectively) was substantially lower than estimates for the general adult (18+) Canadian population (37% and 25%),¹ and somewhat lower than estimates obtained through an online survey of university students in Canada (17.5% and 5.3%).⁴⁹ These differences are likely largely attributable to the nature of the sample, both in terms of age and socio-economic status. The prevalence of obesity is typically

much lower among young adults than in the overall adult population, and typically, is less prevalent among those with higher levels of education.¹ In addition, given the in-person format of this study, some degree of self-selection bias may have been present, such that students who were overweight or obese may have been less likely to participate in the survey described as related to food choices, compared to studies conducted online. Such differences in BMI may reduce the generalizability of the findings.

The study has several other limitations, including self-reports of food items ordered and the quantity consumed. However, participants were surveyed immediately after they had finished their meal, which minimized the likelihood of recall bias. Other studies also have shown a high correspondence between self-reported measures of noticing, use and actual consumption verified through objective measures and sales data.^{43,45} Self-reported measures also included height and weight used to calculate BMI. Any measurement error associated with self-report questions would apply to both baseline and follow-up and, therefore, is unlikely to account for the differences observed over time. The study lacked a “no intervention” control group to account for any secular trends between baseline and follow-up. To minimize the potential for bias, the study was conducted during weeks outside of the official exam schedule and during a period when the cafeteria menu was constant across baseline and follow-up. The consistency in menu offerings is a strength of the current design. In several other naturalistic studies, changes in nutrition labeling were accompanied by healthier food offerings; however, the effects from the current study cannot be attributed to changes in the menu offerings. The cohort design and the naturalistic setting of the study—labels were displayed in a “real” cafeteria for one full week—increase the external validity of the findings and are considerable strengths of the study.

Summary

The study suggests that displaying calorie amounts on menus and menu boards can help to reduce excess energy intake in a cafeteria setting. The findings add to the growing evidence base from experimental and naturalistic interventions on the efficacy of nutrition labeling on menus. This evidence should be interpreted within the broader context of research, which includes post-market evaluations of menu labeling regulations that have been implemented in several US cities and states. The literature from natural policy experiments is more mixed with respect to identifying benefits of menu labeling. There is a need to integrate evidence from experimental, naturalistic and qualitative research to a greater extent to identify why these studies are more equivocal. Future research also should examine different presentation formats for calorie amounts, such as integrating symbolic

information with calorie amounts; whereas several studies suggest that calorie numbers alone are effective, others suggest that the use of prescriptive symbols such as “traffic lights” indicating high and low amounts may enhance effectiveness.^{15,16}

Human Subjects Statement

The study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving human subjects were approved by the University of Waterloo Office of Research Ethics (ORE#: 18078). Verbal informed consent was obtained from all participants.

Conflict of Interest Statement

All authors of this article declare they have no conflicts of interest.

Acknowledgments

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