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The effects of calorie labels on those at high-risk of eating pathologies: a pre-post intervention study in a University cafeteria



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ABSTRACT

Objectives: The aim of the study was to examine the effect of a public policy (menu labelling) on those at high-risk for eating pathologies. Specifically, the study looked for any adverse effects related to eating disturbance level.

Study design: The study employed a pre-post intervention design. Baseline collection took place in October 2012. One week prior to follow-up in November 2012, calorie labels were displayed next to virtually all menu items in a University cafeteria. Labels remained throughout the entire duration of follow-up.

Methods: Participants were female undergraduates (N = 299). At baseline and follow-up, a survey assessed eating disturbance level (Eating Attitudes Test-26), emotional state, frequency of engaging in unhealthy weight-related behaviours, and calorie consumption.

Results: Generalized estimating equations were used to test changes in negative outcomes over time in response to calorie labels. Calorie consumption did not significantly decrease from baseline (mean = 660.5 kcal) to follow-up (mean = 600.5 kcal; $P = 0.104$). There were no changes in emotional states such as body image satisfaction ($P = 0.447$), anxiety ($P = 0.595$), positive affect ($P = 0.966$), negative affect ($P = 0.576$), and unhealthy weight-related behaviours such as bingeing ($P = 0.268$), exercising excessively ($P = 0.847$), or restricting calories ($P = 0.504$). Additionally, there were no interactions between eating disturbance level and time.

Conclusions: Overall, no adverse outcomes were found for this at-risk population. Calorie labels did not differentially affect those with higher levels of eating disturbance. Future research should focus on examining the impact of calorie labels among those with clinical eating disorders.

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Introduction

Obesity is a growing public health concern. Recent estimates indicate that one-quarter of Canadians are obese and an additional 37% of the population are overweight.¹ Globally, the World Health Organization (WHO) estimates that approximately 1.4 billion adults worldwide are overweight and 500 million are obese.² Obesity has been associated with the incidence of type 2 diabetes, asthma, gallbladder disease, osteoarthritis, chronic back pain, certain types of cancer, and cardiovascular disease.¹ Additionally, the burden of obesity has been estimated to cost \$4.6 to \$7.1 billion annually in Canada through direct and indirect costs.¹

Increased energy intake at the population level is primarily responsible for the rise in obesity.^{3,4} Recent Canadian estimates suggest that approximately 60% of Canadians eat at a restaurant at least once per week, and 7% consume food at a restaurant daily.⁵ Although not all food consumed outside of the home is of poor nutritional quality, restaurants generally offer foods that have large portions, and are high in calories, fat, and sodium.⁶ Research indicates that individuals are unable to accurately estimate the calorie amounts of large portions of food,^{7,8} and the odds of becoming overweight or obese increase with greater fast-food consumption.⁹ Given the high prevalence of consuming food at restaurants and quick-service establishments, these locations offer excellent opportunities for public health interventions.

The provision of nutrition information at full-service restaurants and quick-service establishments represents a population level intervention aimed at moderating calorie intake outside the home. The rationale behind menu labelling is that providing consumers with calorie information may promote healthier eating through greater awareness of calorie content.

In the U.S, the FDA is finalizing regulations that will cause restaurant chains to display calorie amounts on menus next to the item name and the price, along with a statement about daily caloric intake requirements.^{10,11} Currently, no legislation exists in Canada for the mandatory provision of calorie amounts on menus. The evidence on the impact of calorie labelling on menus on consumption is mixed. Some studies have shown a modest effect of calorie reduction, and others have found no effect.^{12–17} Studies specifically examining University populations have generally found a decrease in calories consumed when actual ordering behaviour was measured,^{18–20} and increased intentions to order lower calorie/healthier meal options when only intentions were measured.^{21–25} The impact of calorie labels may be greater among females,²⁶ those higher in dietary restraint,²⁷ or those who count calories.²⁸

One potential barrier to menu labelling is a concern over unintended effects among subsets of the population.^{29–31} In particular, it is unclear how calorie labelling may impact individuals with eating disorders or those trying to recover from them. To date, little or no research has examined this concern. Previous literature has demonstrated that individuals with eating concerns ranging from shape/weight concerns to clinically diagnosable eating disorders demonstrate decreased body image,^{32–36} increased anxiety,^{37–40} and worse mood^{41,42} in response to food and high calorie food in particular.

Individuals with disordered type eating may also engage in unhealthy practices such as bingeing, and using inappropriate compensation behaviours (exercising excessively, vomiting, or using laxatives) in response to food.^{43–46} To date, there is no empirical literature as to whether the presence of calorie labels may exacerbate existing eating concerns.

Eating pathologies are a serious health concern. In Canada, approximately 3% of women will be affected by an eating disorder in their lifetime.⁴⁷ The prevalence rate is likely an underestimation of those suffering from eating pathologies as the criteria for diagnosis are stringent. Sub-clinical eating disorders, henceforth called eating disturbances, do not meet the clinical definition of a disorder yet still involve many of the same underlying dysfunctions.⁴⁸ Disturbances are a concern as they are more common than disorders, and can transition into clinically diagnosable eating disorders. Estimates suggest that the prevalence of eating disturbances ranges from 3% to 5% among adult women, and up to 15% among adolescent females.^{48,49}

The current study sought to examine whether the implementation of calorie labels in a restaurant setting were associated with any changes in affective reactions (body image satisfaction, state anxiety, and mood), or changes in the frequency of engaging in unhealthy weight-related behaviours. Additionally, the study examined changes in calorie consumption.

Methods

Protocol & participants

The study was conducted on a University campus (located in Southwestern Ontario, Canada), as part of a larger pre-post study examining menu labelling in a student residence cafeteria. Eligible undergraduate students over the age of 16 completed a 10-min exit survey one month before (October 2012) and one week after (November 2012) calorie amounts were displayed on cafeteria menu boards.

The intervention involved displaying calorie amounts next to each food item. The calorie amounts appeared in red font while item names were in black; all information was displayed in size 24 font. Signs with calorie labels were displayed as close to the food item as possible (either in a list format for items grouped together, or individually placed directly beside the item). Foods that were not labelled included prepackaged items such as chips and chocolate bars, which already had nutrition facts displayed. Labels were checked daily for visibility and accuracy. The initial exit survey collected socio-demographic measures, an assessment of food selection, consumption, and awareness, recall, and use of calorie information. The response rate for the larger study was 49.3%. Ethics approval was obtained from the research institution's Office of Research Ethics. Written informed consent was obtained from all participants.

Upon completion of the exit survey, female participants were approached to complete a 10-min paper-based survey. All surveys were self-completed immediately after administration in a private, quiet area. Participants then sealed their survey in an opaque envelope and returned it to the

researcher. The same survey was administered pre- and post-calorie labelling. The response rate of the survey was 60.5%. The paper-based survey was linked with the participants' initial exit survey using a unique set of identifying questions. Participants were remunerated \$5 for each survey completed. Female undergraduate students are considered a high-risk group for developing eating disorders which is why they were chosen for this study.^{50,51} Overall, 325 participants completed the paper-based survey. Twenty-six participants were deleted due to key variables missing, or because they could not be linked with the main electronic survey using identifying variables, for a sample size of 299 participants. Participants were eligible to complete the survey at baseline and follow-up, resulting in a 'cohort' sample that completed the survey at both time points, and a 'baseline/follow-up only' sample that completed the survey at a single time point.

Measures

Demographic information

Demographic information included gender and race. Weight perceptions ('Do you consider yourself: overweight, underweight, or about the right weight?') and weight aspirations ('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?') were assessed using NHANES measures.⁵² Self-reported height and weight were used to calculate BMI into underweight, normal weight, overweight, and obese categories using the WHO guidelines.⁵³ The categories of overweight and obese were collapsed, as there were very few participants in each category (25 and three respectively).

Calorie consumption

Food selection was recorded as part of the initial exit survey completed by participants. Questions were asked regarding all beverage and food items purchased, and what proportion was consumed. Nutrition information was provided by the University's Food Services Department. In the case of missing information, calorie amounts were estimated using nutrient analysis software, The Food Processor (version 10.10.2), from *esha* Research (Salem, OR). The Canadian Nutrient File (version 2007) within The Food Processor was used to calculate missing information, unless available options did not match the food item, in which case an alternate file was used from the program.

Eating disturbance

Eating disturbance was measured using the Eating Attitudes Test, a validated measure of symptoms and concerns relating to eating disorders.^{54,55} Scores on the EAT-26 range from zero to 78, with higher scores indicative of greater eating disturbance levels. The EAT-26 can also be analyzed using a cut-off score of greater than 20 denoting participants as high-risk for eating disturbance. The analysis was conducted on the continuous scores from the EAT-26. An error occurred during the baseline survey administration, in which the 24th statement 'I like my stomach to be empty' was inadvertently omitted. Therefore, EAT-26 scores were calculated without this item at both baseline and follow-up. Excluding this item

may have lowered participant's EAT-26 score; however, since it was left out for all participants, scores could still be compared between baseline and follow-up.

Body image

Short-term fluctuations in body image satisfaction were measured using the six-item Body Image States Scale (BISS). Scores on the BISS range from one to nine, with higher scores indicating greater body satisfaction.⁵⁶

Anxiety

Anxiety was measured using a shortened six-item version of Spielberger's State-Trait Anxiety (STAI) Scale.^{57,58} The STAI-6 was scored as a continuous variable with scores ranging from six to 24.

Mood

Mood or affect was measured using the Positive and Negative Affect Schedule (PANAS). The 20 question scale has two subscales, 10 questions pertaining to positive affect, and 10 to negative affect.⁵⁹ Scores on each subscale range from 10 to 50.

Perceived stress

Stress was measured via the 10-item version of the Perceived Stress Scale.⁶⁰ Scores range from zero to 40 and higher scores indicate greater perceived stress.⁶¹

Engaging in unhealthy weight-related behaviours

Six questions were used to assess the frequency of participation in certain behaviours. Participants were asked how often in the past week have you: 1) 'gone on eating binges where you feel that you may not be able to stop'; 2) 'exercised more than 60 min a day to lose or control weight'; 3) 'ate less than you wanted to as a way to control your calorie intake'; 4) 'thought about your weight'; 5) 'ever made yourself sick (vomited) to control your weight or shape'; and 6) 'ever used laxatives, diet pills, or diuretics (water pills) to control your weight or shape'. The response options for those questions ranged from *never*, to *five or more times* in the past week. The questions were adapted from the behavioural questions that accompany the EAT-26 scale.⁶² For analysis, these variables were re-categorized into binary variables (no times in the past week vs one or more times).

Data analysis

Analysis was conducted using SPSS Version 21 (Chicago, Illinois). Analyses examined 11 primary outcomes: body image, anxiety, positive affect, negative affect, calorie consumption, and the frequency of bingeing, engaging in excessive exercise, restricting calories, thinking about weight, vomiting, and using laxatives, diet pills or diuretics. The last three outcomes could not be run due to quasi-complete separation of the data; frequencies are still presented in the tables. Generalized estimating equations (GEE models) were run on the entire sample (N = 299) adjusting for the following covariates: eating disturbance, BMI, race, perceived stress level, weight perceptions, and weight aspirations. All models included an indicator variable of 'wave' (1 = baseline and 2 = follow-up). A two-way interaction between wave and eating disturbance was

entered in the models. If the interaction was not significant it was removed. GEE modelling allowed us to include participants that did and did not answer the survey at both time points as it takes into account the correlated nature of a persons' data.⁶³

The final sample consisted of participants who completed the survey at one time point and those that completed it at both time points. Sensitivity analyses were conducted among the cohort sample only and those that only completed the baseline or follow-up. Unless otherwise noted, the pattern of findings across subsamples was the same.

Results

Sample characteristics

Sample characteristics are presented in Table 1. All characteristics were tested for differences between baseline and follow-up using t-tests or Chi-squared tests.

Affective reactions

Means, and the results from the linear GEE models for body image satisfaction, anxiety, and mood are provided in Table 2. The findings indicate no effect of wave for any of the four affective outcomes. The interaction term between wave and eating disturbance was not significant in any of the models.

In addition to examining changes from baseline to follow-up, the current study examined associations between

covariates and the primary outcomes. Those with higher eating disturbance levels had lower body image satisfaction ($b = -0.04$, $P = <0.001$), and had greater negative affect ($b = 0.11$, $P = 0.017$). When the analysis was run on the baseline/follow-up only group, eating disturbance was no longer significantly related to negative affect ($b = 0.07$, $P = 0.196$). Those with higher perceived stress scores had worse body satisfaction ($b = -0.05$, $P < 0.001$), less positive affect ($b = -0.17$, $P = 0.038$), greater negative affect ($b = 0.42$, $P < 0.001$) and greater anxiety ($b = 0.31$, $P < 0.001$). When the analysis was run on the baseline/follow-up only group, perceived stress was no longer significantly related to positive affect ($b = -0.20$, $P = 0.057$). Among the main sample, those who thought they were 'overweight' had lower body image satisfaction than those who thought they were 'underweight' ($b = -0.39$, $P < 0.001$) or 'about the right weight' ($b = -1.02$, $P < 0.001$). Additionally, those who wanted to 'lose weight' had lower body image satisfaction than those who wanted to 'stay the same weight' ($b = -0.52$, $P = 0.001$).

Unhealthy weight-related behaviours

The frequency of engaging in unhealthy weight-related behaviours are presented in Table 3. There were no statistically significant changes from baseline to follow-up on any of the unhealthy weight-related behaviours from the models. Additionally, none of the two-way interactions between wave and eating disturbance were significant.

Those with higher eating disturbance levels were more likely to report bingeing (OR = 1.07, $P < 0.001$), exercising

Table 1 – Sample characteristics (N = 299).

	All baseline	All follow-up	Test statistics	
	(n = 131)	(n = 168)	F-value	P-value
Eating disturbance				
Mean Score (SD)	8.4 (7.8)	9.6 (8.8)	F = 1.631	P = 0.203
Low Risk ^a	90.8% (119)	88.7% (149)	X ² = 0.366	P = 0.545
High Risk	9.2% (12)	11.3% (19)		
Perceived stress level				
Mean (SD)	20.6 (5.9)	21.0 (5.9)	F = 0.550	P = 0.358
BMI				
Underweight	9.9% (13)	9.5% (16)	X ² = 2.734	P = 0.435
Normal weight	71.0% (93)	73.8% (124)		
Overweight and obese	12.2% (16)	7.1% (12)		
Not stated	6.9% (9)	9.5% (16)		
Race				
White	51.1% (67)	47.0% (79)	X ² = 0.500	P = 0.479
All Others	48.9% (64)	53.0% (89)		
Weight perception				
Overweight	13.0% (17)	13.7% (23)	X ² = 0.621	P = 0.733
Underweight	6.9% (9)	4.8% (8)		
About right	80.2% (105)	81.5% (137)		
Weight aspiration				
Lose weight	45.0% (59)	42.3% (71)	X ² = 2.978	P = 0.395
Gain weight	2.3% (3)	2.4% (4)		
Stay same weight	26.0% (34)	34.5% (58)		
Not trying to do anything	26.7% (35)	20.8% (35)		

^a Low Risk < 20 on EAT-26. High Risk ≥ 20.

Table 2 – Affective changes from baseline to follow-up (N = 299).

Outcome	Baseline	Follow-up	Test statistics		
	Mean (SD)	Mean (SD)	Beta ^a	(95% CI)	P-value
Body image satisfaction	5.2 (1.3)	5.1 (1.3)	0.08	(−0.13, 0.30)	0.447
Anxiety	12.0 (4.2)	12.3 (4.2)	0.22	(−0.59, 1.03)	0.595
Positive affect	24.8 (7.6)	25.0 (7.9)	−0.04	(−1.63, 1.56)	0.966
Negative affect	15.8 (6.3)	16.4 (6.2)	0.36	(−0.89, 1.60)	0.576

^a Beta values for the difference between baseline and follow-up from a GEE model adjusting for wave, BMI, race, perceived stress level, weight perceptions, and weight aspirations.

excessively (OR = 1.05, $P = 0.005$), and restricting calories (OR = 1.12, $P < 0.001$) at least once in the past week. Additionally, those with higher perceived stress were more likely to report bingeing (OR = 1.05, $P < 0.001$). People were more likely to restrict calories if they thought they were 'overweight' (OR = 9.10, $P = 0.19$) or 'about the right weight' (OR = 9.46, $P = 0.019$) compared to 'underweight'. Additionally, those who wanted to 'lose weight' were more likely to restrict calories than those who wanted to 'gain weight/stay the same weight' (OR = 3.7, $P < 0.001$), and those who 'weren't trying to do anything about their weight' (OR = 3.4, $P = 0.003$).

Calorie consumption

Average calorie consumption at baseline was 660.5 kcal (SD = 308.7), and at follow-up was 600.5 kcal (SD = 281.9). A GEE model was run with the outcome of calorie consumption. There was not a statistically significant change in calorie consumption from baseline to follow-up ($b = -58.09$, $P = 0.104$). Additionally, the interaction between eating disturbance and time was not significant. Fig. 1 displays the relationship between calorie consumption and eating disturbance quartile scores at baseline and follow-up. Eating disturbance level is higher with increasing quartiles.

Discussion

Overall, there were no adverse effects of calorie labels observed for any of the outcomes tested, including affective reactions, and weight-related behaviours. It was hypothesized that exposure to calorie labels would make the presence of food more salient and therefore lead to worse outcomes for

those with higher levels of eating disturbance. As expected, individuals with disordered type eating were more likely to report decreased body satisfactions,^{32–36} greater negative affect,^{41,42} and were more likely to engage in negative weight-related behaviours,^{42,48,64} similar to previous research. However, the prevalence of these outcomes did not increase following the implementation of calorie labelling in the restaurant, and there were no interactions between survey period and disordered type eating. These findings suggest few if any detectable adverse outcomes and a similar response to calorie labelling regardless of disordered eating risk. It is possible that calorie labels confirmed people's estimates of calorie amounts; therefore, those with higher levels of eating disturbance had a better idea of what they were consuming (thereby diminishing any negative effects). It is also possible that since the cafeteria setting provided patrons with a variety of options (both low calorie and high calorie), that people did not feel restricted to a certain type of food that may have led to negative outcomes. Interestingly, recent research suggests that support for menu labelling is high not only among the general public (92% support), but also among those with self-reported eating disorders (82–92% support depending on disorder type).⁶⁵

The current study found that calorie consumption at a single meal decreased by an average of 60 calories in response to calorie labels, which was not statistically significant given the current sample size. In the literature, the evidence regarding menu labelling is inconclusive, with some studies finding a decrease in calories, and others finding no difference in response to labels.^{12–14,16,17} Reductions seen in the literature are usually modest, around 10–20 calories per meal.¹⁴ The interaction between eating disturbance and survey period was not statistically significant, which indicates that

Table 3 – Likelihood of engaging in unhealthy weight-related behaviours from baseline to follow-up (N = 299).

Outcome	Baseline % ^a	Follow-up % ^a	Test statistics		
			OR ^b	(95% CI)	P-value
Bingeing	32.8%	28.6%	0.75	(0.44, 1.25)	0.268
Exercising excessively (>60 min/bout)	35.9%	38.1%	1.05	(0.64, 1.70)	0.847
Restricting calories	62.6%	61.7%	0.84	(0.51, 1.40)	0.504
Thinking about weight	92.4%	92.3%	^c		
Vomiting	0.8%	0.6%	^c		
Using Laxatives, Diet Pills, Diuretics	3.1%	3.0%	^c		

^a The percent of the study sample engaging in the behaviour once/week or more.

^b Odds ratios adjusting for wave, BMI, race, perceived stress level, weight perceptions, and weight aspirations.

^c Unable to run these outcomes due to quasi-complete separation of data.

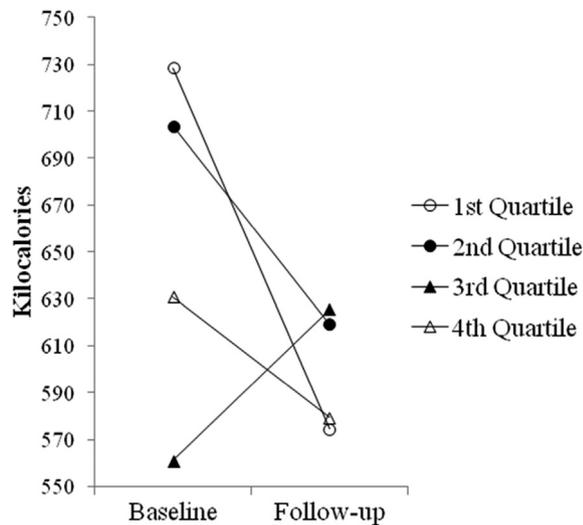


Fig. 1 – Association between calorie consumption and eating disturbance (quartiles) from baseline to follow-up (N = 287).

differences in calorie consumption were similar across eating disturbance levels. These findings are similar to the results for affective reactions, and weight-related behaviours.

The current study has several limitations and strengths. The first limitation is that the study lacks a true control group. However, measures were incorporated that assessed factors that may have produced secular trends over the academic calendar, such as perceived stress, so that they could be controlled for during statistical analysis. The second limitation is the use of self-reported measures. Participants may have been reluctant to admit engaging in certain behaviours (such as bingeing or vomiting). Research assistants assured participants of the confidentiality of their data, and instructed them to self-complete the survey in a private location, and then seal the survey in an opaque envelope before returning it. The third limitation is self-selection bias. Individuals with higher levels of eating disturbance may have been hesitant to complete the study upon learning that it centred around eating patterns. Looking at the sample characteristics from the current study, mean eating disturbance scores match quite closely with what is seen in the literature for young females, suggesting it was fairly representative.⁵⁵ Finally, the timing of the follow-up period so close to calorie labelling implementation may not have allowed participants enough time to adapt to the labels. Study timing was restricted based on the academic calendar; however, most students ate all their meals at the cafeteria and would have had high levels of exposure to the labels.

The study also has several strengths. The naturalistic design allowed participants to order and eat the meals from the cafeteria thus having higher external validity. Another strength of the study was the range of outcomes measured. The study examined affective and behavioural (both moderate and severe) outcomes that may fluctuate in response to calorie labels. By assessing many outcomes the study hoped to capture the spectrum of compensation behaviours used in response to food. The level of exposure to calorie labels in the current study was another strength. The study was conducted

in a cafeteria setting of a University residence; therefore, if labelling was associated with adverse outcomes, the study would be well-suited to capture these outcomes given that the ‘dose’ of labelling is greater than would be the case for the general public.

Conclusions

No adverse outcomes from calorie labelling on menus were observed in an at-risk population for eating disorders, including those with higher levels of eating disturbances. Future research should be conducted among sub-populations with clinical eating disorders. The current study has implications for menu labelling. Countries such as the U.S. and Australia have passed menu labelling laws, and the Province of Ontario, Canada is in the process of passing legislation. As an argument against policy legislation, concerns have been raised in Parliamentary debates regarding the possible consequences of calorie labelling on those with eating concerns, a topic which has little evidence. The current study has the potential to add to the evidence base on menu labelling and address concerns that have been raised.

Author statements

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Ethics approval

Ethics approval was provided by the Office of Research Ethics at the research institution's University.

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Competing Interests

None declared.

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