



Association Between Menus' Calorie Labels and Students' Food Choices: A Cross-Sectional Study

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Abstract

A policy that mandates posting calorie information on monitors and printed menus in restaurants was implemented in Saudi Arabia in 2018. This may help consumers make healthier decisions. This study assessed the level of awareness regarding calorie labeling on menus and its association with restaurant food choices among Saudi university students. A cross-sectional study was conducted using 400 female Saudi students at Princess Nourah Bint Abdulrahman University (PNU), Riyadh. Pregnant or lactating students or those who had any dietary restrictions were excluded. An online self-administered questionnaire regarding demographic characteristics, awareness of calorie labeling, and restaurant food choices were used. Pearson's and Ma Neman's chi-square tests, the odds ratio, and multivariate binary logistic regression were used in the analysis. While 73.5% of the students noticed the calorie labeling on the restaurant's menus, only 24% of students read it carefully. No statistically significant association was observed between the awareness of calorie labeling and food selection. Comparing good versus poor awareness about labels, 67.7% versus 49% of participants change their food selections based on the calorie information on the menu ($p < 0.0007$), and 77.8% versus 22.2% select items with fewer calories ($p < 0.001$). Calorie labeling may be an effective method for improving food choices among those who have an awareness of such and use calorie information. Nevertheless, public health education campaigns are needed to increase awareness of calorie requirements and the value of calorie labeling on restaurant menus.



Article History

Received: 16 July 2022

Accepted: 29 August 22


Keywords

Calorie labeling;
Food choice;
Restaurants;
Riyadh.

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Doi: <http://dx.doi.org/10.12944/CRNFSJ.10.2.30>

Introduction

Obesity is defined as abnormal or excessive body fat accumulation that could adversely affect an individual's health.¹ According to the World Health Organization, the global obesity rate nearly tripled between the years 1975 and 2016.¹ More specifically, a significant increase in obesity rates has been observed in the Kingdom of Saudi Arabia (KSA), with this percentage increasing from 22% from 1990 to 1993 to 36% in 2005.² This is linked to the rapid socio-cultural changes that occurred after oil exploration and the economic boom in the 1970s and the 1980s in the Arab Gulf region.³ As a result, significant changes in food choices and eating habits emerged.³ A recent cross-sectional study conducted in the KSA in 2020 reported that the national weighted prevalence of obesity [Body Mass Index(BMI) \geq 30 kg/m²] was 24.7%.⁴ As such, the Saudi population has witnessed an increased intake of processed meat and animal products at the expense of fruits and vegetables.^{5,6} Frequent dining out and the consumption of fast food have also been observed⁷ due to a sudden and unexpected increase in restaurant availability and affordability. According to the General Authority for Statistics, there were about 15,782 restaurants in SA in 2014.⁸ This has led to remarkable consequences in terms of greater meal portion size, lower food quality, greater calorie consumption and increased body weight. In this regard, Delavari *et al.* (2013) confirmed the association between food consumption away from home and the increased incidence of obesity and other chronic diseases.¹⁰ In more detail, Bhutani *et al.* (2018) indicated that the consumption of one meal from fast-food and dining-in restaurants per week was associated with BMIs that were higher by 0.8 and 0.6 kg/m², respectively.¹¹

As part of the National Saudi strategy to combat nutrition, the Saudi Food and Drug Administration (SFDA), in 2018, implemented a policy that mandated posting the calorie information on monitors and printed menus in restaurants.¹² This approach may help consumers to make healthier decisions, improve food choices and limit excess calorie intake.¹³ It is well established that consumers regularly underestimate the caloric content of the food consumed from restaurants in the absence of any labeling.¹⁴ In support to this finding, previous studies have reported that using calorie information on menus helped consumers to choose

foods with fewer calories at fast-food restaurants.^{15,16} In contrast, in another study, no difference was observed in terms of average calories purchased before and after calorie-label regulations.¹⁷ A prospective study examined the implementation of calorie labeling in a large fast-food restaurant franchise, and found a small reduction in mean calories purchased per transaction (60 calories/transaction); however, this reduction diminished over one year of follow-up.¹⁸ Studies on the Saudi population are limited in terms of the awareness of the Saudi population of the importance of reading food labeling to ensure a healthy menu selection. A recent study found that the new regulation introduced by the SFDA mandates calorie labeling in restaurants and cafeterias has improved the behaviour of 50% of Saudi adults.¹⁹ Therefore, the current study aimed to assess the level of awareness of calorie labeling on menus and its association with restaurant food choices among female university students at Princess Nourah Bint Abdulrahman University (PNU), Riyadh (KSA). This will provide a comprehensive understanding of consumer behaviour among this age group and design an effective intervention program to encourage healthy food choices.

Materials and Methods

Study Design and Participants

A cross-sectional study was conducted on students at PNU, Riyadh, KSA, between February and March 2020. Students who were pregnant or lactating or who had any dietary restrictions that might affect their food choices, such as food allergies, celiac disease, diabetes, heart diseases and renal problems, were excluded from the study. All participants provided written informed consent to participate in the study and had the choice to continue or withdraw from the study without any obligations. The study procedure was approved by the Princess Nourah Bint Abdulrahman Institutional Review Board (IRB # 20-0042 dated 29 January 2020).

Sampling Method and Calculation

The convenience sampling method was used in this study. The sample size was calculated based on the sample size equation from the total population (PNU students) of 52,308; $(n) = Z^2 pq/d^2$, where the z score for 95% confidence level = 1.96, p = the prevalence of the factor under study was estimated to be 50%, $q = 1 - p = 50\%$ and $d =$ margin of error = 0.05%.

Thus, the study's sample size was estimated to be a minimum of 384 participants.

Measurement Instruments

A questionnaire was developed in the Arabic language by the authors based on the knowledge available in the literature.^{19,20} Three experts in the field of health education and nutrition validated the questionnaire using a scoring sheet. The scoring sheet listed each question and asked the expert to score each question based on appropriateness, importance and phrasing and asked them to add any further comments. Questions were modified based on expert scores and comments whenever necessary. Then, the questionnaire was tested for its readability on a group of 20 PNU students, and their data were not included in the main study analysis. Participants in this pilot test confirmed that the questionnaire's instructions, layout, length, ease of completion and time required to complete were appropriate. Furthermore, respondents were given the opportunity to ask questions; no difficulties in understanding the questions were reported.

The final questionnaire consisted of the following socio-demographic information (such as age, marital status, educational level and family monthly income) and questions about the how many times in last month the participant had eaten in a restaurant. Three questions assessed the awareness of calorie labeling on restaurant menus, specifically whether the calorie information on the menu was noted, was perceived as important and had a relationship with total calorie intake. The last section of the questionnaire was composed of seven questions that assessed the awareness of calorie labeling on food choices from restaurant menus. Thus, the collected data revealed whether and how the participant changed their food choices based on the calorie information on the restaurant's menu. Regarding the effect on food choices, participants were asked questions concerning how they usually order, with the main dish, ordered a salad or fresh vegetables, added anything to the food items (such as adding extra cheese or extra sauce), ate complimentary items (such as butter and bread) and ordered low-calorie beverages and dessert.

The scoring in the second section was used to reflect a person's level of awareness of calorie labeling on restaurant menus. The first question had scores

as follows: 'yes, I read it carefully' = 2 points; 'yes, but I don't read it carefully' = 1 point; 'no or I don't care' = 0 points. Questions 2 and 3 were scored as follows: 'yes' = 2 points; 'no', 'I do not care' or 'I don't know' = 0 points. The total scores ranged from zero to six, where six represented the highest level of awareness of calorie labeling on restaurant menus. A score of less than or equal to three represented poor awareness, and a score of more than three indicated good awareness. The same scoring system was applied to the third section's questions, which assessed the effect of the awareness of calorie labels on food choices from restaurant menus. All questions were scored as follows: 'yes' = 2 points, 'sometimes' = 1 point and 'no' = 0 points. The total scores ranged from 0 to 12, where 12 represented the highest impact on the part of calorie labeling on food choices. A score of less than or equal to six indicated poor food choices, and one of more than six indicated good food choices.

Statistical Analysis

Data were analyzed using SPSS Version 26.0 statistical software (IBM Inc., Chicago USA). Frequencies and percentages were used to describe the categorical study and outcome variables. A non-parametric Pearson's Chi-square fitness test was used to reveal the statistical significance of the observed categorical responses to various items related to the awareness of the calorie labeling on restaurants' menus and compare the distribution of proportions regarding calorie labeling on menu food choices in relation to the awareness of calorie labeling. A Z-test was used to compare the individual proportion of each item response in relation to the awareness of calorie labeling. McNemar's Chi-square test was used to observe the association between the paired binary variables (awareness of calorie labeling and Food choices on restaurant menus). The odds ratios (unadjusted and adjusted) are used as a measure of association between the characteristics of study subjects and the binary outcome variables (awareness about calorie labeling – yes or no; food choices (good food selection and poor food selection) on restaurant menus. Multivariate binary logistic regression analysis was used to identify the variables that are independently associated with the two binary outcomes. A p-value of ≤ 0.05 and 95% confidence intervals are used to report the statistical significance and precision of the results.

Results

Socio-Demographic Characteristics of The Studied Population

Four hundred female students were enrolled in this study. Of these, 48.5% were in the age group of 18–20 years, and 45.8% were 21–23 years old. Most participants were single (96%), and 45.7% had a monthly family income of more than 15,000 Saudi Riyals. The study subjects were selected from the 1st to 6th academic years, where 25.3% of them were from the 1st year, 25.5% of them were 4th year, 17.3% were 3rd year, 16.5% were from 2nd year and the remainders were in the 5th or 6th years of their academic study. The college type distribution was as follows: health colleges (24.5%), science colleges (32.3%) and human and community colleges (27.8% and 15.5%, respectively) (Table 1). About three-quarters of the students reported consuming food from restaurants three times or more per month.

Table 1: Distribution of Socio-demographic characteristics of the study subjects (n = 400)

Characteristic	n	(%)
Age (years)		
18–20	194	(48.5)
21–23	183	(45.8)
≥ 24	23	(5.8)
Marital Status		
Single	384	(96)
Married	16	(4)
Academic study (college)		
Health colleges	98	(24.5)
Sciences colleges	129	(32.3)
Human colleges	111	(27.8)
Community college	62	(15.5)
Academic study level		
First-year	101	(25.3)
Second-year	66	(16.5)
Third-year	69	(17.3)
Fourth-year	102	(25.5)
Fifth-year	39	(9.8)
Sixth-year	23	(5.8)
Family monthly income (SR)		
Less than 5,000	35	(12.9)
5,000–10,000	45	(16.6)
10,000–15,000	67	(24.7)
More than 15,000	124	(45.7)
NA	129	(32.3)

SR = Saudi Riyals; NA = not available.

Awareness of Calorie Labeling on Restaurant Menus

The distribution and comparison of responses to the three questions regarding awareness of calorie labeling on restaurant menus show statistically significant differences for all three questions. For the question, 'Did you notice the calorie information on the restaurant's menu?' 50.3% had responded with 'Yes, but I did not read it carefully', which is statistically significant higher ($p < 0.0001$) than the other two options ('Yes, I read it carefully' and 'No, I did not notice it, and I do not care'). For the second question, 'Is it important to add calorie information on the restaurant's menu?', 90.5% responded with 'Yes,' which is statistically significantly higher than the other options ($p < 0.0001$). For the third question, 'Is there any relationship between adding calorie information on menus and total calorie intake?', 73.5% responded positively, which is statistically significant ($p < 0.0001$) (Table 2).

The Effect of Calorie Labeling on Food Choices in Restaurants

The detailed results of the third section of the questionnaire are summarised in Table 3. A significant difference was found for four out of seven questions. Around 68% and 49% of participants with good and poor awareness, respectively, reported that 'yes' and 'sometimes' they do change their food selection or food choices based on the calorie information on the restaurant's menu ($p < 0.0007$). For the statement 'If yes or sometimes, how does calorie labeling influence your food choices', the three responses of the study subjects show a statistically significant difference for two options, specifically 77.8% and 66.7% of those who had an awareness of calorie labeling responded 'by selecting an item with fewer calories' and 'by choosing a small portion size' ($p < 0.0001$; $p = 0.012$). When asked 'Do you order a salad or fresh vegetables with the main dish?', 74.5% of participant with good awareness responded 'yes' or 'sometimes', versus 63.2% for the participants belonging to the poor awareness group ($p = 0.028$). In contrast, the proportion of the poor-awareness group was significantly higher (88.7%) as compared to the good-awareness group (78.6%) when confirming (yes or sometimes) that they added something to food items (such as adding extra cheese or extra sauces) ($p = 0.002$) (Table 3).

Table 2: Distribution and comparison of responses regarding awareness of the calorie labeling on restaurant menus (n = 400)

Questions	n	(%)	X ² -value	p-value
Did you notice the calorie information on the restaurant's menu?				
Yes, I read it carefully	97	(24.3)	51.60	<0.0001
Yes, but I did not read it carefully	201	(50.3)		
No, I did not notice it, and I do not care	102	(25.6)		
Is it important to add calorie information to the restaurants' menu?				
Yes	362	(90.5)	262.44	<0.0001
No and I don't know	38	(9.5)		
Is there any relationship between adding calorie information on menus and total calorie intake?				
Yes	294	(73.5)	89.53	<0.0001
No and I do not care	106	(26.5)		

Of the 400 study subjects, 294 (73.5%) had good awareness of the calorie labeling, and 106 (26.5%) had poor awareness of the calorie labeling, whereas 316 (79%) exhibited good food selection, and 84 (21%) exhibited poor food selection. The Mac Nemar's test showed no statistically significant association between the study subjects' awareness of the calorie labeling and their food selection ($p=0.063$).

Table 3: Distribution and comparison of responses regarding calorie labeling on food choices in restaurants in relation to study subject's awareness of the label (= 400)

Questions	Awareness about calorie labeling		X ² -value / z-value	p-value
	aware (n = 294)	unaware (n = 106)		
Usually, do you change your food selection or food choices based on the calorie information on the restaurant's menu?				
Yes and sometimes	199(67.7)	52(49.0)	11.54	0.0007
No	95(32.3)	54(51.0)		
If yes or sometimes, how does calorie labeling influence your food choices? * (n = 251)				
Selecting items with less calorie	172(77.8)	49(22.2)	8.27	<0.0001
Selecting items with high in calorie	15(60.0)	10(40.0)	1.00	0.317
Choosing a small portion size	38(66.7)	19(33.3)	2.52	0.012
Do you order a salad or fresh vegetables with the main dish?				
Yes & sometimes	219(74.5)	67(63.2)	4.85	0.028
No	75(25.5)	39(36.8)		
Do you modify or add anything to food items such as adding extra cheese or extra sauces?				
Yes and Sometimes	231(78.6)	94(88.7)	5.21	0.002

No	63(21.4)	12(11.3)		
Do you eat any complimentary or free items, such as butter and bread, which some restaurants provide?				
Yes and Sometimes	210(71.4)	78(73.6)	0.179	0.672
No	84(28.6)	28(26.4)		
Do you order low-calorie beverages with the main dish?				
Yes and Sometimes	139(47.3)	39(36.8)	3.46	0.063
No	155(52.7)	67(63.2)		
Do you order dessert after the main dish?				
Yes and Sometimes	144(49.0)	68(59.4)	3.78	0.052
No	150(51.0)	38(40.6)		

*Multiple responses; Data presented are frequencies in number and percentage n(%).

Table 4: Association between study subjects' socio-demographic characteristics and their awareness of calorie labeling

Characteristics	Awareness of calorie labeling		Unadjusted odds ratio (95% CI's)	p-value
	aware (n = 294)	unaware (n = 106)		
Age groups (years)				
18–20	142(73.2)	52(26.8)	1.19(0.46,3.10)	0.712
21–23	136(74.3)	47(25.7)	1.27(0.49,3.27)	0.626
≥ 24	16(69.6)	7(30.4)	1.0(ref.)	--
Marital status				
Single	285(74.2)	99(25.8)	2.24(0.81,6.17)	0.119
Married	9(56.2)	7(43.8)	1.0(ref.)	--
Type of college				
Health colleges	85(86.7)	13(13.3)	3.35(1.53,7.35)	0.003
Science college	98(75.9)	31(24.1)	1.61(0.83,4.14)	0.143
Human college	70(63.1)	41(36.9)	0.87(0.46,1.68)	0.874
Community college	41(66.1)	21(33.9)	1.0(ref.)	--
Academic study level				
First-year	81(80.2)	20(19.8)	1.66(0.79,3.45)	0.178
Second-year	41(62.1)	25(37.9)	0.67(0.32,1.41)	0.291
Third-year	52(75.4)	17(24.6)	1.25(0.58,2.72)	0.571
Fourth-year	76(74.5)	26(25.5)	1.20(0.59,2.42)	0.620
Fifth- and sixth-year	44(71.0)	18(29.0)	1.0(ref.)	--
Family monthly income (SR)				
Less than 5,000	25(71.4)	10(28.6)	1.16(0.51,2.65)	0.716
5,000–15,000	80(71.4)	32(28.6)	1.16(0.67,2.02)	0.589
More than 15,000	101(81.5)	23(18.5)	2.05(1.14,3.67)	0.016
NA	88(68.2)	41(31.8)	1.0(ref.)	--

Data presented are frequencies in number and percentage n(%)

The Associations between Socio-Demographic Variables and Awareness of Calorie Labeling and Food Choices on Restaurant Menus

The association between study the subjects' socio-demographic characteristics and the binary variable, that is, their awareness of the calorie labeling (yes or no), is statistically significant for the study variables 'type of college' and 'family monthly income'. Among the four types of colleges, health colleges were highly statistically significantly associated with awareness of calorie labeling, where the odds ratio of 3.35 indicates that the odds of study subjects from health colleges having an awareness of calorie labeling are 3.35 times higher as compared with study subjects from community colleges ($p=0.003$). Also, no statistically significant association was observed for the other two types of colleges (science and human). For the variable termed family monthly income, having an income of more than 15,000 SR categories was statistically significantly associated with an awareness of calorie labeling, where the odds ratio of 2.05 indicates that the odds of study subjects whose family monthly income was more than 15,000 SR having an awareness of calorie labeling is 2.05 times

greater as compared with subjects who did not reveal their family monthly income ($p=0.016$). The other categories of family monthly income (less than 5,000 and 5,000–15,000) are not statistically significantly associated with an awareness of calorie labeling. Also, the other characteristics (age groups, marital status and academic study level) are not statistically significantly associated with an awareness of calorie labeling (Table 4).

The association between a study subject's socio-demographic characteristics and the binary variable, which is their food choices on restaurant menus (good food selection versus poor food selection), shows statistically significant associations for the study variables of age group and academic study level. Regarding age groups, two age groups (18–20 and 21–23) are highly statistically significantly associated with food choices on restaurant menus (odds ratios of 2.78 and 3.63, respectively) ($p=0.025$ and $p=0.005$). As far as academic study level is concerned, being in the third year level was statistically significantly associated with food choices on restaurant menus, with an odds ratio of 3.65 ($p=0.012$) (Table 5).

Table 5: Association between study subjects' socio-demographic characteristics and their food choices on restaurant menus

Characteristics	Food Choices		Unadjusted odds ratio (95% CI's)	p-value
	Good food (n = 316)	Poor food (n = 84)		
Age groups (years)				
18–20	152(78.4)	42(21.6)	2.78(1.14,6.79)	0.025
21–23	151(82.5)	32(17.5)	3.63(1.46,9.00)	0.005
≥ 24	13(56.5)	10(43.5)	1.0(ref.)	--
Marital status				
Single	304(79.2)	80(20.8)	1.27(0.40,4.03)	0.689
Married	12(75.0)	4(25.0)	1.0(ref.)	--
Type of college				
Health colleges	80(81.6)	18(18.4)	1.00(0.48,2.11)	0.995
Science college	102(79.1)	27(20.9)	1.18(0.53,2.62)	0.685
Human college	85(76.5)	26(23.4)	0.88(0.41,1.84)	0.711
Community college	49(79.0)	13(21.0)	1.0(ref.)	--
Academic study level				
First-year	84(83.2)	17(16.8)	1.72(0.79,3.72)	0.169
Second-year	47(71.2)	19(28.8)	0.86(0.39,1.88)	0.705

Third-year	63(91.3)	6(8.7)	3.65(1.33,10.05)	0.012
Fourth-year	76(74.5)	26(35.5)	1.02(0.49,2.09)	0.964
Fifth- and sixth-year	46(74.2)	16(25.8)	1.0(ref.)	--
Family monthly income (SR)				
Less than 5,000	31(88.6)	4(11.4)	1.77(0.57,5.49)	0.322
5,000–15,000	82(73.2)	30(26.8)	0.62(0.34,1.15)	0.130
More than 15,000	98(79.0)	26(21.0)	0.86(0.46,1.60)	0.637
NA	105(81.4)	24(19.6)	1.0(ref.)	--

Data presented are frequencies in number and percentage n(%)

The multivariate binary logistic regression shows that 'type of college' is independently statistically significantly associated with an awareness of calorie labeling (aware versus unaware), where being a student at a health college was statistically significantly independently associated with such an awareness. The adjusted odds ratio of 3.35 indicates that the odds of health colleges subjects having an awareness of calorie labeling is 3.35 times greater

when compared with subjects from community colleges. For the other binary outcome variable 'food choices on restaurant menus (good versus bad food selection), being in the 21– 23-year age group and being the third-year academic level are statistically significantly independently associated with food choices on restaurant menus (the corresponding adjusted odds ratios are 3.57 and 6.07, respectively) (Table 6).

Table 6: Characteristics independently associated with study subjects' awareness of calorie labeling and food choices on restaurant menus based on a binary multiple logistic regression

Awareness of calorie labeling (Aware and Unaware)

Characteristics	Adjusted odds ratios (95% CI's)	p-value
Type of college		
Health colleges	3.35(1.53,7.35)	0.003
Science college	1.62(0.83,3.14)	0.154
Human college	0.87(0.46,1.68)	0.687
Community college	1.0(ref.)	--

Food choices on restaurant menus (Good and Poor)

Characteristics	Adjusted odds ratios (95% CI's)	p-value
Age groups (years)		
18–20	0.75(0.14,4.08)	0.744
21–23	3.57(1.25,10.19)	0.017
≥ 24	1.0(ref.)	--
Academic study level		
First-year	4.81(0.97,23.93)	0.055
Second-year	2.47(0.49,12.41)	0.272
Third-year	6.07(1.34,27.49)	0.019
Fourth-year	0.70(0.30,1.65)	0.419
Fifth- and sixth-year	1.0(ref.)	--

Discussion

It is well established that the promotion of overall community health is indirectly affected by food choices at the individual level.²¹ Conceiving and implementing national nutrition policies and regulations are keys in developing a supportive environment that leads to consumer behavioral change.^{22,23} In the KSA, the mandatory food labeling on menus in restaurant is considered one of the most important regulations by the SFDA in terms of aiming to contribute to obesity reduction among Saudis.¹² Thus, it is worth to examine the effectiveness of this regulation by assessing the association between the awareness of calorie labeling and food choices in restaurants among female university students. The main results indicate that only 24% of the studied population confirmed reading the calorie labeling carefully, although the about three-quarters demonstrated an awareness of calorie labeling on restaurant menus. In addition, no statistically significant association was observed between an awareness of calorie labeling and food selection. These results raise concerns about the effectiveness of the calorie labeling policy as per its translation into tangible behavior by Saudi consumers.

Since the SFDA implemented a calorie-labeling policy in 2018, several research studies have focused on the evaluation of the potential and actual effectiveness of calorie labels in restaurants within the Saudi context. Alkhatami *et al.* (2021) reported that only 24.4% of Saudi participants utilized caloric information on menus to make a meal decision.²⁴ A recent quasi-experimental study among Saudi adult women revealed that listing calories on menus led to the choice of lower-calorie items, which, in turn, contributed to a significant reduction in calorie intake in the experimental group as compared to the control group.²⁵ This finding was corroborated by the majority of the menu calorie labeling policy literature, which has demonstrated the remarkable influence on the part of calorie labeling on restaurant menus on customers' eating behaviours, as indicated by a decrease in total calorie intake.²⁶⁻²⁹ A systematic literature review concluded that the effect on total calories purchased existed only among consumers who noticed the calorie labels on menus.⁹ Similarly, our study showed that high calorie awareness was significantly associated with changes in food selection, specifically choosing small portion sizes and ordering a salad or fresh vegetables with the

main dish. Taken together, these findings suggest that calorie labeling policy may be an effective strategy for obesity prevention, as previously reported.³⁰ In contrast, the analysis of transactional sales data in Riyadh city revealed no significant impact on the part of calorie-labeling policy on calorie intake in physical or online ordering platforms.³¹ This could be explained by the fact that the analysis was performed for a single fast-food restaurant chain and data were collected in a short time frame (one week) after the implementation of the calorie-labeling policy. Evidence suggests that a policy focusing on caloric content may not significantly affect customers' food choices and may be an ineffective strategy with which to reduce obesity rates.³² An awareness of the importance of calorie information may be an important factor in increasing the effectiveness of the calorie-labeling policy, particularly decreasing calorie intake. The impact of calorie labels with and without social campaigns on food choices has been previously studied, and it has been observed that calorie labels with social campaigns have increased consumer awareness and led to lower-calorie food selections.³³ Awareness campaigns or considerable media attention to the importance of the nutrition information on restaurant menus could increase the effectiveness of the calorie-labeling policy on individuals' food choices.

Regarding an awareness of calorie labeling in restaurant menus, nearly two-thirds of students had noticed the calorie information on the restaurant menus, however, its effects were limited to a minority of students, who may have had a willingness to change their food choices or control their weights. The value of calorie labeling was obvious only among the one-fifth of the students who changed their food choices based on the calorie labeling. Despite the large percentage of students who were aware of calorie labeling, only 24% of students read it carefully, and about one-quarter of the participants never noticed it. As expected, noticing the calorie information has not been associated with purchasing fewer calories³⁴ or changed the consumer's ability to estimate calories.³⁵ Only those who reported using the calorie labels consumed fewer calories as compared with those who did not.³⁴ Although the causes of noticing and developing an awareness of calorie information are multi-factorial, the potential contributors are sex, weight and the frequency

of eating at fast-food/chain restaurants.³⁶ A lack of consumer nutrition knowledge is also considered a crucial barrier regarding calorie labeling in that it can be misinterpreted by consumers.³⁷ Environmental, personal and label-related factors, on the other hand, influence food-purchasing behaviours, and it is the interaction of these factors that will determine whether and how menu calorie labels affect dietary behaviour in individuals,^{33,38} for example, significant differences were obtained based on age and college in the present study. By applying the Theory of Planned Behavior, researchers have identified that attitude was the strongest predictor of utilising caloric information in making a meal decision.²⁴ However, plausible explanations for our findings concerning ignoring caloric information could be a lack of awareness of the importance of calorie labeling, not being interested, individuals being indifferent about their body image, and individuals being interested in food taste only (results not shown). The most likely reason for this result is a lack of awareness of the recommended daily calorie intake, which, in turn, could help explain the importance of calorie labeling.³⁴ Moreover, a lack of supporting guidance and educational material, as well as an invisible or unattractive labeling format and presentation, could limit the effectiveness of calorie labels.³⁰ One study suggests that, in order for calorie labels to be effective, they must be prominent, large enough, and obtained from reliable authoritative sources.³⁹

The lack of awareness of calorie labeling policy raises some concerns about the need to provide education and guidance for the target populations before policy implementation. Businesses follow multi-channel marketing strategies; thus, policy makers should recognize the incentives and investigate consumer attitudes to influence the way consumers act toward food purchases. To do so, we recommend raising awareness of calorie values through public outreach campaigns because the majority of study participants noticed but did not use the caloric information on menus, indicating a lack of prior knowledge about the value of calories, therefore, they were less influenced by the SFDA's mandatory menu calorie labeling policy. Furthermore, calorie-labeling formats should be considered because preferences for menu labeling formats may differ from one country to another. For instance, in Brazil and the UK, young adults

preferred the information-list-with-symbols format, which was considered a comprehensive and useful aid in making an informed food selection.⁴⁰ Furthermore, we suggest considering the cultural, cognitive, affective, and behavioural nature of a population before imposing a policy or launching a campaign; visualisation techniques in advertising policy or public education campaigns may be more effective in terms of comprehension when they are providing complex or new information.

The limitations of this study include its cross-sectional nature in that inferences regarding causal relationships could not be examined. Because of the use of a non-probability sampling technique, the findings could not be generalised to the entire adult Saudi population. However, data were taken from the PNU, which is the largest all-female university in the world (with more than 50,000 female students), and thus, it may reflect young adult Saudi women fairly well. Thus, this study provides a basis for understanding the extent to which the level of awareness is associated with food selection in the face of food labeling for menus in restaurants.

Conclusion

To our knowledge, the current study is one of the first studies to assess the awareness of calorie labeling and its association with food choices after a mandatory menu calorie-labeling implementation. The new SFDA calorie-labeling regulation may not be an effective enough strategy for reducing non-communicable diseases among Saudis, such as obesity. Thus, simply providing such information may not be enough to ensure the expected positive change in terms of a reduction of calorie intake. Further efforts are needed to raise awareness and provide education about recommended calorie intake and the value of calorie-labeling policy to meet the expectations of the policy.

Acknowledgments

The authors would like to thank all participants in this study and the expert professionals for their feedback on the questionnaire.

Funding

None

Conflict of Interest

The authors have not stated any conflicts of interest.

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