Assessing Use of Caloric Information on Restaurant Menus and Resulting Meal Selection in Saudi Arabia: Application of the Theory of Planned Behavior

Areej Ali Alkhathamia, Areej Turki Duraihima, Fay Fallaj Almansoura, Ghada Abdulaziz Alotaya,
Hadeel Sami Alnowaisera, Basil H. Aboul-Enein b, Enmanuel A. Chavarria c, and Nada Benajiba a
aPrincess Nourah Bint Abdulrahman University; bLondon School of Hygiene & Tropical Medicine; cUniversity of Texas Health Science Center at
Houston

ABSTRACT

Background: Beginning in 2019, the Saudi Government required restaurants to post caloric information on menus to facilitate informed meal choices by Saudi consumers.

Purpose: To assess the impact on consumer food choices, leveraging TPB, related to caloric information on menus among restaurants in Saudi Arabia.

Methods: A cross-sectional study among adult Saudi consumers was conducted. Theoretically based on TPB, data were gathered on the use of caloric information on menus in restaurants across
Riyadh.

Results: Only 24.4% of participants utilized caloric information on menus to make a meal decision.
Attitude (r = 0.65), and *perceived behavioral control* (r = 0.62) significantly correlated with *intention*.
Multiple regression analysis showed that *attitude* ($R2$ = 0.47, P = .05), and *perceived behavioral control* ($R2$ = 0.11, P = .03) were significant predictors of using caloric information on menus for meal
selection.

Discussion: Among Saudi participants, the use of caloric information on menus was low in their meal decision. Interestingly, *attitude* was found to be a significant predictor of utilizing caloric information in making a meal decision.

Translation to Health Education Practice: Consumer education should consider constructs of the
TPB in intervention development and evaluation strategies to influence attitudes toward healthy eating behaviors and enhance the use of caloric information on restaurant menus in making informed meal decisions.

Background

Obesity is defined as abnormal or excessive fat accumulation, generally accepted as a BMI of 30 kg/m2 or greater, and is associated with increased health risks. [1] Worldwide, obesity has become a pandemic, as rates have doubled since 1980.[2] Approximately one-third of the world's inhabitants are obese.[3] Globally, in 2014 trends in BMI among adults showed that 10.8% of men, and 14.9% of women were obese.[4] An increased prevalence of obesity also affects adolescents and children at a more alarming rate (5.6% among boys and 7.8 among girls).[5] Notwithstanding, the Saudi population also faces an obesity epidemic. Data from the 2013 Saudi Health Interview Survey (SHIS) demonstrate elevated rates of obesity throughout Saudi Arabia (prevalence of 28.7% among adults).[6] More recently, this prevalence has increased to 33.7% within the adult population. Furthermore, it is predicted that the obesity prevalence will be 41% among men and 78% among women by 2022.[7] Studies investigating obesity confirmed that this condition increases the risk of developing other diseases, including insulin resistance, type 2 diabetes, cardiovascular disease, and cancers.[8,9] The obesogenic environment in Saudi Arabia has been attributed to many factors, all resulting from economic growth during the last three decades.[10–12] In parallel, a noticeable change and modernization started characterizing Saudi society where 80% of Saudi citizens now live in urban areas.[13] In tandem, in terms of food consumption, a remarkable increase in variety of food choices has exacerbated concerns over obesity among the Saudi population.[14]

Recent research indicates that eating patterns in Saudi Arabia have shifted from a traditional diet containing dairy products, dates, and cereals toward a more westernized diet composed of foods high in added sugar, cholesterol, and fat.[14–20] According to the General Authority for Statistics, more than 15,700 restaurants in Saudi Arabia promote dining out and convenient home delivery service for obtaining ready-to-eat meals.[21] In fact, sales related to dining out is estimated to reach 7–9 billion USD in 2020.[22] The result has been a remarkable increase in daily calorie consumption.[23] Adam et al.[24] estimated that dietary energy supply was 3078 kcal/capita/day, which is remarkably higher than the average requirements of 2100 kcal/capita/day. To combat this growing concern, the strategic plan, "Vision 2030", was created with an aim at reducing the rising rate of obesity among the Saudi population.[25] Consequently, beginning in 2019, the Saudi Food and Drugs Authority required that restaurants label calories on menu choices in the hopes of enabling informed meal choices by Saudi consumers.[26] In the effort to reduce non-communicable diseases, the Saudi Arabian government introduced the aforementioned as a component of a larger set of regulations all aiming to reduce the high rate of NCD in Saudi Arabia. In fact, these regulations included the reduction of amounts of sugar, salt, along with saturated, and transformed fats in processed foods.[27–30] In the legislation, manufacturers were also targeted for increased awareness and engagement toward reducing the calorie contents in their food production.[27–30]

The literature presents several health behavior theories that assist in understanding consumer behavior toward food choices, including the Theory of Planned Behavior (TPB). The TPB consists of four constructs: *attitudes*, *subjective norms*, *perceived behavioral control*, and *intention* to perform the behavior.[31] Developed by Icek Ajzen,[32,33] the TPB has been utilized frequently in explaining certain behavioral patterns. Researchers continue examining the TPB toward understanding how individuals make behavioral decisions. Several studies have successfully utilized the TPB to explain eating behaviors among various age groups.[31,33–40] In a study conducted in the U.S. by Stran et al.,[31] researchers found that positive attitudes toward calorie labeling were predictive of intentions to use nutritional labeling, which

ultimately prompted change in the calorie content of the ordered meal. Another study conducted in the U.S. by Roseman et al.[41] found that calorie content information on the menu, along with consumer subjective nutrition knowledge, had a significant impact on intention to select lower calorie foods. Further still, reviews conducted by Swartz et al.[42] and Sinclair et al.[43] communicate mixed results on menu labeling and outcomes of meal selection. In the first review, it was reported that that calorie labeling does not lead to an intended effect as far as decreasing calorie purchasing or consumption is concerned.[33] In contrast, the second review indicated that including of contextual or interpretive caloric information on restaurant menus seemed to be helpful in consuming fewer calories when eating outside the home.[34]

Current efforts build on research performed by Radwan et al.[44] where they found that menu labeling may serve as an intervention tool to encourage informed calorie intake by consumers. We build on scientific premise by addressing gaps in the literature communicated in the work conducted by Benajiba et al.[45] among Arab consumers, which include lack of consensus regarding expected outcomes on food label policy, nutrition knowledge and understanding of target populations, and health behaviors. Recent studies have assessed the usefulness of caloric information on menus in restaurants among Saudi population. The focus of these studies[46,47] included was on either knowledge and perception or knowledge combined to attitudes and practices related to the use caloric information on menus in restaurants. Recently, an evaluation of the opinions of Saudi consumers regarding the mandatory caloric information on menus was published.[48] To our knowledge, however, no research has analyzed the use of caloric information menus in restaurants to predict meal selection among Saudi consumers by applying the TPB model.

Purpose

The purpose of this study was to investigate Saudi consumer behavior following the implementation of Saudi Technical regulations that call for caloric information to be provided for menu items in restaurants across the country. The TPB served as our theoretical framework and was utilized to better understand the reasons for Saudi consumer food choices in relation to caloric information

on menus in restaurants. Thus, we report on beliefs that influence a consumer's food choice regarding caloric information on menus in restaurants as they relate to the TPB's four constructs.

Methods

A cross-sectional study was conducted from January to February 2020 in two public malls in Riyadh (Saudi Arabia). Adult Saudi males and females were approached to participate in the study. Those interested were introduced to the study and provided with informed consent upon enrollment. Inclusion criteria encompassed adults aged 18 to 45 years. Exclusion criteria encompassed following any type of prescribed diet (including diet therapy), and those diagnosed with the following chronic diseases: diabetes, hypertension, cardiovascular disease, renal disease, high cholesterol, and liver disease. Rationale for these exclusion criteria is based on the condition's influence on consumer food choice that could produce bias.

The current study was granted permission from the Institutional Review Board of Princess Nourah Bint Abdulrahman University (IRB number:19-0285). Retailers gave permission for study staff to recruit participants from their locations.

Data were collected using a questionnaire consisting of three sections; demographics, use of caloric information, and questions regarding the Theory of Planned Behavior and its four constructs: *attitudes, subjective norms, perceived behavioral control*, and *intention*. To ensure clarity and ease of understanding by the participants, the questionnaire was pretested among 25 individuals. Questionnaire items were revised accordingly from feedback provided during pretesting.

The questionnaire included the following three sections:

(a) **Demographic data**: Gender, age, education level, and monthly income.

(b) **Use of caloric information on menus in restaurants**: Assessed with the item, "How often do you use caloric information on menus in restaurants to make a decision on your choice of meal?" Response choices: "always", "frequently", "sometimes", "rarely", and "never".

(c) **Items assessing constructs of TPB**: A total of 13 items (assessing *attitude, subjective norms, perceived behavior control*, and *intention*) were adapted and translated from prior valid and reliable measures.[49] Translation of items to Arabic was completed by

expert translation services. Items were then translated back to English (also by experts) to allow for certainty of meaning. Translated items were pretested to assess clarity. Adaptation of original items reflected study objectives.

(i) ***Attitude*** consisted of three items: (1) "Every time I go to the restaurant, I read the caloric information on menus to make my meal decision", (2) "In the past 3 months, when dining in restaurants, I read the caloric information on menus to make my meal decision", and (3) "In the next 3 months, when dining in restaurants, I will use caloric information on menus to make my meal decision".

(ii) ***Subjective Norm*** consisted of four items: (1) "My family thinks I should use the caloric information on menus to make a meal decision every time I go to a restaurant", (2) "My friends think I should use caloric information on menus to make my meal decision every time I go to a restaurant", (3) "My family uses caloric information on menus to make a meal decision every time they go to a restaurant", and (4) "My friends use caloric information on menus to make a meal decision every time they go to a restaurant".

(iii) ***Perceived Behavioral Control*** consisted of three items: (1) "I consider myself very knowledgeable about using caloric information on menus in restaurants", (2) "I am confident that I can apply the caloric information on menus to make a healthy choice every time I dine at a restaurant", and (3) "For me to use caloric information on menus in restaurants, for the next 3 months is under my control".

(iv) ***Intention*** consisted of three items: (1) "I intend to use caloric information on menus to make a meal decision in a restaurant", (2) "I will use caloric information on menus in restaurants, for the next 3 months", and (3) "I plan to use caloric information on menus in restaurants, for the next 3 months".

Responses for the above items were measured using a Likert scale from 1 to 5, where 1—I strongly disagree, 2—I disagree, 3—Neutral, 4—agree, and 5—strongly agree.[50]

Attitude, subjective norms, perceived behavioral control,

and *intention* were scored as follows: (1) *Attitude* items are added giving a possible range of 3–15 (due to Likert scale).[50,51] We assumed that 50% and above of total scoring (≥9) indicated positive attitudes, and below 50% of total scoring (<9) indicated having negative attitudes. (2) *Subjective norms* items are similarly added to give a range of 4–20. We assumed that 50% and above of total scoring (≥12) indicated having positive subjective norms, and below 50% of total scoring (<12) indicated having negative subjective norms. (3) *Perceived behavioral control* items score range from 3 to 15. We again assumed that 50% and above of total scoring (≥9) indicated having positive perceived behavioral control, and below 50% of total scoring (<9) indicated having negative perceived behavioral control. Last, (4) *Intention* items scoring ranges 3–15. The assumption remains the same where 50% and above of total scoring (≥9) indicated having positive intention, and below 50% of total scoring (<9) indicated having negative intention.

All data analyses were performed using SPSS version 21. Demographic data were analyzed using simple descriptive statistics. Kolmogorov-Smirnov test was conducted to test normality of data. TPB internal consistency was tested by Cronbach's alpha yielding α = .82 for *attitude*, 0.80 for *perceived behavior control*, 0.78 for *subjective norms* and 0.87 for *intention*. The one-way ANOVA test was used to compare mean scoring values of constructs based on the frequency of using the caloric information on menus. A Pearson test was used to examine the associations between the TPB model constructs. To predict intention and behavior, multiple regression analysis was conducted. A *P*-value of < .05 was used for significance.

Results

Participant demographic characteristics are shown in Table 1. A total of 385 participants were included in the study. Most participants were female (64.7%). The average age of the participants was 27.17 years (SD • }7.2). Most participants attained a diploma or bachelor's degree (69.4%), and more than half (50.4%) reported a monthly household income of more than 10,000 SAR (i.e. 2,659 USD).

Table 1. Social demographic characteristics of the participants

(*N* = 385).
Variable *N* %
Gender
Male 136 35.3
Female 249 64.7
Level of education
Primary school\Secondary school\High school 96 24.9
Diploma\Bachelor's degree 267 69.4
Master's degree\PhD degree 22 5.7
Monthly household income
Less than 3000 SAR 21 5.5
3000–6000 SAR 53 13.8
7000–10 000 SAR 117 30.4
More than 10 000 SAR 194 50.4
SAR: Saudi Arabia Riyal.

Table 2 demonstrates descriptive statistics relevant to TPB constructs among adult Saudi consumers and their use of caloric information on menus in restaurants.
Table 3 demonstrates associations of TPB constructs with frequency of use of caloric information on menus in restaurants (where frequency served as the dependent variable). The following independent variables were tested: *attitudes*, *subjective norms*, *perceived control*, and *intention*. Results indicate that when the frequency of using caloric information on menus in restaurants increases, the mean scoring value increases gradually in all questions except for the item, "My friends think I should use caloric information on menus to make my meal decision every time I go to a restaurant". All the questions were significant ($P < .03$) except for the item, "My friends use caloric information on menus in restaurants to make a meal decision every time they go to a restaurant".
Pearson bivariate correlations among TPB constructs are presented in Table 4. The relationship between *attitude* and *perceived behavioral control* was significant at ($r = 0.51$, $P < .01$). *Attitude* ($r = 0.65$) and *perceived behavioral control* ($r = 0.62$, $P < .01$) had the greatest influence on *intention*. In contrast, *subjective norm* ($r = 0.28$, $P < .01$) had less influence on behavior (frequency of use of caloric information on menus in restaurants).
Multiple regression coefficients among TPB constructs are presented in Figure 1. The relationship between *subjective norm* ($R2 = 0.05$, $P = .31$) and *intention* ($R2 = 0.00$,

P = .94) on behavior (frequency of use of calorie labeling) are not significant. However, the relationship between *attitude* (*R*2 = 0.47, *P* = .05) and *perceived behavioral control* (*R*2 = 0.11, *P* = .03) on behavior (frequency of use of caloric information on menus in restaurants) are significant. *Attitude* had the highest influence on frequency of use of caloric information on menus in restaurants.

Table 2. Descriptive statistics for the theory of planned behavior constructs (*N* = 385).
Variable Mean ±SD Range
Behavior (1 item):
How often do you use caloric information on restaurant menus to make a meal decision 2.6 1.3 1–5
Attitude (3 items): 8.8 3 3–15
Every time I go to the restaurant, I read the caloric information on restaurant menus to make meal decision 2.7 1.1 1–5
In the past 3 months, I would to use the caloric information on restaurant menus to make meal decision 2.7 1.2 1–5
In the next 3 months, I would to use the caloric information on restaurant menus to make meal decision 3.4 1.1 1–5
Subjective norm (4 items): 10.7 3.5 4–20
My family thinks I should use the caloric information on menus to make a meal decision every time I go to a restaurant 2.8 1.1 1–5
My friends think I should use the caloric information on menus to make my meal decision every time I go to a restaurant 2.7 1.1 1–5
My family uses the caloric information on menus to make a meal decision every time they go to a restaurant 2.6 1.1 1–5
My friends use the caloric information on menus to make a meal decision every time they go to a restaurant 2.6 1.1 1–5
Perceived Behavioral control (3 items): 10 2.9 3–15
I consider myself very knowledgeable about using the caloric information on menus in restaurants. 3.2 1.1 1–5
I am confident that I can use the caloric information on menus to make a healthy choice every time I goes to the restaurant 3.5 1.1 1–5
For me to use the caloric information on menus in restaurant, for the next 3 months is under my control 3.4 1.2 1–5
Intention (3 items): 9.7 3 3–15
I intend to use the caloric information on menus to make a meal decision in a restaurant 2.9 1.1 1–5
I will use the caloric information on menus, for the next 3 months 3.4 1.1 1–5
I plan to use the caloric information on menus, for the next 3 months 3.4 1.1 1–5

Table 3. Mean ± SD of scoring of constructs based on the frequency of using the menu calories label (*N* = 385).

Mean ± SD
Variable
Strongly
disagree Disagree Neutral Agree
Strongly
agree *P*-value
Attitude (3 items):
Every time I go to the restaurant, I read the caloric information on menus to make meal decision
1.3 ± 0.5 2.1 ± 1.0 2.8 ± 1 3.5 ± 1.1 4.0 ± 1.3 <.0001
In the past 3 months, I would to use the caloric information on menus to make meal decision
1.6 ± 1.0 2.1 ± 1.0 2.7 ± 1 3.4 ± 1.0 4.2 ± 1.1 <.0001
In the next 3 months, I would to use the caloric information on menus to make meal decision
1.4 ± 0.8 2.1 ± 1.0 2.3 ± 1.1 3 ± 1.2 3.2 ± 1.5 <.0001
Subjective norm (4 items):
My family thinks I should use the caloric information on menus to make a meal decision every time I go to a restaurant
2 ± 1.2 2.3 ± 1.1 2.8 ± 1.2 2.8 ± 1.3 3.4 ± 1.4 <.0001
My friends think I should use the caloric information on menus to make my meal decision every time I go to a restaurant
2.2 ± 1.3 2.5 ± 1.2 2.5 ± 1.2 3 ± 1.3 2.7 ± 1.4 .002
My family uses the caloric information on menus to make a meal decision every time they go to a restaurant
2.1 ± 1.2 2.4 ± 1.2 2.8 ± 1.2 3 ± 1.5 3.1 ± 1.3 <.0001
My friends use the calories information on menus to make a meal decision every time they go to a restaurant
2.3 ± 1.2 2.6 ± 1.2 2.5 ± 1.2 2.9 ± 1.6 2.9 ± 1.6 .055
Perceived Behavioral control (3 items):
I consider myself very knowledgeable about using the calories information on menus. 1.6 ± 0.9 2 ± 1.0 2.7 ± 1.2 2.9 ± 1.2 3.4 ± 1.2 <.0001
I am confident that I can use the calories information on menus to make a healthy choice every time I goes to the restaurant
1.7 ± 1.1 2.1 ± 1.0 2.4 ± 1.2 2.7 ± 1.2 3.5 ± 1.2 <.0001
For me to use the calories information on menus, for the next 3 months is under my control
1.9 ± 1.2 2.2 ± 1.0 2.4 ± 1.1 2.8 ± 1.2 3.2 ± 1.4 <.0001
Intention (3 items):
I intend to use the calories information on menus to make a meal decision in a restaurant 1.6 ± 1.1 2.1 ± 1.0 2.6 ± 1.0 3.1 ± 1.3 3.8 ± 1.3 <.0001
I will use the calories information on menus, for the next 3 months 1.8 ± 1.2 2.1 ± 1.0 2.3 ± 1.0 2.9 ± 1.2 3.4 ± 1.5 <.0001
I plan to use the calories information on menus, for the next 3 months 1.8 ± 1.3 1.9 ± 0.8 2.3 ± 1.0 2.8 ± 1.2 3.3 ± 1.4 <.0001
One-way ANOVA test is applied to assess the differences between different means.

Table 4. Pearson bivariate correlation (*r*) between constructs of the theory of planned behavior.
Attitude Subjective norms Perceived behavior control Intention Behavior
Attitude – – – – –
Subjective norms 0.36* – – – –
Perceived behavior control 0.51* 0.30* – – –
Intention 0.65* 0.33* 0.62* – –
Behavior 0.63* 0.28* 0.41* 0.45* –
* *P*-value < .01.

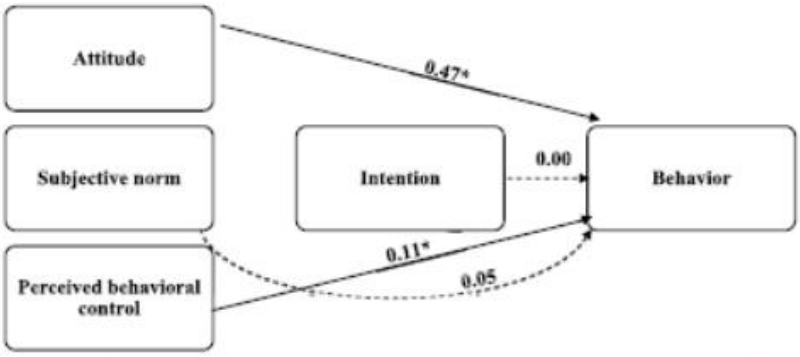

Figure 1. Multiple regression coefficients on the constructs of the theory of planned behavior toward behavior (the use of the caloric information on restaurant menus). * *P*-value is significant in < .05

Discussion

While making individual food choices are determinant into promoting the overall health, creating a supportive environment nationally is essential in encouraging and increasing healthy consumer preferences and behaviors.52 The improvement of dietary behavior at the population level in Saudi Arabia might be achieved with national policies and regulations on nutrition and food production .53–57 Thus, it is worth examining outcomes stemming from the implementation of Vision 2030 by the Saudi Food and Drug Authority (SFDA) which instructed all restaurants to list calories for menu items, in an effort to mitigate NCD related to unhealthy eating habits.26 The current study's purpose was to assess the use of caloric information on menus in restaurants on making meal decisions among Saudi adult consumers.

Findings among studies conducted in the U.S. support the view that caloric information on menus given in restaurants may promote healthier lifestyles among college

students.[41] Even with efforts taken by the SFDA to improve nutritional awareness, there exists a dearth of studies examining the use of caloric information provided on menus given in restaurants, and other consumer behaviors among Saudi adults.

In a recent study, Tami et al.[58] indicated that Saudi adults supported the food regulation released by the SFDA. Hence, our findings indicate that only 24.4% of participants communicate "always" using caloric information posted on menus given out at restaurants.

Concurrently, Alkhaldy et al.[48] reported that even if Saudi consumers demonstrated remarkable support to the policy instructing restaurants to provide caloric information on menus, the same respondents expressed they would be less probable to eat in a restaurant providing such information on menus. Moreover, a study conducted by Washi[59] in UAE found general awareness among most consumers (89.5%) for reading food labels. However, consumers communicated only reading basic information, such as production and expiration dates.[59]

Current study findings communicate similarities to those in the literature, such that consumers seem to not use food labels when deciding on products to purchase or consume. Further, we similarly find that consumers may not frequently use caloric information on menus when making meal choices. Together, these findings suggest that consumers may be at risk for low nutrition literacy – the ability to evaluate nutrition information to make informed decision on nutritional value.

Interestingly, in contrast, Vargas-Bustamante[60] found that 38% of participants interviewed at food courts use caloric information provided on menus to make their food choices. Differences in outcome for Vargas-Bustamante[60] may be due to menu formatting aimed at communicating foods with low-calories.

The use of TPB was predicated on the theory's as and popularity for predicting human rationale in relation to a specific decision-making behavior.[61] The predictors of TPB are attitude, social norms, perceived behavioral control which are grounded on functions of behavioral, normative, and control beliefs. The assets of such model are weighted by the assessment of the resulting behavior and incentive to fulfill it.[62] Our findings suggest a significant association between *attitude* and use of caloric information on restaurant menus. This mirrors prior findings by Kim et al.[63] where *attitude* determined

intention among consumers. Further, our findings suggest behavioral beliefs positively influence *attitude* regarding reading caloric information on restaurant menus. Dunn et al.[36] communicate *attitude* as positively influenced by *intention*, where fast food is perceived as providing convenience, and satisfaction. Together, these findings may indicate perspectives that could influence *attitude*.

Our findings show that *subjective norms* had little influence on the use of caloric information on restaurant menus ($R2 = 0.05$, $P = .31$). This contrasts with prior results by Sharifirad et al.[23] that found that *subjective norms* had the strongest influence on consumer fast food behavior among Iranian high school students' ($R2 = 0.17$, $P = .001$). These contrasting findings may be related to age, as high school students are more influenced by their families and friends, compared to adults aged 18 to 45-years. Alternatively, it may also be related to cultural differences between the Iran population and the Saudi population.

Intention had almost no influence on the use of calorie information on restaurant menus by Saudi adults consumers ($R2 = 0.00$, $P = .94$). Similar results were found in a study conducted at the University of Alabama, where students ordered significantly fewer calories when caloric information was posted.[31] According to Stran et al.,[31] the change in calories ordered from a full-service menu was not significantly correlated with intention ($R2 = -0.15$, $P = .15$). The similarity between the studies may be due to similarities in demographics.

Limitations of this study include the use of convenience sampling and a small number of data collection sites. Thus, results may not be generalizable to all Saudi adult consumers. However, data collection sites host heavy consumer traffic, and thus, these sites were selected as they reflect a great multitude of the Saudi demographics sought by the current study. Some study strengths include our findings lending further support to the established literature in finding that subjective norm is the least predictive among the TPB constructs.[64,65]

Translation to Health Education Practice

Health Educators should consider constructs of the TPB in intervention development and evaluation strategies to influence attitudes and subsequently enhance the use of caloric information on restaurant menus, by Saudi consumers, in making informed meal decisions.

The current study demonstrates that almost half of the participants (49.8%) never use caloric information on restaurant menus to make an informed decision about their meal. The examined TPB constructs of attitude, subjective norm, perceived behavioral control, and intention each show different levels of association with the studied behavior. Current study findings strongly suggest that attitude contributes to the use of caloric information on restaurant menus when making a meal decision. Subjective norms and intention were not significantly associated with the use of caloric information on restaurant menus. Our findings suggest that diffusing nutrition messages at community levels would be helpful in communicating the importance of the information provided by calorie labels posted on menus. Thus, we communicate that future efforts may involve Health Educators and community nutritionists in teaching consumers how to read and understand calorie-labeling. Educational efforts such as these could be effective in bridging the intention–behavior gap assessed in this study.

In assessing the most up-to-date resources on Health Education, we consulted the NCHEC.org website[66] throughout the study period and manuscript development (Spring through Winter 2020). Our work covers Area I, Area II, and Area IV of responsibilities for Health Educators. Specifically, relevant to Area I the manuscript was theoretically pinned on the Theory of Planned Behavior and its constructs. This allowed for efficient assessment of outcomes in our study. Thus, the subcompetency, "1.1.4 Apply Theories and/or models to assessment process" was applied in these efforts. The text communicates how the TPB constructs assisted in assessing outcomes and lends toward future efforts by highlighting the need to focus on intervening on participants' attitudes for creating behavior change toward the use of caloric information. We are confident that TPB constructs will facilitate future educational efforts, and its assessment.

In addressing Area II, we specifically tackled the following sub-competency, "2.5 Address factors that influence implementation of Health Education/promotion". This sub-competency was accomplished by assessing TPB constructs and related health behavior outcomes. As such we understood that TPB constructs such as attitudes would guide areas in need of addressing for efficient implementation of future Health Education/promotion interventions relevant to creating informed

meal decisions. Our use of TPB constructs facilitates future efforts by informing us of the need to create an attitude change, and in doing so self-efficacy, perceived control, and intention will also be targeted. From our efforts, we see that this is the most efficient route toward health behavior change in comparison to targeting other constructs such as intention.

In addressing Area IV, we specifically covered the following sub-competency, "4.2.4 Analyze and synthesize information found in the literature", As we evaluated the literature, we discovered the need to assess the outcomes stemming from new regulations in Saudi Arabia relevant to efforts on reducing NCDs. Thus, we found that an assessment of value was necessarily relevant to outcomes stemming from regulations enforcing caloric information on restaurant menus in Saudi Arabia. The literature also helped the current study investigators determine outcome similarities and differences in comparing efforts from other studies.
Therefore, the literature assisted in both highlighting a knowledge gap need and comparing results to guide future interventions. All in all, CHES/MCHES NCHEC Responsibilities, Competencies, and Sub-competencies, are instrumental in Health Education intervention efforts. We communicate how these have guided both the design and outcome assessment of the current study. These efforts lend efficiency toward future efforts. Thus, the current study highlights areas to consider for Health Educators planning nutrition education efforts and provides information on designing, and evaluating efforts using TPB constructs.

Acknowledgments
The authors would like to express their gratitude to Cassandra Enzler for providing valuable edits to several drafts of this article.

Disclosure statement
No potential conflict of interest was reported by the authors.

Human subjects approval statement
The current study was granted permission from the Institutional Review Board of Princess Nourah Bint Abdulrahman University (IRB number: 19-0285).

Funding
This research was funded by the Deanship of Scientific Research at Princess Nourah bint Abdulrahman University

through the Fast-track Research Funding Program.

ORCID

Basil H. Aboul-Enein http://orcid.org/0000-0002-4957-2136
Enmanuel A. Chavarria http://orcid.org/0000-0001-8418-5361
Nada Benajiba http://orcid.org/0000-0002-5533-7626

References

1. World Health Organization. Obesity. https://www.who.int/topics/obesity/en/. Published 2020. Accessed November 11, 2018.
2. Chooi YC, Ding C, Magkos F. The epidemiology of obesity. *Metabolism*. 2019;92:6–10. doi:10.1016/j.metabol.2018.09.005.
3. Bluher M. Obesity: global epidemiology and pathogenesis. *Nat Rev Endocrinol*. 2019;15(5):288–298. doi:10.1038/s41574-019-0176-8.
4. NCD Risk Factor Collaboration (NCD-RisC). Trends in adult body-mass index in 200 countries from 1975 to 2014: a pooled analysis of 1698 population-based measurement studies with 19.2 million participants. *Lancet*. 2016;387(10026):1377–1396. doi:10.1016/s0140-6736(16)30054-x.
5. NCD Risk Factor Collaboration (NCD-RisC). Worldwide trends in body-mass index, underweight, overweight, and obesity from 1975 to 2016: a pooled analysis of 2416 population-based measurement studies in 128・9 million children, adolescents, and adults. *Lancet*. 2017;390(10113):2627–2642. doi:10.1016/s0140-6736(17)32129-3.
6. Saudi Arabian Ministry of Health. Saudi health information survey - Adult obesity at a glance. https://www.moh.gov.sa/Ministry/Statistics/Documents/obesity.pdf. Published 2014. Accessed November 5, 2019.
7. Al Quwaidhi AJ, Pearce MS, Critchley JA, Sobngwi E, O'Flaherty M. Trends and future projections of the prevalence of adult obesity in Saudi Arabia, 1992–2022. *East Mediterr Health J*. 2014;20(10):589–595. doi:10.26719/2014.20.10.589.
8. Kopelman P. Health risks associated with overweight and obesity. *Obes Rev*. 2007;8(s1):13–17. doi:10.1111/j.1467-789X.2007.00311.x.
9. Renehan AG, Tyson M, Egger M, Heller RF, Zwahlen M. Body-mass index and incidence of cancer: a systematic review and meta-analysis of prospective observational studies. *Lancet*. 2008;371(9612):569–578.

doi:10.1016/s0140-6736(08)60269-x.
10. World Health Organization. Diabetes country profiles 2016 - Saudi Arabia. https://www.who.int/diabetes/country-profiles/sau_en.pdf?ua=1. Published 2020. Accessed June 2, 2020.
11. Musaiger AO. Overweight and obesity in Eastern Mediterranean region: prevalence and possible causes. *J Obes*. 2011;2011:407237. doi:10.1155/2011/407237.
12. Badran M, Laher I. Obesity in Arabic-speaking countries. *J Obes*. 2011;2011:686430. doi:10.1155/2011/686430.
13. McKinsey Global Institute. Saudi Arabia beyond oil: the investment and productivity transformation. https://www.mckinsey.com/~/media/McKinsey/Featured%20Insights/Employment%20and%20Growth/Moving%20Saudi%20Arabias%20economy%20beyond%20oil/MGI%20Saudi%20Arabia_Executive%20summary_December%202015.pdf. Published 2015. Accessed December 31, 2020.
14. Al-Rethaiaa AS, Fahmy AE, Al-Shwaiyat NM. Obesity and eating habits among college students in Saudi Arabia: a cross sectional study. *Nutr J*. 2010;9(1):39. doi:10.1186/1475-2891-9-39.
15. Aboul-Enein BH, Bernstein J, Neary AC. Dietary transition and obesity in selected Arabic speaking countries: a review of the current evidence. *East Mediterr Health J*. 2017;22(10):763–770. doi:10.26719/2016.22.10.763.
16. Bakhotmah BA. The puzzle of self-reported weight gain in a month of fasting (Ramadan) among a cohort of Saudi families in Jeddah, Western Saudi Arabia. *Nutr J*. 2011;10(1):84. doi:10.1186/1475-2891-10-84.
17. Musaiger AO. *Food Composition Tables for Arab Gulf Countries: Gulfoods*. Manama, BH: Arab Center for Nutrition; 2006.
18. Midhet FM, Al-Mohaimeed AA, Sharaf FK. Lifestyle related risk factors of type 2 diabetes mellitus in Saudi Arabia. *Saudi Med J*. 2010;31(7):768–774. PMID: 20635010.
19. Al-Suliman NA. *The Health and Nutritional Factors of Chronic Medical Diseases among Saudi Females in Jeddah City*. Manama, BH: Arab Center for Nutrition; 2008.
20. Al Qauhiz NM. Obesity among Saudi female university students: dietary habits and health behaviors. *J Egypt Public Health Assoc*. 2010;85(1–2):45–59. PMID: 21073847.
21. Bouznif MM, AlMudbel J, Almarshed S, Ben Ajmi IM. A case study about accelerating expansion of restaurants

industry in Saudi Arabia. *Bus Manage Strat*. 2018;9 (1):173–195. doi:10.5296/bms.v9i1.13283.
22. Foodex Saudi. Fast food sales are expected to grow at a compound annual growth rate (CAGR) of 7.1 % which is estimated of $7.9 billion in 2020. https://www.foodexsaudi.com/en/news/402. Published 2017. Accessed December 30, 2019.
23. AlAmer NA, AlOmar RS, AlKaltham SM. et al. Perceived effect of calorie count display on customers' eating behaviors in food facilities of Eastern Province, Saudi Arabia: a mixed method study. *J Multidiscip Healthc*. 2020;13:1849–1861. doi:10.2147/JMDH.S283568.
24. Adam A, Osama S, Muhammad KI. Nutrition and food consumption patterns in the Kingdom of Saudi Arabia. *Pak J Nutr*. 2014;13(4):181–190. doi:10.3923/pjn.2014.181.190.
25. Government of Saudi Arabia. Saudi vision 2030. https://vision2030.gov.sa/en/node. Published 2020. Accessed December 5, 2019.
26. Saudi Food & Drug Authority. Restaurants and cafes obliged to display calories. https://www.sfda.gov.sa/ar/food/news/Pages/f5-8-2018a1.aspx. Published 2017. Accessed January 3, 2020.
27. Saudi Food & Drug Authority. Food regulations. https://www.sfda.gov.sa/en/food/about/regulations/Pages/default.aspx. Published 2020. Accessed June 20, 2020.
28. Saudi Food & Drug Authority. Food technical regulations and standards project. https://www.sfda.gov.sa/en/food/about/administration/management_regulations/pages/regulations_standards-project.aspx. Published 2020. Accessed December 6, 2020.
29. Saudi Food & Drug Authority. SFDA healthy food strategy. https://www.sfda.gov.sa/ar/awareness/Documents/SFDA-HealthyFoodStrategy.pdf. Published 2020. Accessed July 3, 2020.
30. Saudi Food & Drug Authority. SFDA launches healthy food regulation strategy tomorrow. https://old.sfda.gov.sa/en/food/news/Pages/f11-9-2018a1.aspx. Published 2018. Accessed June 4, 2020.
31. Stran KA, Knol LL, Severt K, Lawrence JC. College students' intentions to use calorie information on a restaurant menu: application of the theory of planned behavior. *Am J Health Educ*. 2016;47(4):215–223. doi:10.1080/19325037.2016.1179142.
32. Ajzen I. The theory of planned behavior. *Organ Behav Hum Decis Process*. 1991;50(2):179–211. doi:10.1016/0749-5978(91)90020-T.

33. Ajzen I. Consumer attitudes and behavior: the theory of planned behavior applied to food consumption decisions. *Ital Rev Agric Econ*. 2015;70(2):121–138. doi:10.13128/REA-18003.
34. Xiao JJ, Wu GJ. Completing debt management plans in credit counseling: an application of the theory of planned behavior. *Financ Couns Plan*. 2008;19 (2):29–45. http://afcpe.org/journal-articles.php?volume=382&article=339 .
35. Satsios N, Hadjidakis S. Applying the theory of planned behaviour (TPB) in saving behaviour of Pomak households. *Int J Financ Res*. 2018;9(2):122–133. doi:10.5430/ijfr.v9n2p122.
36. Dunn KI, Mohr P, Wilson CJ, Wittert GA. Determinants of fast-food consumption. An application of the theory of planned behaviour. *Appetite*. 2011;57 (2):349–357. doi:10.1016/j.appet.2011.06.004.
37. Kocken PL, van Kesteren NM, Buijs G, Snel J, Dusseldorp E. Students' beliefs and behaviour regarding low-calorie beverages, sweets or snacks: are they affected by lessons on healthy food and by changes to school vending machines? *Public Health Nutr*. 2015;18 (9):1545–1553. doi:10.1017/s1368980014002985.
38. Lim HJ, Kim MJ, Kim KW. Factors associated with nutrition label use among female college students applying the theory of planned behavior. *Nutr Res Pract*. 2015;9(1):63–70. doi:10.4162/nrp.2015.9.1.63.
39. Sharifirad G, Yarmohammadi P, Azadbakht L, Morowatisharifabad MA, Hassanzadeh A. Determinants of fast food consumption among Iranian high school students based on planned behavior theory. *J Obes*. 2013;2013:1–7. doi:10.1155/2013/147589.
40. Yazdanpanah M, Forouzani M. Application of the theory of planned behaviour to predict Iranian students' intention to purchase organic food. *J Clean Prod*. 2015;107:342–352. doi:10.1016/j.jclepro.2015.02.071.
41. Roseman MG, Joung HW, Choi EC, Kim HS. The effects of restaurant nutrition menu labelling on college students' healthy eating behaviours. *Public Health Nutr*. 2017;20(5):797–804. doi:10.1017/s1368980016002871.
42. Swartz JJ, Braxton D, Viera AJ. Calorie menu labeling on quick-service restaurant menus: an updated systematic review of the literature. *Int J Behav Nutr Phys Act*. 2011;8(1):135. doi:10.1186/1479-5868-8-135.
43. Sinclair SE, Cooper M, Mansfield ED. The influence of menu labeling on calories selected or consumed:

a systematic review and meta-analysis. *J Acad Nutr Diet*. 2014;114(9):1375–1388.e1315. doi:10.1016/j.jand.2014.05.014.
44. Radwan H, Faroukh EM, Obaid RS. Menu labeling implementation in dine-in restaurants: the Public's knowledge, attitude and practices. *Arch Public Health*. 2017;75:8. doi:10.1186/s13690-017-0177-9.
45. Benajiba N, Mahrous L, Bernstein J, Aboul-Enein BH. Food labeling use by consumers in Arab countries: a scoping review. *J Community Health*. 2020;45(3):661–674. doi:10.1007/s10900-019-00750-6.
46. Arwa MT, Afnan HS. Nutritional knowledge and consumers' perception toward menu calorie labeling use in Saudi Arabia. *J Organ Behav Res*. 2020;5:148–163.
47. Alassaf HI, Alaskar YA, Alqulaysh BF, et al. Assessment of knowledge, attitudes and practices of Saudi adults about calorie labeling in central Saudi Arabia. *Saudi Med J*. 2020;41(3):296–303. doi:10.15537/smj.2020.3.24916.
48. Alkhaldy AA, Taha DS, Alsahafi SE, Naaman RK, Alkhalaf MM. Response of the public and restaurant owners to the mandatory menu energy-labelling implementation in restaurants in Saudi Arabia. *Public Health Nutr*. 2020;23(18):3435–3447. doi:10.1017/S1368980020000245.
49. Fishbein M, Ajzen I. *Predicting and Changing Behavior: The Reasoned Action Approach*. New York, NY: Psychology Press; 2010.
50. Likert R. A technique for the measurement of attitudes. *Arch Psychol*. 1932;22:1–55.
51. Mircioiu C, Atkinson J. A comparison of parametric and non-parametric methods applied to a Likert scale. *Pharmacy*. 2017;5(2):26. doi:10.3390/pharmacy5020026.
52. Hawkes C, Smith TG, Jewell J, et al. Smart food policies for obesity prevention. *Lancet*. 2015;385(9985):2410–2421. doi:10.1016/s0140-6736(14)61745-1.
53. Diepeveen S, Ling T, Suhrcke M, Roland M, Marteau TM. Public acceptability of government intervention to change health-related behaviours: a systematic review and narrative synthesis. *BMC Public Health*. 2013;13(1):756. doi:10.1186/1471-2458-13-756.
54. Mazzocchi M, Cagnone S, Bech-Larsen T, et al. What is the public appetite for healthy eating policies? Evidence from a cross-European survey. *Health Econ Policy Law*. 2015;10(3):267–292. doi:10.1017/s1744133114000346.
55. Bhawra J, Reid JL, White CM, Vanderlee L, Raine K,

Hammond D. Are young Canadians supportive of proposed nutrition policies and regulations? An overview of policy support and the impact of socio-demographic factors on public opinion. *Can J Public Health*. 2018;109 (4):498–505. doi:10.17269/s41997-018-0066-1.
56. Brambila-Macias J, Shankar B, Capacci S, et al. Policy interventions to promote healthy eating: a review of what works, what does not, and what is promising. *Food Nutr Bull*. 2011;32(4):365–375. doi:10.1177/156482651103200408.
57. Mozaffarian D. Dietary and policy priorities to reduce the global crises of obesity and diabetes. *Nat Food*. 2020;1(1):38–50. doi:10.1038/s43016-019-0013-1.
58. Tami S, Are A-M-M. *Saudi Adults Supportive of Saudi Food & Drug Authority's Food Policies? Assessment of Public Support & Awareness for Saudi Food & Drug Authority's Food Policies*. Hofuf, SA: King Faisal University; 2020.
59. Washi S. Awareness of food labeling among consumers in groceries in Al-Ain, United Arab Emirates. *Int J Mark Stud*. 2012;4(1):38–47. doi:10.5539/ijms.v4n1p38.
60. Vargas-Bustamante A. Menu labeling perception and health behaviors among immigrant and US born minority populations: assessment in two Los Angeles public markets. *Salud Publica Mex*. 2013;55(Suppl 4):S515–522. doi:10.21149/spm.v55s4.5157.
61. Sommer L. The theory of planned behaviour and the impact of past behaviour. *Int Bus Econ Res J*. 2011;10 (1):91–110. doi:10.19030/iber.v10i1.930.
62. Ajzen I, Driver BL. Prediction of leisure participation from behavioral, normative, and control beliefs: an application of the theory of planned behavior. *Leis Sci*. 1991;13 (3):185–204. doi:10.1080/01490409109513137.
63. Kim E, Ham S, Yang IS, Choi JG. The roles of attitude, subjective norm, and perceived behavioral control in the formation of consumers' behavioral intentions to read menu labels in the restaurant industry. *Int J Hosp Manag*. 2013;35:203–213. doi:10.1016/j.ijhm.2013.06.008.
64. Riebl SK, Estabrooks PA, Dunsmore JC. et al. A systematic literature review and meta-analysis: the theory of planned behavior's application to understand and predict nutrition-related behaviors in youth. *Eat Behav*. 2015;18:160–178. doi:10.1016/j.eatbeh.2015.05.016.
65. Povey R, Conner M, Sparks P, James R, Shepherd R. The theory of planned behaviour and healthy eating: examining additive and moderating effects of social influence

variables. *Psychol Health*. 2000;13(3):991–1006. doi:10.1080/01490409109513137.
66. National Commission for Health Education Credentialing. Responsibilities and competencies for health education specialists. https://www.nchec.org/. Published 2021. Accessed January 3, 2021.