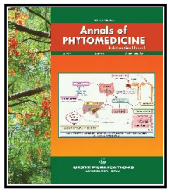
Annals of Phytomedicine 13(1): 879-887, 2024

DOI: http://dx.doi.org/10.54085/ap.2024.13.1.94

Annals of Phytomedicine: An International Journal
http://www.ukaazpublications.com/publications/index.php

Print ISSN : 2278-9839 Online ISSN : 2393-9885



Original Article : Open Access

The impact of using physical activity calorie equivalent (PACE) labelling in reducing calorie consumption

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Article Info

Article history
Received 2 May 2024
Revised 18 June 2024
Accepted 19 June 2024
Published Online 30 June 2024

Keywords
Physical activity calorie equivalent
Questionnaire
Demographics
Physical activity
Nutritional information

Abstract

The world is facing an obesity crisis, with billions of adults classified as overweight or obese. It is well-established that lowering calorie intake and boosting physical activity leads to sustainable weight loss. Consequently, physical activity calorie equivalent (PACE) food labels have been proposed to enhance awareness of the calorie content in foods. This study aimed to assess the impact of PACE food labelling on food choices. Four hundred and twenty-two Saudi adults aged over 18 years completed an online questionnaire between March and April 2022. The survey consisted of four sections: Demographics, physical activity, nutritional information, and the effect of food labels on choices. It also investigated the likelihood of consuming foods marked with calorie and PACE labels. Of the 422 participants, most (51.4%, n = 205) indicated they would check calorie information when ordering food at a restaurant. The majority of individuals responded that menu labelling affects their decisions on what to buy when eating out (51.7%, n = 106). There was a significant difference between the groups using different food labels; participants who referred to PACE labels made healthier food choices compared to those who used calorie labels. This research showed that when eating out at restaurants, most participants actively check calorie information, indicating a strong interest in understanding the nutritional content of their meals. Additionally, most participants noticed calorie counts for items they were considering ordering. Moreover, menu labelling significantly influences participants' decisions regarding what to order, highlighting the importance of providing clear nutritional information to assist individuals in making informed choices about their food

1. Introduction

Obesity is a growing public health concern worldwide, especially in the last few decades, and has negatively affected people's health. For instance, heart disease, hypertension, and type 2 diabetes are among the diseases caused by obesity (World Health Organization, 2016). One of the primary factors leading to obesity is increased energy consumption accompanied by reduced energy expenditure (Hill *et al.,* 2012; National Center for Health Statistics (NHS) Choices, 2014). There is an elevated level of awareness about the significance of healthy food choices and physical activity in protecting individuals from becoming obese and improving overall health and well-being (Celis-Morales *et al.,* 2015).

Labels play a significant role in attracting consumers' attention and determining their food choices (Clement *et al.,* 2013). Therefore, the adoption and implementation of labelling policies that enhance food choices have been prioritized as an obesity-prevention measure (De Oliveira *et al.,* 2020). Labels are considered a nudging tool to change people's behaviour by providing information about foods in a new approach (Cadario and Chandon, 2020). Thus, labels that include physical activity calorie equivalents are a type of nutrition labelling that might be more influential than other label formats in helping consumers make food-related choices (Swartz *et al.,* 2011). Activity equivalent calorie labels may prove more useful for people unable to interpret current front-of-package (FOP) labels (Royal Society for Public Health, 2016). FOP labels are simplified nutrition labels located on the front of food and beverage packaging. They are designed to provide consumers with easy-to-understand information about the nutritional content of a product at a glance. With physical activity calorie equivalent (PACE) food labelling, the public could better understand what a calorie means, enabling them to make more informed choices about what they consume (Yang *et al.,* 2021). To assess the effect of physical activity labels on influencing participants to make healthier food choices at a population level, it is essential to understand how they may contribute to the health of the individuals they target (Masic *et al.,* 2017). Furthermore, it is crucial to assess whether physical activity calorie equivalent (PACE) labels are more effective than standard calorie labels alone and whether a combination of both types of labelling yields better results (Masic *et al.,* 2017). Additionally, presenting exercise equivalent figures may prompt individuals to consider their food choices in the context of a wider understanding of energy intake and expenditure (Cecchini and Warin, 2016; Worsley, 2002). Therefore, this research seeks to evaluate the impact of PACE food labelling on food choices.

Labels have a significant role in attracting the consumers' attention and determining the choice of foods (Clement *et al.,* 2013). Therefore, the adoption and implementation of labelling policies that enhance food choices have been prioritized as an obesity-prevention measure

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(De Oliveira *et al.,* 2020). It is considered a nudging tool to change people's behaviour by providing information about foods in a new approach (Cadario and Chandon, 2020). Thus, labels that include physical activity calorie equivalents are a type of nutrition labelling that might be more influential than other label formats in helping consumers make food-related choices (Swartz *et al.,* 2011).

2. Materials and Methods

2.1 Study design

The study took place in March of 2022 on all regions of Saudi Arabia. Participants were Saudi adults aged over 18 years. A structured questionnaire was performed, containing four sections: Demographics, physical activity, nutritional information, and the effect of a food label on choices (Appendix). The first section contains demographic information, including age, gender, monthly income, region, height, weight, and educational level. In the physical activity section, there are two questions about its importance. The nutritional information contained 9 questions about the importance of food labels and how they influence their choices (Butler, 2018). In the final section of the study, participants were shown images of ten commonly available and recognizable foods in Saudi Arabia, as identified by Alexander (2020). These foods were presented in two ways: Once with calorie content and another time with PACE labels. For foods with calorie data, participants were asked questions about observing a picture of calorie information and their attitude towards making a choice to select this food item, whereas, for foods with PACE labels, the question was about observing a picture and quantifying the min of moderate exercise needed to burn off the food, and similarity, their attitudes towards making a choice to select this food item. Calorie and PACE values for the foods were sourced from a physical activity guide for calorie calculation for various physical activities provided by the Saudi Ministry of Health. The PACE labels indicate the min counts of moderate exercise allowed for expanding the energy content of the foods for Saudis, as per the Ministry of Health in Saudi Arabia (2020). Participants' answers to food questions were presented with both calorie and PACE labels as they were collected using the options: "I will refrain from eating it," "I might eat it," and "I will keep eating it." The questionnaire was translated into Arabic to cater to research participants of all ages and educational backgrounds. We used academic translators and tools to ensure high-quality translation. The process involved initial electronic translation, followed by human editing and proofreading by native Arabic speakers and subject matter experts to refine the translation and ensure its accuracy and readability. As no standardized tool was available for evaluating the nutritional information effect displayed on menu boards, the researcher and research supervisor developed the survey. Ethical approval was obtained from the Research Ethics Committee comprised Ethics No: 57148 of experts under the Deanship of Scientific Research in the Vice Rectorate for Graduate Studies and Scientific Research at King Saud University.

2.2 Data collection

Individuals who lived in Saudi Arabia were asked to take part in the study through online channels. They were assured that their responses would be kept confidential, participation was entirely voluntary, and the outcomes would aid in enhancing community awareness and refining consumer decisions.

2.3 Inclusion and exclusion criteria

The inclusion criteria required participants to be adults aged 18 years and older, residents of Saudi Arabia, and able to read and understand Arabic. Additionally, the study included participants who were used to purchase food from restaurants at least once a week and provided informed consent to participate in the study. The exclusion criteria excluded individuals under 18 years old, non-residents of Saudi Arabia, and those unable to read or understand Arabic. Furthermore, individuals with medical conditions requiring specialized diets that might not reflect typical consumer behavior and participants who did not fully complete the survey or provided inconsistent responses were also excluded.

2.4 Statistical analysis

The study did not employ randomization in the selection of participants. Instead, it used a convenience sampling method, which involved recruiting participants through online and social media channels.

A sample is identified using the sample size equation. The sample comprised 422 participants aged over 18, 50% females and 50% males.

$$\text{Sample size} = \frac{Z_1 - \frac{a^2}{2} p(1-p)}{d^2}$$

For data entry and statistical analysis, the statistical analysis (SPSS VER 26) program for windows was utilized. Data first was checked for normality and reliability before statistical analysis was performed. Then descriptive statistics were conducted where categorical variables were presented as count and per cent. Numerical variables were presented as mean and standard deviation. Frequency is used to analyze demographic data such as age, gender, region, education level, and monthly income. Initial background data ANOVA and Independent Samples Test were used to find the correlation between research questions. The probability value is considered significant when $p<0.05$. A p-value over 0.05 suggests no significant effect. Values between 0.05 and 0.01 are marginally significant. p-values between 0.01 and 0.001 are moderately significant, showing stronger evidence. Values below 0.001 are highly significant.

3. Results

3.1 Demographic information

The sample included 422 participants; among them, 211 were males (50%), and 211 were females (50%). Most participants were aged between 18-30 years (46.4%, n = 196), (32.7%, n = 138) were aged 31-40 years, (15.4%, n=65) were aged 41-50 years, and (5.5%, n = 23) were aged over 51 years. The mean weight was 72.5 kg, and the mean height was 166.2 cm. Participants' BMI ranged from 15.82 to 49.38 (M = 27.06). Whereas, most participants were in bachelor's college (40%, n = 169), (36.3%, n =153) were postgraduate, and (16.4%, n = 69) were in their high school. The Central region had the most participants (57.6%, n = 243), the West region had (15.2%, n = 64), the East region had 10% (n = 42), the North region had (9.2%, n = 39), and the South region had (8.1%, n = 34). In monthly income, most participants were (42.7%, n = 180) less than 5000 Saudi Riyals (SAR), (19%, n = 80) were 6000 to 10,000 SAR, (17.1%, n = 72)

were 11,000 to 15,000 SAR, and (10.9%, n = 46) were 16,000 to 20,000 SAR. The sample average BMI was 27.06, which is considered overweight according to the WHO (World Health Organization, 2016). Demographic characteristics are summarized in Table 1.

Table 1: Demographic characteristics across the sample of participants

Characteristics	N	%
Gender		
Male	211	50%
Female	211	50%
Age		
18-30	196	46.4%
31-40	138	32.7%
41-50	65	15.4%
Greater than 51	23	5.5%
Region		
North region	39	9.2%
West region	64	15.2%
Central region	243	57.6%
East region	42	10%
South region	34	8.1
Education		
High School	69	16.4%
Diploma	31	36.3%
Bachelor's degree	169	40%
Postgraduate	153	7.3%
Monthly income (SAR)		
Less than 5000	180	42.7%
6000 to 10,000	80	19%
11,000 to 15,000	72	17.1%
16,000 to 20,000	46	10.9%
21,000 to 30,000	27	6.4%
More than 31,000	17	4%
BMI		
Normal weight < 25 kg/m^2	358	91.23%
More than normal weight > 25 kg/m^2	37	8.76%

3.2 Physical activity

In the second section on physical activity, most participants (81.5%, n = 344) indicated that physical activity was 'important' or 'very important'. Eight point three per cent (8.3%, n = 35) rated it as 'average,' while nine percent (9%, n = 38) considered it 'of little importance,' and one point two per cent (1.2%, n=5) deemed it 'not important.' Most participants (26.3%, n = 111) reported engaging in less than half an hour of physical activity per week, while (25.1%, n = 106) said they engage in 30-60 min per week. Eighteen per cent (18%, n = 76) reported more than 150 min per week, and (15.2%, n = 64) reported 61-90 min per week, as shown in Table 2 below. There is a higher percentage of physical activity among those who seek calorie information, with (51.4%, n = 205) of them practising physical activity for more than 60 min per week, as seen in Table 2 below.

Table 2: Physical activity of participants

Total (n = 422)	N	%
The importance of physical activity		
Very important	185	43.8%
Important	159	37.7%
Average	35	8.3%
Little important	38	9%
Not important	5	1.2%
Min per week of physical activity		
Less than 30 min/week	111	26.3%
30-60 min/week	106	25.1%
61-90 min/week	64	15.2%
91-120 min/week	40	9.5%
121-150 min/week	25	5.9%
More than 150 min/week	76	18%

3.3 Nutritional information

Most participants (41.5%, n = 175) of the 422 reported getting information about healthy food choices from the internet; (23.5%, n = 99) got information about healthy food choices from social media; (18.2%, n = 77) got information about healthy food choices from health professionals; and the remainder (16.8%, n = 71) got information about healthy food choices from other sources such as family, friends, newspapers, magazines, gyms, nutritionists, *etc.* Most participants (45.3%, n =191) reported that they sometimes check the calorie numbers for specific items of interest, (16.4%, n = 69) reported constantly considering the calorie information, and (38.4%, n = 162) reported never considering the calorie data when purchasing outdoors. Most participants (59.5%, n = 251) buy food from a restaurant 1-2 times per week, while (48.6%, n = 205) of them consider calorie information when ordering food. Among those who do look for calorie information, they were asked about its influence on their ordering decisions. Of the 205 participants who responded to this question, the majority (51.7%, n = 106) stated that it does have some influence. Specifically, of those who seek calorie information, the majority (46.3%, n = 95) do so for weight maintenance purposes, and most (14.5%, n = 61) report occasionally noticing the calorie count for the items they're considering ordering.

Table 3: Influence of calorie information on menu labels on consumers' food choices

Total population	N	%
A lot of influence	94	45.9%
Some influence	106	51.7%
No influence	5	2.4%
Total	**205**	**100%**

Most participants (45.9%, n = 94) stated that calorie information impacts their choices when ordering or purchasing food while dining out. This is consistent across genders, with (48.2%, n = 54) of males and (43%, n = 40) of females expressing the same.

Out of the total 422 participants, the majority (48.6%, n = 205) indicated that they consider calorie information when ordering food at a restaurant, as detailed in Table 4 below.

Table 4: Proportions of participants who look for calorie information when ordering food out at a restaurant

Variable	N	%
Yes	205	51.4%
No	217	48.6%
Total	**422**	**100%**

Most participants (46.3%, n = 95) check calorie information when they order food at a restaurant for weight maintenance, while (27.8%, n = 57) do so to meet their daily energy needs. However, (15.6%, n = 32) are driven by their curiosity, and (10.3%, n = 21) have other reasons for this action, such as medical conditions. When asked about the calorie count they believed to be "too many" for one item

a meal, (50.7%, n = 104) reported 501 - 999 calories is considered to be "too many," while (21%, n = 43) reported that they consider 1000 - 1499 calories to be "too many" as seen in Figure 1 below. Generally, for a meal, (62.7%, n = 27) of males considered 1000-1499 calories to be "too many", and (56.7%, n = 59) of females considered 500-999 calories to be "too many".

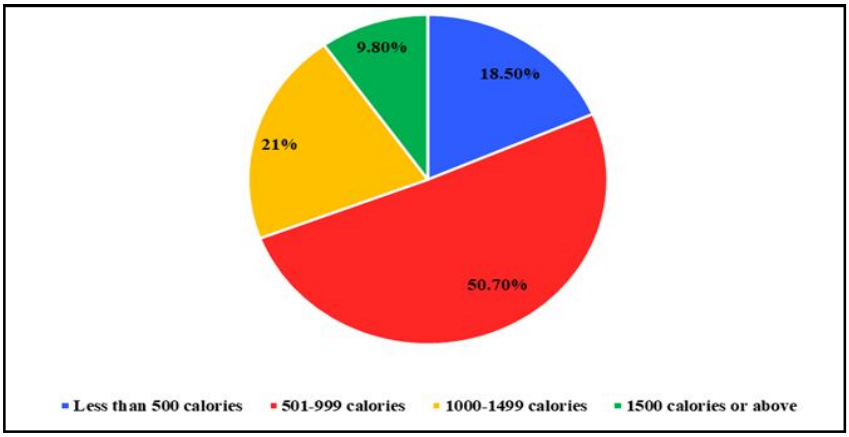

Figure 1: How many calories they believed to be "too many" for one item in a meal.

3.4 Effect of a food label on selection

When comparing PACE labels to calorie labels on foods, the healthiness of participants' choices differed. The majority of participants indicated they were more likely to refrain from eating foods with PACE labels than those with calorie labels (44.1%, n = 186). However, for certain foods, PACE labels did not influence the likelihood of consumption (24.6%, n = 103). Additionally, some participants were less likely to continue eating foods when they responded to PACE labels than calorie labels (31.7%, n = 133). The mean of PACE labels is 21.9455, greater than the mean of kcal labels is 19.5284, and greater than the mean of no label 17.9218. Table 6 below shows that there is a significant difference in the effects of physical activity calorie equivalent (PACE) labels on consumer choices based on age and monthly income.

Table 6: ANOVA test for the differences according to age, education, and monthly income, and chi-square test for the differences according to sex and BMI (n = 422)

Characteristics	N	No label mean (SE)	kcal label mean (SE)	PACE label mean (SE)	label
Age					
18-30	196	22.7 (0.79)	19.5 (0.72)	17.0 (0.78)	
31-40	138	22.1 (0.68)	19.1 (0.62)	15.7 (0.68)	0.566
41-50	65	22.0 (0.82)	18.9 (0.75)	16.0 (0.82)	
>50	23	22.3 (1.24)	18.4 (1.14)	15.6 (1.24)	
Sex					
Male	211	22.8 (0.69)	19.4 (0.63)	15.8 (0.69)	**0.001***
Female	211	21.7 (0.67)	18.5 (0.62)	16.4 (0.67)	
Education					
High School	69	22.5 (0.87)	18.8 (0.8)	16.2 (0.87)	
Diploma	31	22.6 (1.01)	19.8 (0.92)	15.8 (1.01)	0.218
Bachelor's degree	169	22.3 (0.68)	18.5 (0.62)	16 (0.68)	
Postgraduate	153	21.8 (0.65)	18.8 (0.6)	16.3 (0.65)	
BMI					
<25>25	358	22.1 (0.46)	19.4 (0.42)	17.1 (0.46)	0.090
25	37	22.5 (0.99)	18.5 (0.91)	15.1 (0.99)	
Monthly income					
Less than 5000	180	23 (0.75)	20.1 (0.69)	16.8 (0.75)	
6000 to 10,000	80	22.7 (0.8)	19 (0.74)	16.4 (0.8)	
11,000 to 15,000	72	22.1 (0.78)	18.32 (0.72)	14.8 (0.78)	0.099
16,000 to 20,000	46	22.6 (0.89)	18.3 (0.82)	15.1 (0.89)	
21,000 to 30,000	27	21.1 (1.1)	19.1 (1.1)	17.1 (0.9)	
More than 31,000	17	21 (1.32)	19.3 (1.2)	17.4 (1.3)	

*The mean difference is significant at the 0.05 level.

4. Discussion

4.1 Introduction to menu labelling and its impact

Increased restaurant meal consumption is linked to lower nutrient-density foods and greater calorie, fat, and sodium intake (Wu and Sturm, 2012). Menu labelling was introduced to assist consumers in making healthier choices, consuming less calories, losing weight, and improving their general health (Hodge and White, 2012). Food labelling, notably PACE labels, is a focus of this ongoing research because they provide an alternate visualization of nutrition data that may be more familiar to consumers to apply calorie intake statistics on a daily basis.

The purpose of this study was to estimate the PACE food labelling influence on the food choices of Saudi Arabia. After collecting and analyzing surveys in Saudi Arabia, the report of findings showed that the majority buy food from a restaurant once to twice per week. Most subjects search for calorie data when buying their food at a restaurant. Although, a large body of prior research suggests that giving nutritional information on menu items encourages notional choosing lower-calorie options (Bollinger *et al.,* 2011; Brissette *et al.,* 2013; Krieger *et al.,* 2013), research has indicated that this knowledge only affects decisions in particular individuals (Girz *et al.,* 2012; Temple *et al.,* 2011), or may have no contribution in influencing their decisions at all (Downs *et al.,* 2013; Holmes *et al.,* 2013; Swartz *et al.,* 2011). It has been proposed that these contradictory findings are due to consumers' challenges in perceiving a conceptual understanding of messaging, such as the definition of a "calorie" (Dowray *et al.,* 2013). Instead, alternatives, such as physical activity requirements, could be a more effective way of disseminating this knowledge and allowing for more low-calorie food choices (Masic *et al.,* 2017). The present evidence backs up this theory, with more people choosing lower-calorie product alternatives. According to recent studies, decreasing excess kcal intake by 100 kcal/day could help 90 per cent of adults lose weight (Hill *et al.,* 2012).

4.2 Effectiveness of menu labeling

The current study found that at least half of Saudis utilize menu labelling in restaurants. Similarly, Fitch *et al.* (2009) reported that over 75% of surveyed individuals would use calorie information if it were available at fast-food restaurants, while Roberto *et al.* (2009) discovered that only 0.1% of customers sought nutritional information before making a purchase. This indicates that most participants seek calorie details when ordering food at a restaurant and occasionally review the calorie counts for specific items they are interested in.

4.3 Gender differences and menu labeling

The study results indicated that more females than males would use menu labelling. Fitch *et al.* (2009) found that gender differences in the desire for calorie information on menu boards were not significant. However, Chen *et al.* (2015) discovered that females were much more likely than males to notice calorie information. Additionally, women are generally more responsible for family cooking, which may increase their knowledge and awareness of calorie intake and weight management.

4.4 BMI and menu labelling usage

The findings of this study did not provide evidence supporting a significant difference in the BMI levels of Saudis between those who utilize menu labelling and those who do not. People who use menu labelling do so for a variety of reasons, including improving their BMI and meeting their daily needs.

4.5 Physical activity and menu labelling

The current research identified a significant difference in the physical activity patterns of Saudis between two categories: Individuals who employ menu labelling and those who do not. Among those utilizing calorie data, a larger percentage participates in over 60 min of physical exercise weekly, as per the study's findings. This discovery aligns with Butler (2018) study, which also highlighted a significant discrepancy in physical activity levels between menu labelling users and non-users. However, overall, the effect of sample size affected the study findings, showing that high physical activity was not substantially correlated with a higher use of menu labelling (Butler, 2018). Additionally, the current study found that those with the most hours of physical activity had increased use of PACE labelling and were more influential in deciding to choose food. PACE labels may be more important for people who have engaged in physical activity for longer periods because they offer physical activity information.

4.6 Impact of PACE labels on consumer behaviour

The study findings indicate that calorie data on menu labels affects consumer meal selections. A different study conducted a national survey involving 1,000 parents who were randomly assigned to one of four fast food menus: No labels, calorie information only, calories plus min of exercise needed to burn them, or calories plus miles of walking required. The findings indicated that PACE labeling could impact parents' choices regarding fast food items for their children and motivate them to encourage their children to exercise (Viera and Antonelli, 2015). Other elements, such as taste and cost, also affect consumer decisions. Consumers might choose an unhealthy but tastier option over a healthy one (Raghunathan *et al.,* 2006). However, activity-equivalent calorie labels can influence their health-related choices. This study shows that PACE labels can alter consumer preferences (Yang *et al.,* 2021). Specifically, consumers are more inclined to buy healthy foods when PACE labels are present, suggesting a hesitation to purchase unhealthy foods, particularly when labels display the min of walking required for burning calories. Furthermore, PACE labels help reduce the intention to buy unhealthy and high-calorie foods.

The results of this study align with other research conducted in the literature, which states that various food labels affect people's decision-making regarding their food choices. Food labels affect food choices, diet, and overnutrition. (Masic, Christiansen *et al.,* 2017). According to previous literature, these findings could be due to the fact that PACE labels allow for easier access and an understandable format of food information, such as nutrition knowledge, providing an applicable approach to individuals daily. This could result in affecting one's lifestyle, thus having healthy food choices. (Cecchini and Warin, 2015; Worsley, 2002).

As PACE labels allow for a more accessible and intelligible type of nutrition knowledge (Alexander, 2020), using exercise equivalent data could inspire considering food choices with a more comprehensive awareness about energy intake and expenditure (Cecchini and Warin, 2015; Worsley, 2002). Therefore, the study results show that PACE labels are more effective than kcal labels or no labels. Additionally, other studies have shown that PACE labels have significant effects on consumers' preferences for food (Yang *et al.,* 2021; Fitch *et al.,* 2009). In comparison to different food labelling systems, this label system provides the value of quantification of different types of food (Daley *et al.,* 2020).

4.7 Practical implications

This research offers practical insights for shaping policies and programs aimed at promoting healthier eating habits and improving public health. By advocating for the adoption of PACE labelling in menu regulations and tailoring nutrition education campaigns, policymakers can enhance consumer awareness of the link between food choices and physical activity. Community outreach efforts and partnerships with the food industry can further support access to healthier options. Integrating nutrition education into school and workplace programs reinforces the importance of balanced diets.

Appendix

Questionnaire

Section 1: Demographic information

Gender	**Male**	**Female**	
Age	18-30	31-40	
	41-50	Greater than 51	
Region	North Region	West Region	
	Central Region	East Region	
	South Region		
Education	High School	Diploma	
	Bachelor's degree	Postgraduate	
Monthly income (SAR)	Less than 5000	6000 to 10,000	
	11,000 to 15,000	16,000 to 20,000	
	21,000 to 30,000	More than 31,000	
Weight			
Height			
Section Two: Physical activity participants			
Importance of physical activity	Very important	Average	Not important
	Important	Little important	
Min per week of physical activity	Less than 30 min/week	30-60 min/week	61-90 min/week
	91-120 min/week	121-150 min/week	More than 150 min/week
Section three: Nutritional information			
Influence of calorie information on menu labels on my food choices	Much influence	Some influence	No influence
I look for calorie information when ordering food at a restaurant	Yes	No	
How many calories do you believe to be "too many" for one item in a meal?	Less than 500 calories 501-999 calories	1000-1499 calories 1500 calories or above	

Section four: The effect of food labels on choices (images)

5. Conclusion

In conclusion, this study has provided valuable insights into the effects of both calorie and PACE labeling on the dietary behaviors of Saudi adults, elucidating the multifaceted determinants that govern the efficacy of labeling interventions in shaping food choices. Through a systematic examination of various labeling modalities, this research has enriched our understanding of the complex interplay between labeling strategies and consumer decision-making processes, contributing to the literature on nutrition and behavioral economics.

Furthermore, this investigation underscores the imperative of advancing public health initiatives that foster informed dietary decision-making. By interrogating the differential impacts of labelling

schemes, this study underscores the necessity of tailored interventions that resonate with diverse demographic profiles and behavioural dispositions. Such insights not only deepen our comprehension of consumer behaviour within the context of food choice but also inform the design and implementation of evidence-based interventions aimed at promoting healthier dietary patterns and ameliorating the burden of diet-related chronic diseases. Of paramount significance is the advocacy for the widespread adoption of PACE labelling as a potent tool for augmenting health literacy and fostering salutary dietary behaviours. PACE labels offer a bridge between caloric intake and physical activity expenditure, thereby empowering consumers to make dietary decisions aligned with their health and wellness objectives. The empirical findings of this study show that PACE labelling could engender a paradigm shift in consumer attitudes and behaviour toward food consumption, thereby mitigating the escalating public health challenges posed by sedentary lifestyles and poor dietary habits.

Acknowledgements

The authors would like to express their gratitude to for their valuable contributions to this research project. Additionally, we extend our appreciation to the participants who volunteered their time and insights. We also acknowledge the contributions for their assistance with data collection, analysis, and manuscript preparation.

Conflict of interest

The authors declare no conflicts of interest relevant to this article.

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Citation **Wejdan Dhafer Algarni and Hayat Saeed Alzahrani (2024). The impact of using physical activity calorie equivalent (PACE) labelling in reducing calorie consumption. Ann. Phytomed., 13(1):879-887. http://dx.doi.org/10.54085/ap.2024.13.1.94.**