10.21608/meae.2024. 337955.1343

المجلة المصرية للإقتصاد الزراعى
ISSN:2735-4040(Online), 1110-6832 (print)
https://meae.Journals.ekb.eg/

التحليل الاقتصادي لجودة الملصقات الغذائية في المملكة العربية السعودية

Economic Analysis for Nutritional Labels Quality in Saudi Arabia

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المستخلص

لمساعدة المستهلكين لاختيار أغذية صحية، فرضت هيئة الغذاء والدواء في المملكة العربية السعودية وضع ملصقات الحقائق التغذوية على الأطعمة المعبأة. إلا أنه بخصوص الأطعمة المعبأة الصغيرة المستهلكة كحصة واحدة، لا تزال متطلبات ملصقات الحقائق التغذوية تتسم بالمرونة، بما يتيح للشركات الغذائية الاختيار بين نمطين لعرض الحقائق التغذوية. حيث يعرض النمط الأول المعلومات التغذوية لكامل الحصة، بينما يعرض النمط الثاني المعلومات التغذوية لكل 100 ميللتر أو جرام. وللمقارنة بين النمطين، يتسم النمط الأول بالسهولة، بعكس النمط الآخر الذي قد يتطلب عمليات حسابية إضافية للتوصل لإجمالي المكونات التغذوية في الحصة. وعليه تهدف الدراسة إلى التقييم الاقتصادي لتسهيل استخدام ملصقات الحقائق التغذوية للأغذية المعبأة الصغيرة المستهلكة كحصة واحدة. وتركز هذه الدراسة على معلومات السعرات الحرارية على ملصقات الحقائق التغذوية، وباستخدام منهج التفضيلات المعلَّنة، فإن المستهلك مستعد لدفع قيمة إضافية بمتوسط 9% من سعر المنتج للحصول على ملصقات للحقائق التغذوية سهلة الاستخدام. كما تناقش الدراسة التوصيات بشأن السياسات المتعلقة بملصقات المعلومات التغذوية والأبحاث المستقبلية.

بيانات البحث

استلام 2024 /11/20
قبول 12 / 12/ 2024

الكلمات المفتاحية:
ملصقات الحقائق التغذوية؛ معلومات السعرات الحرارية؛ منهج التفضيلات المعلَنة؛ الأطعمة المعبأة؛ الهيئة العامة للغذاء والدواء

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10.21608/meae.2024. 337955.1343

Egyptian Journal Of Agricultural Economics
ISSN:2735-4040(Online), 1110-6832 (print)
https://meae.Journals.ekb.eg/

Economic Analysis for Nutritional Labels Quality in Saudi Arabia

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ARTICLE INFO

Article History
Received:20-11- 2024
Accepted:12**- 12- 2024**

Keywords:
nutritional labels; calorie information; stated preference; packaged food; the Saudi Food and Drug Authority

ABSTRACT

To encourage healthier food choices, the Saudi Food and Drug Authority (SFDA) mandates nutritional labels on packaged foods while maintaining flexible standards for one-serving packages, allowing two displaying styles. The first style provides nutritional information per serving, which is presumably easier for consumers, while the second provides data per 100 ml or gm, potentially obliging calculations to determine the total nutritional content. This study focuses on calorie information, with the aim of estimating consumers' willingness to pay (WTP) for easy-to-read labels. Using the stated preference method, the analysis shows that, on average, consumers are willing to pay an additional 9% above the product price for label ease. The study also discusses policy implications, limitations, and directions for future research.

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1. Introduction

The 2023 Saudi National Health Survey findings revealed a high prevalence of obesity, with 40.5% of individuals aged 15 and older categorized as overweight and 23.7% as obese (The General Authority for Statistics, 2024a). Obesity-related complications include heart disease, stroke, diabetes, high blood pressure, and cancer (The Ministry of Health, 2024). Providing nutritional information is one of several policies aimed at addressing obesity by helping consumers make healthier food choices.

The Saudi Food and Drug Authority (SFDA) mandates that food companies provide nutritional information on packaged foods (The Saudi Food and Drug Authority, 2018, 2021). However, for one-serving food packages, the SFDA allows two styles of displaying nutritional information. The first style displays nutritional information per serving, while the second provides information per 100 ml or gm. For example, when displaying calorie information, the Technical Regulation for the "Requirements of Nutritional Labelling'' states that: "Information on the power level shall be expressed in kilocalories per 100 g or 100 ml or per package if the package of it contains one piece or quantity/ration (The Saudi Food and Drug Authority, 2018)." [1]

A practical example is a small-sized 180 ml Laban (a dairy product), where one company provides calorie information for the entire serving (108 Kcal per 180 ml), while another company displays it as 58 Kcal per 100 ml. The former style is more straightforward and user-friendly, while the other style may impose a cognitive cost on consumers, necessitating them to calculate the total calories per serving.

Label ease is an important element for the success of nutritional information policies. This study aims to estimate consumers' willingness to pay (WTP) for label ease. While SFDA regulations establish label readability through aspects such as design, font type, and listing order (The Saudi Food and Drug Authority, 2018), label ease for one-serving food packages should consider reductive labels that reduce mental calculations required to identify total nutritional contents per serving. The analysis leverages the two displaying styles for one-serving food packages. Although nutritional labels include several components such as calories, fat, protein, and vitamins, this study aims to focus on calorie information, as it is most frequently considered by label users. A study by Shin et al. (2023) reported that 50.1% of label

[1] The Technical Regulation for "Requirements of Nutritional Labeling" number (2233) was approved in 2018 by the Saudi Food and Drug Authority's board of directors.

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users in Saudi Arabia consider calorie information as the most important component of a nutritional panel.

Previous research has identified relationships between label use and diet improvement. Label users are more likely to consume fewer calories and higher amounts of fiber and potassium (Storz, 2023). Christoph et al. (2018) reported that labels are related to healthier food choices, including increased consumption of fruits, vegetables, fiber, and whole grains. However, using nutritional information could lead to unintended consequences. One example is strategic self-ignorance, where consumers intentionally avoid nutritional information to avoid an emotional burden or "emotional tax" (Thunström et al., 2016; Thunström, 2019; Rafiq, 2021; Sunstein, 2021; Nordström et al., 2023). Despite this, the use of nutritional labels still enhances consumer welfare at the aggregated level (Thunström, 2019; Rafiq, 2021).

Any difficulty in understanding nutritional labels can lead to adverse outcomes. First, it may discourage consumers from using nutritional information altogether. Second, it imposes a cognitive cost on those who continue to rely on these labels. With at least 44% of consumers identified as nutritional label users (Arfaoui et al., 2021; Binobead et al., 2022), such costs could be alarmingly and relatively high. Yet, no prior study has examined the effect of different informational styles or consumers' WTP for label ease. To the best of the author's knowledge, this study is the first to examine this issue in terms of SFDA regulations. Employing the stated preference method, the analysis introduces consumers to a hypothetical food choice under a policy designed to improve label ease. Previous research has employed the stated preference method to simulate legislative policies related to nutritional information disclosure (e.g,. Thunström, 2019; Rafiq, 2021). The economic valuation in this study assumes compulsory disclosure of nutritional information per serving on one-serving food packages. The results show that consumers are willing to pay an additional 9% for label ease, providing valuable insights into the potential benefits of reductive labels for one-serving packages.

The rest of the study is organized into four sections. The first section introduces the materials and methods, explaining the data and econometric model used in the analysis. The second section presents the study results. The final two sections offer a discussion of the study findings and conclude the study.

2. Methods and Materials

2.1. Data

This study is based on primary data collected through an online survey conducted in September 2024. Participants 18 years and older were recruited from Zoho Survey's pool. The analysis focuses on the relevant part of the data. The survey included four sections. The first section reminded participants of the implemented policy mandating nutritional label provision on packaged foods, presented an example of a nutritional label, and asked whether they use calorie information. The second section of the survey included the experimental setting and the WTP questions. The third section was about self-control, and the last section collected information on personal health and demographic factors. The survey was pretested and distributed in Arabic.

The survey introduced consumers to a hypothetical scenario through the following steps. First, it explained the two styles of displaying calorie information on nutritional labels for one-serving food packages: some companies provide calorie information per serving, while others present it per 100 ml or gm. Second, participants were asked to imagine themselves at a store buying their preferred cold beverage. They were prompted to choose from a list that included milk/Laban, soda, juice, and energy drinks. The list excluded diet or low-fat options to facilitate concentration on label ease valuation, avoiding distracting cognitions such as the idea that healthier food choices are less tasty (Ran et al., 2017).

Two potential biases could affect the results. The first is hypothetical bias, as people's choices in a hypothetical setting could differ from reality. However, as the hypothetical good—a cold beverage—was familiar to consumers and reflective of a realistic shopping experience, the hypothetical bias is expected to be insignificant (Schläpfer and Fischhoff, 2012). The second bias arises from consumers underestimating the calorie content of a one-serving drink (Franckle et al., 2016). Except for pure milk/Laban, many beverages are considered unhealthy due to high sugar content. A study by Shin et al. (2023) reported that 48% of 250 beverages sold in grocery stores scored the lowest on the Nutri-Score, a ranking system from healthiest to least healthy. Also, to curb sugary drink consumption, the government has imposed a 50% tax on sugary drinks (The Zakat, Tax and Customs Authority, 2024).

To mitigate the issue of underestimating calories, the survey encouraged participants to consider the calories in their preferred beverage by relating them to the effort

required to expend them—particularly, walking for 35 minutes. [2] The hypothetical drink contained 135 Kcal per serving (275 ml), calculated as the average calorie content of a serving of Laban, soda, and energy drinks. However, participants were not provided with the total calorie amount; instead, they were provided with the walking duration required to burn those calories.

Consumers were then asked to imagine a policy mandating food companies to display calorie information per serving on one-serving food packages instead of per 100 ml or gm, simplifying the process of identifying the total number of calories in a serving. They were informed that implementing this policy would incur an additional cost above the drink price of SR 3 (USD 0.8). [3] Using a card payment method, consumers were asked to show the total amount they would pay for the ease of having calorie information per serving. The payment card also included an option for those unwilling to pay more than the drink's base price of SR 3 (USD 0.8).

The payment card elicitation method could introduce censoring bias by potentially missing information at the upper end of the distribution (Rowe et al., 1996). To avoid that, the participants were provided with an open-ended question, allowing them to state their valuations if they exceeded the highest option provided on the payment card (Oerlemans et al., 2016; Aseres and Sira, 2020).

Healthy food choices require self-control to forgo the present satisfaction of high-calorie intake for long-term well-being. Thunström (2019) reported that individuals with lower self-control stated a negative WTP for calorie information in restaurant meals, while those with higher self-control showed a positive WTP for such information. Following Thunström (2019), this study incorporates the self-control measure developed by Haws et al. (2016). This measure is food-domain and includes 10 questions evaluating self-control. Table 1 presents the definitions of the variables used in the analysis. The final sample utilized for the analysis consists of 353 observations.

2.2. Econometric Model

Consumers' WTP for label ease is a latent variable (WTP^*), observed only when consumers state their valuation. Consumers unwilling to pay could have a negative valuation (Thunström 2019; Laffan et al. 2021; Rafiq 2021; Sunstein 2021). For a consumer i, where $i = 1,2,\dots,N$, the WTP for label ease is expressed as:

[2] Calories Burned per Minute Walking, https://transportation.stanford.edu/sites/default/files/2016-07/caloriecalc_walk.pdf.
[3] The exchange rate of USD 1 = SR 3.75, https://www.sama.gov.sa/en-us/finexc/pages/currencyconverter.aspx.

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$$WTP_i = \begin{cases} WTP_i & if \ \ WTP_i^* > 0 \\ 0 & if \ \ WTP_i^* \leq 0 \end{cases}.$$

Table 1: Variables' Definitions

Variable	Definition	Dummy/ continuous
Label-Use	Use calorie information on nutritional labels, 1= Yes, 0= Sometime/No	Dummy
Milk-Laban	Choose milk/laban, 1= Yes, 0= No	
Soda	Choose soda, 1= Yes, 0= No	
Juice	Choose juice, 1= Yes, 0= No	
Energy-Drink	Choose energy-drink, 1= Yes, 0= No	
Diet	Following a diet (all sorts of diets, such as a low-calorie diet), 1= Yes, 0= No	
Collage	A college degree and above, 1= Yes, 0= No	
Female	1= Yes, 0= No	
High-Income	Monthly income exceeds SR 10,000 (USD 2,667), 1= Yes, 0= No	
Employed	1= Yes, 0= No	
Student	1= Yes, 0= No	
Married	1= Yes, 0= No	
Central Region	1= Yes, 0= No	
Saudi	1= Yes, 0= No	
WTP	Consumes WTP for label ease in (SR)	Continuous
Self-control	A food domain measure of self-control	
Age	Age in years	

To estimate WTP, stated values would be regressed on explanatory variables employing a limited dependent variable model, such as the Tobit model (Yu et al., 2014; Ran et al., 2017). However, the analysis revealed limitations in this approach. Among behavioral factors, consumers' WTP for label ease showed a positive correlation with dieting behavior (Diet), by 12%, with significant level of 5%. Among demographic factors, WTP correlated slightly with employment status

(Employed), by 11%, with a significant level of 10%. These weak correlations show that the Tobit model may not be a suitable fit. Further tests showed stronger relationships, with positive correlations between dieting behavior (Diet) and label use (Label-Use) by 33% (with a significant level of 1%) and with milk consumption (Milk) by 15% (with a significant level of 5%). On average, consumers following a diet reported higher WTP for label ease than non-dieters, as illustrated in Figure 1. The mean WTP was SR 0.37 among dieters compared to SR 0.23 among non-dieters, with a mean difference of SR 0.14, with a significant level of 5%. These relationships were used to refine the model's primary identification, illustrated in Figure 2, showing that consumers' WTP for label ease indirectly affects label use through dieting behavior.

To test the relationships, the bivariate probit model was employed as illustrated in Figure 2. This model estimates two potentially related binary outcomes (Cameron and Trivedi, 2005). These outcomes are latent variables written as follows:

$$Y_1^* = X_1'\beta_1 + \mathcal{E}_1$$
$$Y_2^* = X_2'\beta_2 + \mathcal{E}_2, \quad (1)$$

where Y denotes the outcome, X denotes the explanatory variables, and β is the estimated coefficients. The subscripts 1 and 2 are for the two outcomes. $\mathcal{E}_1$ and $\mathcal{E}_2$ are the errors, jointly normally distributed with mean 0, variances 1, and correlation ρ. A correlation between the errors means both outcomes are related. The two outcomes are observed as follows:

$$Y_1 = \begin{cases} 1 \ \ if \ Y_1^* > 0 \\ 0 \ \ if \ Y_1^* \leq 0 \end{cases} \text{ and}$$

$$Y_2 = \begin{cases} 1 \ \ if \ Y_2^* > 0 \\ 0 \ \ if \ Y_2^* \leq 0 \end{cases}.$$

3. Results

3.1. Descriptive Statistics

Tables 2 and 3 present the descriptive statistics for the categorical and continuous variables. Among the sample, 62% of consumers use calorie information on food packages, and 41% follow a diet. Regarding beverage choices, 42% selected milk/Laban, 22% soda, 29% juice, and 7% energy drinks. The demographic information of the participants shows that 71% of them have at least a college degree,

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44% are female, 59% are married, 72% are Saudi nationals, and 41% reside in the central region. Additionally, 26% of consumers report a monthly income exceeding SR 10,000 (USD 2,667). Participants' ages range from 18 to 74 years, with an average age of 33. The self-control measure ranges from 10 to 50, with a mean score of 31.

Figure 1: Mean WTP for Label Ease Based on Following a Diet

Figure 2: The Model

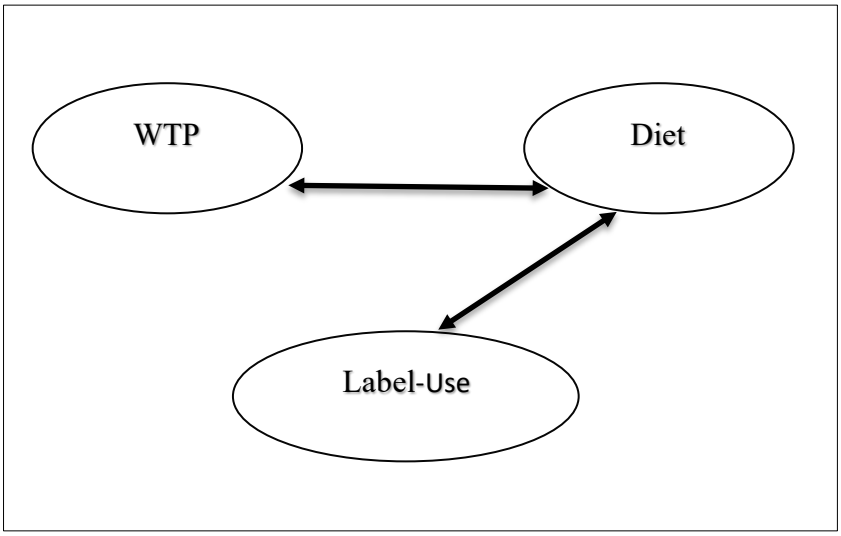

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Table 2: Descriptive Statistics for the Categorical Variables

Variables	Frequency	%
Yes	218	61.76
Milk/Laban	147	41.64
Soda	79	22.38
Juice	103	29.18
Energy-Drink	24	6.80
Diet	145	41.08
Collage	249	70.54
Female	155	43.91
Married	210	59.49
Total	353	100
High-Income	93	26.35
Employed	241	68.27
Student	34	9.63
Central Region	143	40.51
Saudi	254	71.95

N=353

Table 3: Descriptive Statistics for the Continuous Variables

Variable	Mean	S.D.	Min	Max
Self-control	30.61	6.26	10	50
Age (year)	32.77	9.23	18	74
WTP	0.28	0.57	0	7

N=353

On average, consumers are willing to pay SR 0.28 for label ease, with a significant level of 1%. The distribution of WTP is presented in Table 4. Approximately 29% of participants are unwilling to pay for label ease. Among the remaining participants, 25% are willing to pay SR 0.1, and 11% are willing to pay SR 0.15. Consumers indicating valuations of SR 0.5 and SR 0.75 consist of 12% and 8% of the sample, respectively. Only 3.4% responded to the open-ended question, reporting valuations exceeding SR 0.75, with a minimum WTP of SR 1 and a maximum of SR 7.

4. Econometrics Results

Table 5 presents the results of the bivariate probit model estimated with robust standard errors. The log-likelihood test is statistically significant at the 1% level,

indicating a good overall model fit. The correlation coefficient, ρ, is positive and equals 0.49, also significant at the 1% level. This confirms the appropriateness of simultaneously estimating the two outcomes: dieting behavior and label use.

Table 4: Consumers' WTP for Label Ease Distribution

WTP (SR)	Frequency	%
Unwilling to pay	101	28.61
0.1	85	24.08
0.15	40	11.33
0.2	27	7.65
0.35	16	4.53
0.5	44	12.46
0.75	28	7.93
1	1	0.28
2	7	1.98
3	2	0.57
3.75	1	0.28
7	1	0.28
Total	**353**	**100**

Dieting is positively associated with consumers' WTP for label ease (significant at 10%), the choice of milk/Laban (significant at 5%), and self-control (significant at 10%). High-income individuals are less likely to follow a diet (significant at 10%), while those residing in the central region are more likely to follow a diet (significant at 5%). Label use is positively associated with the selection of milk/Laban (significant at 10%). The likelihood of using labels decreases with age (significant at 5%) but increases among married consumers (significant at 1%). Additionally, educated consumers are more likely to use labels, and Saudis are more likely to use labels compared to other nationalities within the country.

5. Discussion

The qualitative analysis findings reveal consumers' endeavors to improve their dietary habits. A majority of consumers (62%) use calorie information on nutritional labels, and 71% of them prefer milk/Laban and juice over less healthy choices like soda or energy drinks. Also, more than a third of consumers reported that they are following a diet. These aspects of food consumption improve health outcomes. Even if the effects of these aspects could be reversed due to high obesity rates and related non-communicable diseases, it is plausible to claim that at-risk individuals are

actively working to improve their dietary behaviors. Supporting this, AlShehri and AlMarzooqi (2022) reported an increasing positive relationship between obesity status and attitudes toward calorie labels, while Bamansoor and Turkistani, (2024) reported higher nutritional label use among consumers with chronic diseases. Such efforts align with the SFDA's Health Food Strategy (2019), which aims to promote a healthy diet to improve health outcomes.

Table 5: The Results of the Bivariate Probit Model

Variables	Outcome 1: Diet			Outcome 2: Label_Use		
	Coefficient	SE	*p* Value	Coefficient	SE	*p* Value
WTP	0.271*	0.145	0.061	-0.011	0.124	0.926
Milk	0.372**	0.170	0.028	0.302*	0.178	0.090
Juice	0.102	0.183	0.578	-0.034	0.186	0.855
Self-control	0.018*	0.011	0.092	0.012	0.011	0.287
Age	0.002	0.008	0.83	-0.022**	0.009	0.017
High-income	-0.302*	0.166	0.068	-0.215	0.168	0.201
Female	-0.147	0.158	0.353	-0.153	0.162	0.343
Married	0.139	0.159	0.382	0.572***	0.165	0.001
College	0.113	0.162	0.484	0.393**	0.161	0.015
Employed	0.155	0.194	0.425	0.268	0.195	0.169
Student	0.209	0.286	0.466	0.423	0.291	0.146
Central Region	0.341**	0.144	0.018	0.097	0.149	0.515
Saudi	0.195	0.161	0.225	0.352**	0.164	0.031
Constant	-1.547***	0.486	0.001	-0.437	0.506	0.388

N=353

$\rho = 0.493$, $\chi^2(1) = 29.14$, *p* Value > χ^2 = (<0.001)

Log pseudo likelihood = -422.75, Wald $\chi^2(26) = 60.15$, *p* Value > χ^2 = 0.0002

*** *p<0.01,* ** *p<0.05,* * *p<0.1*

On average, consumers' WTP for label ease SR 0.28, representing a 9% premium. From a policy perspective, understanding consumers' WTP for label ease is essential as it helps determine the impact of nutritional information on consumer welfare (Rafiq, 2021; Sunstein, 2021; Thunström, 2019). However, aside from dieting, no significant correlations were observed with other expected behavioral factors, implying a stronger preference for label ease among dieters. This aligns with study findings of Giró-Candanedo et al. (2022), who reported that dieters are more frequent users of nutritional labels, have higher levels of nutritional knowledge, and show greater interest in weight control and dietary components.

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Self-control is marginally significant and positively related to dieting but not with label use, suggesting that committing to a diet may be a prerequisite for consistently using labels. High-income individuals were less likely to follow a diet compared to those with low incomes. This aligns with study findings of Binkley (2010) and Binkley and Golub (2011), which reported that low-income individuals are more likely to make unhealthier food choices, making dieting a greater requirement for them. In Saudi Arabia, food cost plays a less important role in this relationship, as nutritious food tends to cost less than unhealthy choices (Gosadi et al., 2016).

Based on the study results, it is recommended to mandate the provision of nutritional information per serving for one-serving food packages instead of per 100 ml or gm. This approach aligns with the needs of at least 41% of consumers who follow a diet, contributing to achieving their dietary goals, such as weight loss (Alkhunein et al., 2024). Moreover, unlike serving-based nutritional information, companies could strategically choose to display information per 100 ml or gm on unhealthy products, exploiting the difficulty consumers face in calculating total nutritional contents per serving. This practice warrants further research into manufacturers' behaviors regarding nutritional information display styles. Another key policy recommendation is to increase awareness and education about using nutritional labels among younger individuals, addressing the observed negative relationship between age and label use.

This study has five limitations. First, the WTP question concentrates on store-bought cold beverages, such as milk/Laban, soda, juice, and energy drinks, so it is not clear to what raising uncertainty about the extent to which the findings can be generalized to other types of one-serving food packages or to online food purchases (Alfawzan and Aljarallah, 2020; Shin et al., 2023; Alkhunein et al., 2024). Second, the hypothetical scenario considered a product sized at 275 ml, yet smaller packages under 100 ml or gm, such as chocolate pieces, may impose different challenges and have different economic valuations. Third, while the results support mandating calorie-per-serving labeling on small-size food packages, further economic evaluation is still required to ensure consumer welfare improvement, as providing information can sometimes lead to disutility for consumers (Allcott and Kessler, 2019; Thunström, 2019; Rafiq, 2021; Sunstein, 2021). Fourth, the analysis did not consider the potential reduction in consumers' need for label ease with repeated

purchases. Finally, any implication of changing nutritional label regulations should consider implications for international food trade (Boza et al., 2019), especially given the high import value of prepared food, which reached SR 36 billion (USD 9.6 billion) in 2023 (The General Authority for Statistics, 2024b). Future research should consider these limitations.

6. Conclusion

This study estimates consumers' WTP for label ease in Saudi Arabia. The analysis examines the varying levels of label ease provided by the two styles of nutritional information display mandated by the SFDA for one-serving food packages. The first style provides information per serving, while the second displays it per 100 ml or gm. These styles differ in the cognitive effort required to determine the total nutritional content of a serving. Disclosing nutritional information per serving is straightforward, whereas reading it per 100 ml or gm could require additional calculations.

In theory, nutritional label policies aim to help consumers make healthier food choices, thereby contributing to the reduction of obesity and other related non-communicable diseases. However, difficulties in using labels can decrease their effectiveness and potentially discourage label use. This analysis employs the stated preference method, beginning with an explanation of the following two styles of nutritional label disclosure: information per serving and per 100 ml or gm. Consumers were then asked to imagine a policy mandating the provision of nutritional information per serving on one-serving food packages. For WTP elicitation, a payment card was used, followed by an open-ended question to capture valuations exceeding the payment card options.

The mean WTP for label ease is 9% above the food product price. The results show that dieters particularly value label ease, as it increases the probability of reading labels. Consumers following a diet expressed a stronger preference for label ease compared to non-dieters. These findings support the recommendation to mandate the display of nutritional information per serving on one-serving food packages.

Conflict of interest:
The author declares that there is no conflict of interest.

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