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The Awareness of Adult Consumers about Added Sugars in Food Products in Libya

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Abstract

Reducing sugar intake has become a focus of many national and international public health policies due to the association between added sugar (AS) intake and the risk of obesity and diabetes. The World Health Organization (WHO) strongly recommended in 2015 that ASs be reduced to 10% of total dietary energy (TE) and 5% of TE for health benefits. This study aims to determine the level of consumer awareness of AS and to demonstrate their ability to classify AS correctly, their awareness of the WHO guidelines regarding the amount of sugar consumed per day, the extent to which the updated food labelling can help manage sugar intake and facilitate healthy food choices, and to examine the influence of gender, age, education level and city on consumer awareness of AS. The study was conducted using an electronic questionnaire administered via social networking sites, gathering responses from 1607 consumers across different cities. The questionnaire covered four main axes: personal information, the importance and use of the Nutrition Facts Label, awareness of the WHO's recommendation, and the ability to correctly classify different types of sugars. Statistical analysis was performed using the Chi-Square test and analysis of variance (ANOVA) at a 5% significance level using the SPSS program. The results of the questionnaire in the sugar classification axis showed that only 23.31% of consumers were able to correctly classify 8 ASs from a list of 10 different sugars, and that the educational level has no effect on consumers' awareness of the

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classification of ASs. The results of the WHO awareness axis showed that 48.81% of consumers were not aware of the WHO guidelines for reducing ASs, while 26.18% of consumers were not aware of the existence of the WHO in the first place. The results of the nutrition facts label use axis showed that 22.42% of consumers consider the nutrition facts label a reliable source, while 28.15% consider the food label an unreliable source. We conclude that the level of consumer awareness of ASs in Libya is very low, even among consumers with a university education and a higher diploma. Accordingly, awareness and education campaigns should be intensified and focused on through various media outlets about the importance of ASs to preserve the health and safety of consumers in Libya.

Keywords: Added sugars, nutritional awareness, obesity, diabetes, nutritional data label.

وعي المستهلكين البالغين حول السكريات المضافة في المنتجات الغذائية داخل ليبيا

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الملخص:

أصبح الحد من تناول السكريات محط اهتمام العديد من سياسات الصحة العامة الوطنية والدولية نظرًا للعلاقة بين السكريات المضافة Added Sugars (ASs) وخطر الإصابة بالسمنة وداء السكري. فقد أوصت بشدة منظمة الصحة العالمية World Health Organization (WHO) في عام 2015 بتقليل السكريات المضافة إلى 10٪ من إجمالي الطاقة الغذائية Total Dietary Energy (TE) وبتخفيضها إلى 5٪ من TE لتحقيق الفوائد الصحية. تهدف هذه الدراسة إلى تحديد مستوى وعي المستهلكين بالسكر المضاف، وإثبات قدرتهم على تصنيفه بشكل صحيح، ومعرفتهم بإرشادات منظمة الصحة العالمية بشأن كمية السكر المستهلكة يوميًا، ومدى مساهمة ملصقات الطعام المحدثة في

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إدارة استهلاك السكر وتسهيل اختيارات الطعام الصحية، ودراسة تأثير الجنس والعمر والمستوى التعليمي والمدينة على وعي المستهلك بالسكر المضاف. أُجريت الدراسة باستخدام استبيان إلكتروني أُجري عبر مواقع التواصل الاجتماعي، وجمعت الاجابات من 1607 مستهلكين من مدن مختلفة. غطى الاستبيان أربعة محاور رئيسية: المعلومات الشخصية، وأهمية واستخدام ملصق المعلومات الغذائية، والوعي بتوصيات منظمة الصحة العالمية، والقدرة على تصنيف أنواع مختلفة من السكريات بشكل صحيح. اجري التحليل الإحصائي باستخدام اختبار مربع كاي(Chi-Square) وتحليل التباين (ANOVA) عند مستوى معنوية 5٪ باستخدام برنامجSPSS . أظهرت نتائج الاستبيان في محور تصنيف السكر أن 23.31٪ فقط من المستهلكين كانوا قادرين على تصنيف 8 ASs بشكل صحيح من قائمة تضم 10 أنواع مختلفة من السكريات، وأن المستوى التعليمي ليس له تأثير على وعي المستهلكين بتصنيف السكريات المضافة. أظهرت نتائج محور الوعي لمنظمة الصحة العالمية أن 48.81٪ من المستهلكين لم يكونوا على دراية بإرشادات منظمة الصحة العالمية لتقليل ASs، بينما لم يكن 26.18٪ من المستهلكين على دراية بوجود منظمة الصحة العالمية في المقام الأول. أظهرت نتائج محور استخدام بطاقة الحقائق الغذائية أن 22.42٪ من المستهلكين يعتبرون بطاقة الحقائق الغذائية مصدرًا موثوقًا به، بينما اعتبر 28.15٪ البطاقة الغذائية مصدرًا غير موثوق به. نستنتج أن مستوى وعي المستهلك بـ ASs في ليبيا منخفض جدًا، حتى بين المستهلكين الحاصلين على تعليم جامعي ودبلوم أعلى. وعليه، ينبغي تكثيف حملات التوعية والتثقيف، عبر وسائل الإعلام المختلفة، والتركيز على أهمية السكريات المضافة للحفاظ على صحة وسلامة المستهلكين في ليبيا.

الكلمات المفتاحية: السكريات المضافة، الوعي الغذائي، السمنة، داء السكري، بطاقة الحقائق الغذائية.

Introduction:

The term ‘added sugars’ refers to sugars and syrups added to foods and beverages by the manufacturer, cook, or consumer, as well as natural sugars that have been added to foods such as honey, fruit juices, and fruit juice concentrates (Cabrera Escobar, *et.al.*, 2012; Amarra *et. al.*, 2016). Food labels on products indicate the presence

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of added sugars. Understanding the different terms used to describe added sugars can help consumers avoid food products rich in added sugars. Therefore, it is important to evaluate consumer knowledge about the terms related to added sugars found on food labels (Sudersanadas *et. al.*, 2022). Excessive intake of added sugars is a concern, as it is linked to several health problems such as obesity, diabetes, depression, and dental disease (Rippe and Angelopoulos, 2016; Hu, *et. al.*, 2019; Gillespie, *et. al.*, 2023). Obesity is a major and recognized risk factor for non-communicable diseases such as heart disease, stroke, cancer, chronic respiratory diseases, and type 2 diabetes, which are leading diseases caused by obesity and are also preventable (SACN, 2016). Overconsumption of added sugars is a significant contributor to the rising pandemics of obesity, prediabetes, and type 2 diabetes (Warshaw and Edelman, 2021). The World Health Organization reported in 2016 that 1.9 billion adults worldwide were overweight, of whom more than 650 million were obese, and in 2019, it reported that 38.2 million children under the age of five were overweight or obese, and the prevalence of obesity doubled between 2013 and 2016. Between 1975 and 2016 AD worldwide, almost three times (WHO, 2016). The Global Burden of Disease Collaborative Network issued in 2016 stating that 65.7% of adults in Libya are overweight or obese, of whom 32.5% are obese. The network also issued in 2017 that 8% of deaths worldwide are attributed to obesity, which is responsible for 4.7 million premature deaths each year, and that the death rate due to obesity in Libya is 14.933 per 100,000 deaths (18.67%). The network issued in 2017 AD that 10.43% of adults aged 20-79 years suffer from diabetes in Libya. Diabetes currently uses about 10% of the national health service budget and is expected to rise to 17% by 2035/2036 (WHO, 2016). Sugar is increasingly linked to the obesity epidemic, and evidence of a link between added sugars and obesity risk has prompted public health agencies to develop strategies to enable consumers to manage their intake of added sugars. The USDA began using the term added sugars (AS) in 2000 to help consumers identify foods with added energy and reduced nutrient content (Lustig, 2013). The American Heart Association (AHA) concluded in its 2009 Scientific Statement that weight gain over the past 30 years is partly related to increased intake of added sugars. The 2015 Scientific Report of the Nutrition Scientific Advisory Committee

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(DGAC) recommended a maximum of 10% of total daily calories from AS. It supported changes to nutrition labels and campaigns to increase consumer understanding of added sugars (DGAC, 2015). In 2015, the World Health Organization (WHO) strongly recommended reducing added sugars to 10% of total dietary energy (TE) and recommended a conditional reduction to 5% of TE to achieve health benefits (WHO, 2015). The American Heart Association (AHA) has recommended a significant reduction in added sugars to help slow the epidemics of obesity and heart disease. It suggests limiting added sugars to no more than 100 calories per day (about 6 teaspoons or 24 grams of sugar) for most women and no more than 150 calories per day (about 9 teaspoons or 36 grams of sugar) for most men (Rippe and Angelopoulos, 2016). The Saudi Food and Drug Authority (SFDA) agreed and published the World Health Organization's recommendation that individual sugar consumption should not exceed 10% of the total energy consumed per person per day, which is equivalent to 12 teaspoons (48) grams of sugar (SFDA, 2021). In 2016, the US Food and Drug Administration (FDA) updated the Nutrition Facts label requirements to include "added sugars" and "total sugars." The goal of introducing the Nutrition Facts label for added sugars was to improve the label information for the consumer and facilitate healthy food choices. Manufacturers with annual sales of $10 million or more were required to update their nutritional labels by January 1, 2020; Manufacturers with less than $10 million in annual sales are required to update their nutrition labels by January 1, 2021. The Nutrition Facts Label (NFL) has emerged as an effective tool to encourage healthy eating and influence consumer behaviour at the point of purchase. The updated label is now bolded with larger text size and a sugar section that includes "Total Sugars" and a line listing "Added Sugars." The updated Nutrition Facts Label (NFL) also provides the % Daily Value for added sugars (calculated based on 50 grams of sugar); thus, the updated NFL provides consumers with the information they need to differentiate between natural and added sugars via the Nutrition Facts Label (FAD, 2016). The updated Nutrition Facts Label effectively establishes a relationship between using sugar information on the label and reducing the intake of foods and beverages high in added sugars. However, the challenge to consumer understanding is the multitude of sugar terms

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on ingredient lists on nutrition labels, the wide variation in the forms and naming of sugars on the Nutrition Facts Label, and the general lack of knowledge about dietary sugar recommendations (Laquatra, *et al.,* 2015). The rising rates of obesity and type 2 diabetes worldwide, and particularly in Libya (Our World in Data), are linked to the excessive consumption of added sugars in processed, high-sugar food products such as soft drinks, juices, and cakes, which are loaded with fructose, a type of simple sugar. Fructose consumption increases hunger and food cravings more than glucose, the main type of sugar found in starchy foods. Knowing the level of awareness of Libyan consumers regarding added sugars in food products, so that we can develop strategies that make it easier for consumers to reduce their sugar intake and manage their intake of added sugars. Due to the lack of local research, studies and surveys on added sugars in food products and the consumer's awareness of them and the importance of knowing the difference between added sugars, natural sugar and artificial sweeteners, this study aims to determine the awareness and understanding of the consumer or shopper about added sugars in the State of Libya on food products in the Libyan market and to determine awareness of some other influential factors such as: educational level, gender (males and females), age and city, as well as consumer awareness of the difference between added sugars, natural sugars and artificial sweeteners and the terms related to sugar in the food labels such as sugar-free, no added sugar, low sugar, less sugar, etc., as well as consumer awareness of the World Health Organization's guidelines regarding sugar intake.

Materials and Methods:

Study sample and electronic questionnaire:

The questions included in the electronic questionnaire were judged by 9 judges from faculty members specialized in the field of food science and technology/Faculty of Agriculture/University of Tripoli. The survey questionnaire test was conducted three times online via the electronic platform (Q Survey), and the sample size included 30 respondents each time, using the Cronbach's alpha test until we obtained the final questionnaire form with a reliability rate of 91% during March 2021.

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Questionnaire distribution:

The questionnaire was conducted as an online survey via the electronic platform QSurvey. The questionnaires were distributed electronically on various social media networks using a sponsored advertisement about Libya for 5 days in March 2021. 1630 electronic questionnaires were answered, of which 1607 questionnaires were fully answered out of the total number of questionnaires.

Questionnaire Questions:

The questionnaire included four axes. The first axis included demographic information (gender, age, educational level, and city). The second axis included questions about the nutritional data panel and understanding the data on the panel. The third axis included questions about awareness of the World Health Organization's recommendations. The fourth axis included questions about the ability to classify sugars correctly.

Statistical Analysis:

The statistical analysis of the data obtained through the questionnaires was conducted first using the Cronbach's Alpha program to test the reliability, and the reliability rate of the questionnaire was 91%. Then, the Statistical Package for Social Sciences (SPSS) program was used. The Chi-Square test was then conducted for the purpose of using frequencies and testing variance (ANOVA) at a significance level of 5% to determine the relationship between the awareness of adult consumers about added sugars in food products in Libya and the variables (gender, age, educational level and city of consumers in the study sample).

Results and Discussion:

Demographic Information Axis:

Number of males and females in the study sample:

The electronic study questionnaires were distributed via social media networks, and it was found that the number of males was 689 respondents and females was 819 respondents, i.e., 42.87% and 57.12%, respectively, as shown in Table No. (1).

Age groups in the study sample:

The study included 5 different age groups ranging in age from 18 years to over 65 years, and through the results, the percentage of each age group participating in the study sample became clear. The

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highest percentage was for the category (18-25) and (25-34), i.e. 81.89% and 15.07% respectively, and the lowest age group was (35-44), (45-64) and (65+), i.e. 2.24%, 0.68% and 0.12% respectively, which represents the lowest age groups between the sexes on the electronic questionnaire, as shown in Table No. (1).

Educational level in the study sample:

The questionnaire also included a question about the educational level and included 4 different educational levels (basic education, intermediate education, higher education and postgraduate studies) and the percentage of respondents from each level was (4.98%, 18.34%, 72.90% and 3.74%) respectively and it became clear that the highest level of responding education was the higher level and the lowest were postgraduate studies and basic education, as shown in Table No. (1).

City in the study sample:

The questionnaire included a question about the city, and the cities that responded most to the questionnaire were (Tripoli, Misurata, Zawiya, and Benghazi), i.e. at a rate of (69%, 4.23%, 4.17% and 2.05%), respectively, and it became clear from the percentages that the city of Tripoli responded most to the study.

Table 1. The Chi-Square test and the ANOVA test at a significance level of 5% for the demographic information axis questions

Variable	Category	Total		P-value
		%	N	
		100	1607	
Gender	Female	57.12	819	0.001
	Male	42.87	689	
Age	(24-18)	81.89	1316	0.001
	(34-25)	15.07	242	
	(44-35)	2.24	36	
	(64-45)	0.68	11	
	(65+)	0.12	2	
Educational level	Basic Education	4.98	80	0.001
	Intermediate Education	18.34	296	
	Higher Education	72.90	1170	
	Postgraduate Studies	3.74	60	

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Axis of importance and understanding of the nutritional data panel:

Participants were asked about the importance of the nutritional data panel, understanding the data on the nutritional data panel, and whether the nutritional data panel is a reliable source, as shown in Figure 1. It was noted from the answers that the percentage of participants who answered "I do not know" about the importance of the nutritional data panel is 39.8%, of whom 23.2% are females and 16.6% are males, followed by those who disagreed with a percentage of 32.4%, of whom 4.2% strongly disagreed, that is, two-thirds of the participants do not think that the nutritional data panel is a reliable source. The percentage of those who agreed that the nutritional data panel is a reliable source was 27.7%, of whom 5.2% strongly agreed, and there were no significant differences between sexes ($p=0.468$) or the educational level ($p=0.189$). There were significant differences for age ($p=0.004$) at a significance level of 5%. As noted in Figure 1, the percentage of those who disagreed that constantly looking at the nutritional data label on food packages is beneficial was 2.1%, while the majority of participants agreed to constantly looking at the nutritional data label at a rate of 83.3%, of whom 19.4% strongly agreed, with females representing 48.2% and males 35.2%. This was confirmed by the results of Tierney *et al.*, (2017) that 84% of the respondents in the questionnaire looked at the nutritional data label constantly. In contrast, the study by Grunert *et al.*, (2010) examined the use of nutrition information on food labels and the understanding of guideline daily amount (GDA) front-of-pack nutrition labels in six European countries. The findings revealed that only 16.8% of shoppers actively sought nutrition information on labels across six product categories. The nutrition grid (table or list), GDA labels, and the ingredients list were the primary sources consulted, with calories, fat, and sugar being the most frequently sought information.

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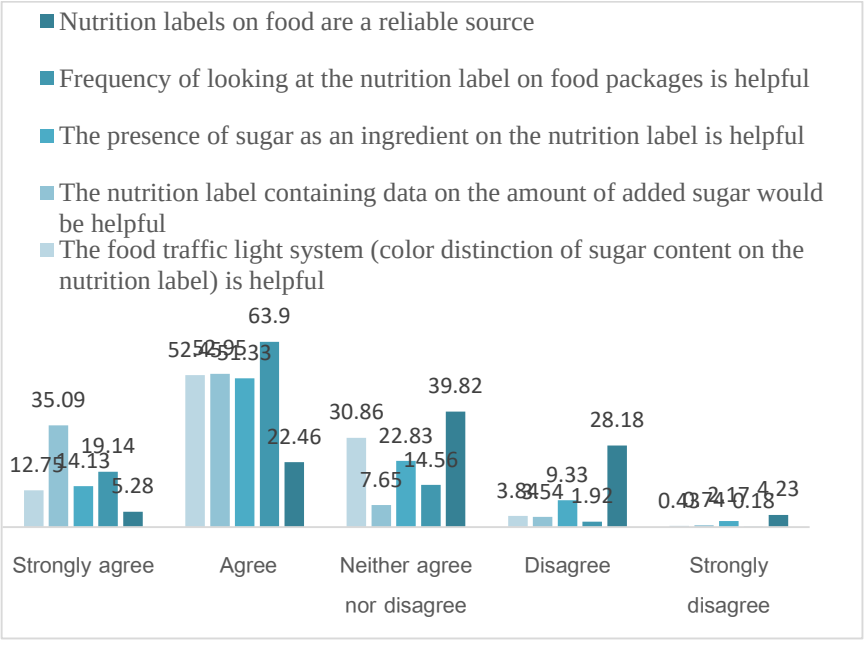

Figure 1. The importance and understanding of the nutritional data panel.

As for the question of whether the presence of sugar as an ingredient in the nutritional data panel is considered useful, as shown in Figure (1), it was found that 65.6% of the participants agreed, where 14.31% of them strongly agreed, 36.52% of them were females and 29.11% were males, and there were significant differences for both genders (p=0.001) and educational level (p=0.003). Also, in the question of whether the nutritional data panel would contain data on the amount of added sugar, the majority of the participants agreed at a rate of 88% (35% of them strongly agreed), where the percentage of females was 50.46% and males 37.58%, while 4.28% of the participants disagreed, and there were no significant differences between the genders, unlike the educational level, where there were significantly differences between the educational levels (p=0.00). While the participants' answers to the question, "Is the food data panel considered a reliable source?" were 39.8% who did not know about the food data panel at all, and 32.4% who did not agree with the reliability of the food data panel on the back of food product packages, (Figure 1). When asked about placing nutritional traffic lights for sugar content on the nutritional data panel in Figure 1, the majority of participants, 65.2%

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(37.58% females and 27.62% males), answered that they agreed that the nutritional traffic light system, i.e. the colour coding of sugar content, is useful, and 12.75% of them strongly agreed. It was also noted that 3.9% of participants did not agree that placing traffic lights for sugar content could be useful, while 30.81% of them did not know about the existence of the traffic light system in the first place. There were no significant differences between genders and educational level, while there were significant differences in age ($p=0.001$). The results of this study were consistent with the results of Tierney *et al.*, (2017) regarding awareness of food traffic signs, as 81% agreed that placing food traffic signs for sugar content on food labels is beneficial (34% of whom strongly agreed), while 7% of participants were not aware of food traffic signs at all. A qualitative study on consumer perceptions and use of traffic light food labelling in Ecuador found that focus group participants were aware of the traffic light label and understood the information it conveyed. However, not all participants changed their attitudes or practices regarding the purchase and consumption of processed foods. Children, adolescents, and adult males reported using the information infrequently, while adolescents interested in health and adult women were more likely to use the label when selecting products (Freire *et. al.*, 2017). Scapin *et al.*, (2020) also indicated that traffic light labels and warning labels were the most effective in increasing consumers' understanding of the sugar content of packaged foods. Participants were also asked to identify the item they thought was the most important to consider to stay healthy, and which they usually look at in the nutritional data panel, as shown in Figure 2. Participants were also asked to nominate the component they believed was most important to consider for maintaining health. The answers were, respectively, all of the previous items at 35.71%, calories 33.6%, no item 11.63%, total sugar 5.60%, total carbohydrates at 4.97%, saturated fat 2.98%, hydrogenated fat 2.42%, total fat 2.24%, and salt 0.74%. There were highly significant differences in the answers for both genders ($p = 0.000$) between males and females. One-third of participants considered all components important for health, and the other third considered calories most important for maintaining health. These could suggest that the participants in the current study prioritized all of the previous items (35.71%) as the item of the most important, followed

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by calories (33.6%) in whatever they bought from the market, but were particularly not careful with the intake of sugars. When comparing these results, Tierney *et al.,* (2017) showed that, the most important items that they usually look at in the nutritional data panel to stay healthy are saturated fat 28%, total sugar 23%, calories 12%, and fat 11%. Adjei *et al.,* (2024) stated that about 28.1 % of the respondents representing the majority chose Sugar, followed by Calories (25 %) and fat (20.8 %) as the items on the food label that interested them during the purchase of food. Nonetheless, the items most important to the respondents were calories (37.5 %), sugar (19.8 %), and fat (12.5 %). Prada *et. al.,* (2020) reported that sugar was deemed the most important nutrient to attend to to stay healthy. In contrast, both caloric content and proteins were deemed the least important nutrients. In a study conducted by Washi (2012) on consumers of groceries in Al Ain, United Arab Emirates, participants were asked about their preferences for information on food labels when considering the purchase of pre-packaged foods. More than half of the respondents (58.8%) expressed a desire to see comprehensive information, including the manufacturer's details, expiry dates, validity dates, nutritive value, health claims, and health warnings. In contrast, 11.4% indicated that they only wanted to see health claims and health warnings, while 9.2% focused solely on the nutritional value. The findings highlight the importance consumers place on the inclusion of expiry and validity dates on food labels, reflecting their concerns about the health risks associated with consuming expired products, rather than their interest in nutritional values. Participants were asked whether there was a difference between sugar naturally present in food ingredients and sugar added to food products, as shown in **Figure 2.**

The majority of participants responded in agreement with a percentage of 85.93% (50.8% females and 35% males), of whom 32.36% strongly agreed, while 11.76% did not know the difference between added sugar and sugar naturally present in food ingredients. In contrast, 2.3% of them disagreed (1.1% females and 1.1% males).

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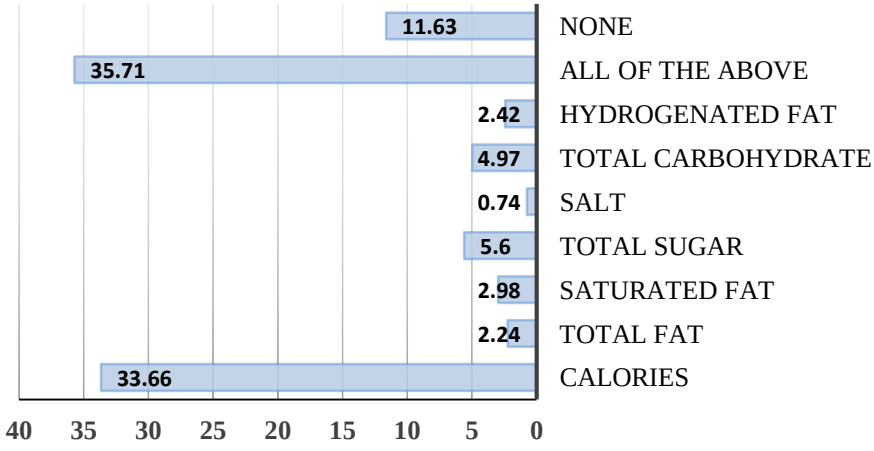

Figure 2. Nutrition panel items of importance to consumers.

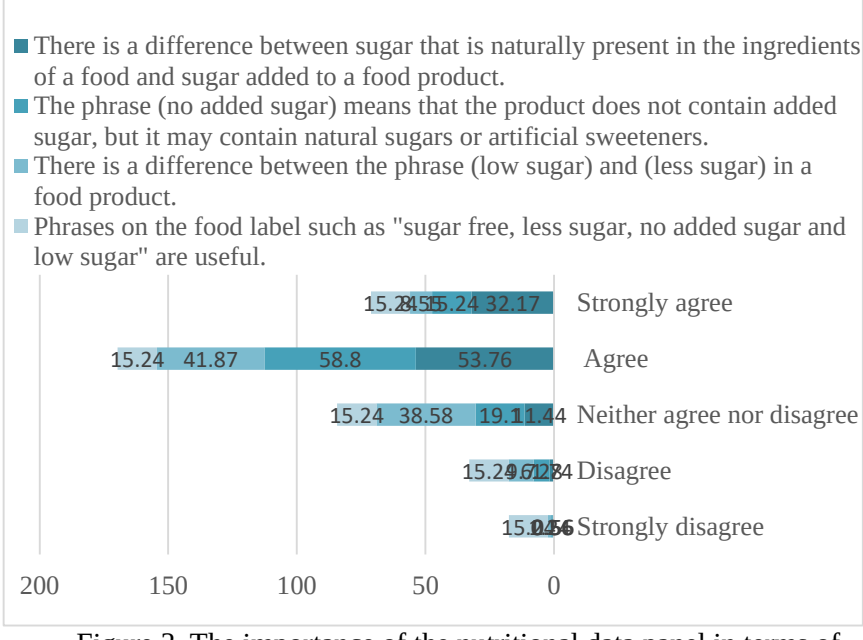

Figure 3. The importance of the nutritional data panel in terms of sugar and phrases related to added sugar.

There were significant differences between genders (p=0.001) and educational level (p=0.003) at a significance level of 5%, while there were no significant differences with regard to age. In the question, the phrase “without added sugar” means that the product does not contain added sugar, but it may contain natural sugars or

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artificial sweeteners, as shown in Figure 3. The majority of participants agreed, with a percentage of 74.04% (43.5% females and 30.4% males), of whom 15.24% strongly agreed, while 19.10% answered "I don't know" (9.8% females and 9.2% males), while only 6.84% answered "I do not agree" that the product contains natural sugar or artificial sweetener in the presence of added sugar. There were no significant differences between genders, age, and educational level. It is shown in Figure 3. in the question, "There is a difference between the phrase "low sugar" and " less sugar" in the food product". The percentage of participants who agreed was 50.4% (27.1% females and 23.3% males), of whom 8.5% strongly agreed. In contrast, 38.5% (23.7% females and 14.8% males) answered that they do not know the difference between the phrases on the nutritional data label, while 10.9% (6.2% females and 4.6% males) of the participants did not agree that there is a difference between the phrase "low sugar" and "less sugar" in the food product. As shown by the statistical analysis, there are no significant differences between gender, educational level, and age. Through the figure (3) of the question, the phrases on the nutritional data panel, such as "sugar-free, less sugar, no added sugar and low sugar" are useful. The results showed that 85.2% (48.3% females and 36.83% males) agreed, of whom 30.6% strongly agreed, and in contrast, 8% disagreed, of whom 2.7% strongly disagreed, while 6.2% answered "I don't know". There were no statistically significant differences for gender, age, and educational level. When participants were asked to improve the nutritional data panel in terms of sugar in what would you like in Figure (4), the answer to all of the above received the highest percentage of 34.28%, followed by putting the guideline amount of sugar intake per day at 17.92%, followed by simplifying the information and putting graphs of the sugar content in the form of teaspoons at 14.87%, then warning signs and specifying the type and name of sugar at 10.95%, followed by a larger font at 6.53%, then putting traffic lights for sugar at 3.73% and finally less information at 1.36%, as there were significant differences between the females and males ($p=0.011$) while, there were no significant differences in age ($p=0.395$) and educational level ($p=0.113$). From our findings, most of the participants have no idea about the traffic light system. 14.87% of participants in our study expressed that illustrating sugar content in terms of teaspoons would be

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particularly effective. This method not only enhances clarity but also alignment well with the language of the WHO guidelines, making it both straightforward and impactful.

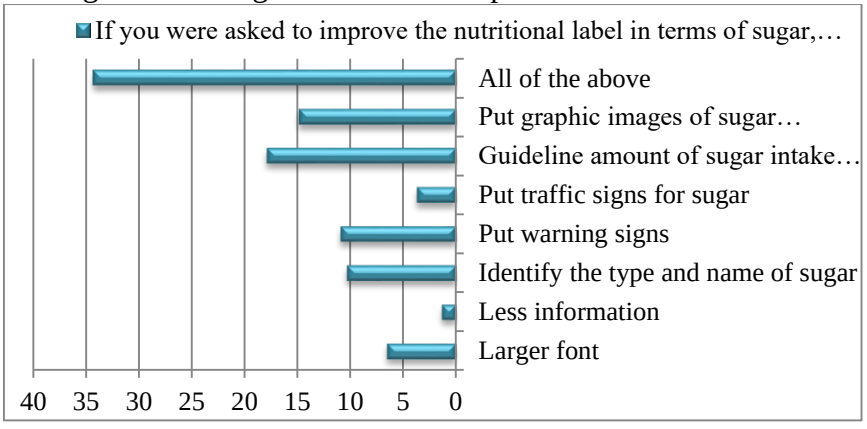

Figure 4. Improves the nutritional data panel in terms of sugar.

These findings align with previous research, which reveals that consumers often find graphical representations invaluable in navigating their choices for healthier food options (Tierney *et al.*, 2017; Adjei *et al.*, 2024). When participants were asked whether the presence of sugar as an ingredient in the nutritional data label behind the food product package is beneficial, 22.83% did not know that sugar was present in the nutritional data label. 11.5% disagreed that the presence of sugar would be beneficial. As for the question of whether placing traffic lights for sugar content could be beneficial, the majority of participants answered 56.81% helpful, while 30.81% disagreed and 3.95% did not know about the colour coding of dietary sugar at all. When comparing these results with the results of the study by Tierney *et al.*, (2017), the answers were as follows: 25% of them wanted a larger font and less information, 15% requested to place a colour coding for the sugar content in the food product (traffic lights for sugar), while 13% wanted to specify the type and name of the sugar and 8% wanted to simplify the information and put graphs of the sugar content in the form of teaspoons. Freire and others (2017) have concluded that the traffic light label is an effective way to convey complex information. Its potential contribution to reducing consumption of products with high levels of fat, sugar and salt could be enhanced by promoting healthy diets among consumers who have not changed purchasing

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and consumption habits, by placing the label on front panels and by monitoring the production and marketing of processed foods. The traffic light system is widely utilized by researchers due to its simplicity, clarity, and ease of understanding (Kunz *et al.,* 2020). This system can help consumers manage their sugar intake and raise awareness about making healthier choices while shopping (Sonnenberg *et. al.,* 2013).

Awareness axis of the World Health Organization recommendations:

Participants were asked in the WHO awareness axis, and the question was as follows: Do you know the WHO guidelines and recommendations for added sugars as shown in Figure (5), the majority of participants answered that they do not know the WHO guidelines and recommendations for added sugars at a rate of 48.72% (27.69% females and 21.03% males), as awareness did not differ between the both genders and there was no significance for gender (p=0.962). While 26.13% (14.9% females and 11.20% males) answered that they did not know about the existence of the World Health Organization at all, including those with higher education (17.48% females and males), despite the presence of significant differences (p=0.001) between educational levels, in contrast, 25.14% (14.49% females and 10.64% males) of the participants answered yes, meaning that they are aware of the World Health Organization's guidelines and recommendations regarding added sugars. In comparison to the findings of Sudersanadas *et. al.,* (2022), respondents displayed lower awareness of the WHO recommendations regarding added sugars. Specifically, only 15.51% of participants correctly identified the WHO's recommendations. Additionally, 17.39% of respondents knew the recommendation to reduce added sugar intake. Tierney *et al.,* (2017) found that approximately two-thirds (65%) of participants were unaware of the revised guidelines from the World Health Organization (WHO). Awareness was particularly low among younger individuals and those with little interest in nutrition. There were no significant differences in awareness based on gender (Males vs. Females: 38% vs. 27%, p = 0.061) or education level (High school vs. College vs. Degree vs. Postgraduate: 33% vs. 39% vs. 29% vs. 40%, p = 0.296). However, significant differences were observed based on age (18–24 years vs. 25–34 years vs. 35–44 years

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vs. 45–54 years vs. 55–64 years vs. 65+ years: 27% vs. 25% vs. 34% vs. 36% vs. 42% vs. 72%, $p < 0.001$) and interest in nutrition (Very interested vs. Interested vs. Not very/Not at all interested: 46% vs. 32% vs. 24%, $p = 0.004$).

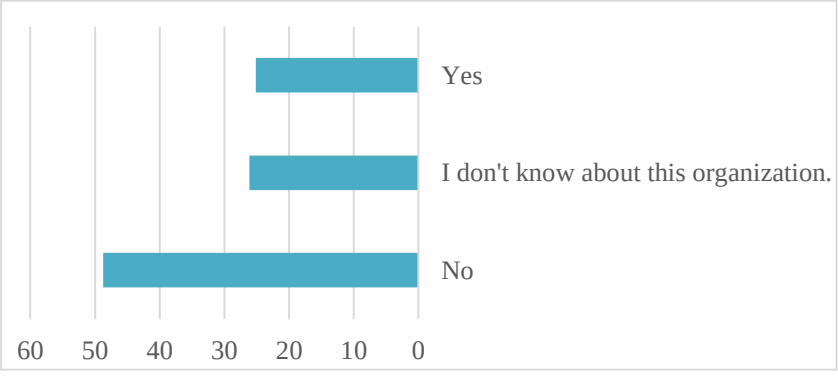

Figure 5. Awareness of the World Health Organization's guidelines and recommendations regarding added sugars.

Adjei, *et al.*, (2024) contacted the majority (62.5 %) of staff (consumers) of the University of Energy and Natural Resources, Ghana reported that they were not aware of the World Health Organization (WHO) recommendations for sugar reduction, whereas 37.5 % were aware of the WHO recommendation for the reduction of added sugars to 5 % daily intake for additional health benefits. There was no significant difference ($p > 0.05$) for the awareness of the WHO recommendations with regard to gender of respondents ($p = 0.278$), age ($p = 0.959$), level of education ($p = 0.888$) and staff category ($p = 0.944$). Knowledge of the WHO guidelines and recommendations for reducing sugar intake is not enough to reduce sugar intake (Kessler, 2014; Tierney *et al.*, 2017; Prada *et. al.*, 2020). Participants were presented with a summary of the WHO guidelines and were asked to rate the ease of the recommendation as shown in Figure 6. 46.72% of participants (25.02% females and 21.7% males) reported that they agreed that the recommendation was easy to understand, 6.09% of them strongly agreed, while 21.56% of participants did not know whether it was easy or difficult to implement. 31.61% (19.4% females and 12.19% males) of participants reported that the recommendation was difficult to implement, and 3.36% of them strongly disagreed

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that the recommendation was easy to implement. There were significant differences between genders (p=0.002), educational level (p=0.002), but unlike age (p=0.209), there were no significant differences between age groups. The results agree relatively with the research conducted by Adjei *et al.*, (2024), according to consumer responses regarding the ease of monitoring their total sugar intake based on WHO guidelines for current labelling, 33.7% found it fairly easy, 22.1% said it was not very easy, 20% considered it very easy, and 12.6% stated it was not easy at all. The findings did not align with the research conducted by Tierney *et al.*, (2017), in which only 3% of respondents reported that implementing the recommendations would be "very easy." In contrast, a majority believed it would either be "not very easy" (45%) or "not easy at all" (25%). Furthermore, there were no significant differences in the percentage of respondents selecting "very easy" based on gender or education.

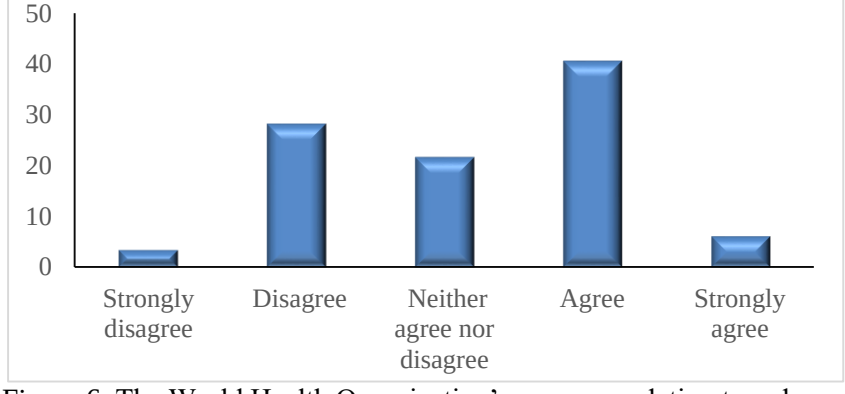

Figure 6. The World Health Organization's recommendation to reduce intake of added sugars is easy to implement based on the updated nutritional data label.

The axis of the ability to correctly classify sugars:

Consumers' knowledge of sugars and sweeteners was an important aim to explore participants' ability to identify added sugars on food labels in food products. Participants were asked to classify each of 10 commonly used food ingredients as natural sugar, artificial sweetener, or added sugar, as shown in Figure (7). All the ingredients presented were classified as either added sugar or artificial sweetener according to the WHO guidelines, but many

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participants classified them as natural sugars. For example, when honey was used as an ingredient to sweeten the product, it was incorrectly classified as natural sugar by 77% (45.9% females and 31% males). Sugarcane juice was also incorrectly classified as natural sugar by 55.8% (31% females and 24% males), while 41% and 63% of participants were unable to correctly classify commonly used ingredients such as saccharin and aspartame, respectively. In contrast, 34.7% of participants correctly classified concentrated fruit juice as added sugar. Tierney *et. al.*, (2017) found that the majority of participants (60%–80%) correctly classified saccharin and aspartame as artificial sweeteners. While Adjei et. al., (2024) reported 18.8 % and 23.9 % of the respondents correctly classified saccharin and aspartame as artificial sweeteners, respectively. Of these (21.5% females and 13.2% males), it was found that only 23.29% of the participants in this questionnaire answered 8 components correctly as added sugars out of 10 components, meaning that the majority of participants were not able to classify correctly and the level of awareness of added sugars present in the food product is very low even among highly educated and postgraduate students. Similar findings were reported by Adjei *et. al.*, (2024) and Tierney *et. al.*, (2017) that the majority of the participants were not able to classify the added sugars and sweeteners correctly. As for the awareness of the correct classification of sugars found in milk, fruits and vegetables, the question was asked: What is the type of sugar found in milk? Is it natural sugar, added sugar, or I don't know? As shown in Figure 8, 40% (22% females and 18% males) of participants incorrectly classified milk sugar as added sugar, while 44% (26% females and 18% males) correctly classified it as natural sugar, 15% did not know whether it was natural sugar or added sugar. There were no significant differences between the sexes (p=0.377), while there were significant differences between the educational levels (p=0.008). 91% (52% females and 39% males) of the participants correctly classified the sugars found in fruits and vegetables as natural sugars, while 4% classified them as added sugars and 5% answered that they did not know whether they were natural or added. Statistically, there were no significant differences between the sexes. (p=0.377) or educational level (p=0.008) or age (p=0.380). Prada *et. al.*, (2020) stated that A Portuguese sample

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categorized sugar sources incorrectly as artificial, namely, fruit concentrate (34%), corn syrup (33%), or xylitol (31%), except that aspartame and saccharine were categorized correctly as “artificial” responses (43% and 36%, respectively). participants with reduced sugar intake requirements, i.e., overweight or obese individuals and patients with pre-diabetes or diabetes, showed poor knowledge, negative attitudes, and suboptimal practices toward non-nutritive sweeteners (Chen *et. al.*, 2024).

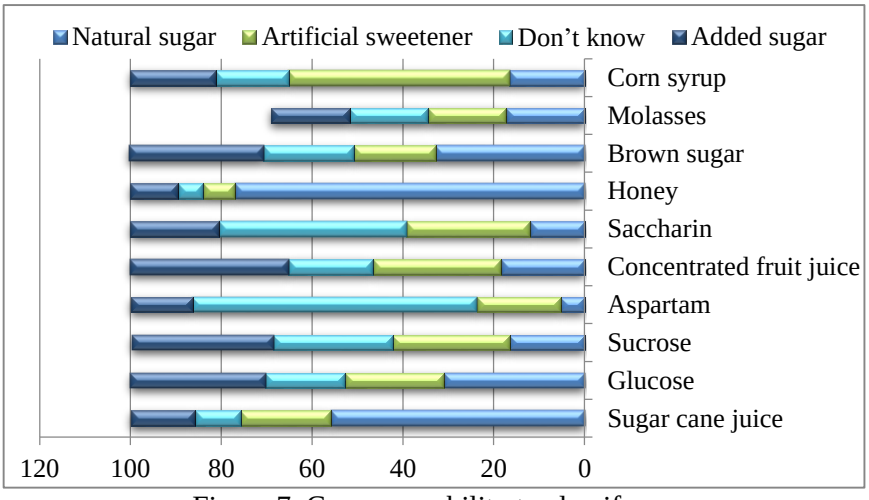

Figure 7. Consumer ability to classify sugars.

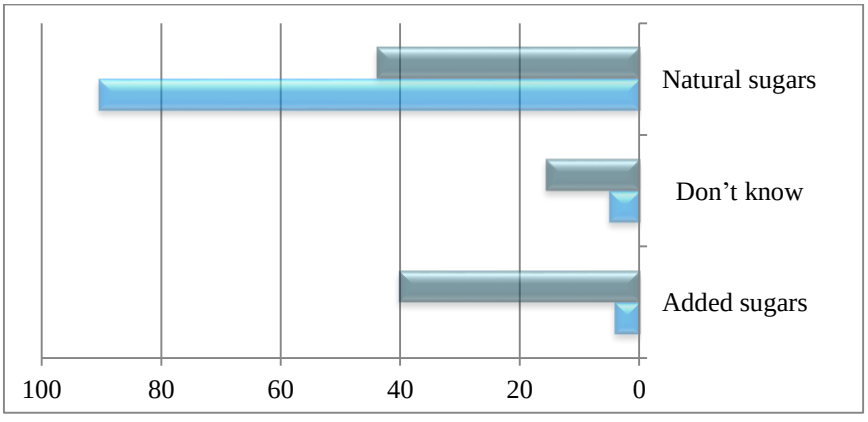

Figure 8. Classify the sugars found in milk, fruits, and vegetables.

Consumers' understanding of the benefits and risks of foods, through awareness programs, can enable them to evaluate the

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information available and accordingly make the right purchasing decisions based on nutritional awareness rather than avoiding risks only (Washi,2012). Given the strong link between food and health, there is always a need for cooperation between organizations and people concerned to explain this relation to consumers and raise their nutritional awareness. To ensure the prevention aspects of food, nutritional awareness. This proactive approach is the best solution for a healthier society.

Conclusion:

This study sheds light on the consumer's understanding and awareness of the food content of added sugars using the current updated nutritional data card. This study concluded that even well-educated people were unable to correctly classify added sugars and that awareness of the WHO's recommendations was very low. A group of respondents did not know the organization at all. It may be time to open up proposals so that we can develop strategies that facilitate consumers to reduce their sugar intake and manage their intake of added sugars within the State of Libya.

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