RESEARCH ARTICLE

Influence of Front-of-Pack Nutrition Labelling on Portuguese Consumers' Food Preferences - a Preliminary Study

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Abstract

Background: Nutrition labelling, as a way of communication between consumers and the food industry, allows them to make more conscious, informed and safe choices when purchasing food products. Simplified nutrition labelling systems are considered one of the best tools for the promotion of healthy eating habits.

Aim: This cross-sectional descriptive study aims to evaluate the use of the front-of-pack (FOP) nutrition labelling in the food choices of Portuguese consumers, as a complement to the Nutritional Declaration, through an online survey.

Methods: The total sample consists of 120 Portuguese individuals, aged between 18-55 years. Data was collected during the January of 2022. Socio-demographic data, knowledge about food labelling and knowledge about FOP nutrition labelling systems (Nutrition Traffic Light and Nutri-Score) were collected.

Results: The results highlight a statistically significant association between gender and the choice to read food labels (p=0.004) and reveal that information expressed on nutrition labels affects consumers' decision (p=0.015), both at the time of purchase. FOP system (p=0.014) as well as location (p=0.010) was preferred to traditional Nutrition Declaration, regarding food label reading. The interest in the product's nutritional value appears to be the main significant motive for influencing label reading (p=0.021). No other statistical relevance was found.

Conclusion: To sum up, when purchasing, the information, location and design of nutrition labels tends to affect consumers' decisions. Thus, food education campaigns amongst the population are necessary to minimize nutritional literacy gaps. However, future studies are needed to assess the impact of the Nutri-Score system on consumers' food choices.

Keywords: Nutrition Labelling, Simplified Nutrition Labelling Systems, Front-of-Pack (Fop), Consumers, Food Choices.

1. Introduction

The food market presents an increasingly diversified offer adapted to consumers' demands, and it is also noticeable that consumers are more sensitized and aware of the need for behavioural changes, accentuating their interest in nutrition labelling (Finance, 2018; Matias et al., 2020). According to European Regulation (EU) No. 1169/2011, food labelling is a tool that allows access to information on food products. Therefore, customers are becoming more aware of their nutritional content, allowing them to make more appropriate, conscious, informed and safe choices. (APN & DGAV, 2017; Gregório et al., 2017). However, the development of health policies that facilitate literacy and understanding of the information expressed on nutrition labels is fundamental to promote better food choices (APN & DGAV, 2017). Thus, the World Health Organization (WHO) proposed the existence of a simplified labelling system, i.e., a front-of-pack (FOP) nutrition information system, with the purpose of improving dietary patterns and, consequently, preventing the occurrence of diet-related diseases (Egnell et al., 2019; Martini et al., 2022).

The main purpose of FOP labelling systems is to provide nutritional information to consumers through a simple and visually appealing format, allowing a quick decision on the nutritional content of food products, and is therefore an effective means to obtain health benefits (Kanter et al., 2018; UNICEF, 2020). Current regulations in national territory for the adoption of a specific model of simplified nutrition labelling appears to be lacking (Kanter et al., 2018; World Obesity Federation, 2019) However, in the national market, several food industries have used this type of approach, such as Nutritional Traffic Light and Nutri-Score (Mendonça, 2017; World Obesity Federation, 2019). In Portugal, these nutrition tools are the most commonly used as simplified nutritional systems. The Nutritional Traffic Light system, developed by the Food Standards Agency (FSA), consists of the individualized analysis of four nutrients (carbohydrates, lipids, saturated fatty acids and salt) with the subsequent assignment of a colour code (green, yellow, red) to each of the food chemicals (APN - Portuguese Nutrition Association, 2019; UNICEF, 2020) However, the same may be considered rather simplistic, misleading the consumer by not differentiating the individual characteristics of foods (Tarabella & Voinea, 2013; Pettigrew et al. , 2022). In fact, studies suggest a system only focused on "*negative*" nutrients appears to be inefficient, when compared to foods of the same category, which also contain "*positive*" nutrients (Tarabella & Voinea, 2013; Egnell et al, 2019). Yet, Nutri-Score is based on the FSA model and assesses the nutritional quality of foods, with the exception of alcoholic beverages, using a scoring scale (Matias et al, 2020; Bossuyt et al., 2021; Egnell et al., 2021). This score uses a rating based on letters and colours: A, B, C, D and E; dark green, light green, yellow, orange and red; respectively (Matias et al., 2020; Bossuyt et al., 2021; Egnell et al., 2021). That said, Nutri-Score aims to inform consumers in a more straightforward and comprehensible manner regarding the overall nutritional value of foods, as well as encourage food producers to improve the nutritional position of their products on the market (Goiana-Da-Silva et al., 2019; Hercberg et al., 2021).

Recent studies have compared the Nutri-Score system with other FOP nutrition labelling systems, indicating that the first one is more relatable and understandable, as opposed to the Nutrition Traffic tool (Goiana-Da-Silva et al., 2019; Bossuyt et al., 2021). However, and beyond the shortcomings associated with the use of this type of labelling tools, several researchers claim that the information and communication on labels, mainly on the front side, may influence consumer behaviour; and thus, improving the population's eating habits (Hersey et al., 2013; Goiana-Da-Silva et al., 2019; Hercberg et al., 2021). Hence, this study aims to evaluate the addition of the FOP food labelling system in portuguese consumers' food choices, as opposed to a Nutritional Declaration alone.

2. Material and Methods

2.1 Data Collection Design

A cross-sectional descriptive study was conducted with a randomised voluntary sample of 120 individuals, based on an online questionnaire (Google Forms) applied during January 2022 and shared via social networks. Individuals aged with or over 18 years old that resided in the Lisbon Metropolitan Area, Portugal, were defined as the target population required for study entry. Individuals who did not comply with the previously stated inclusion criteria were excluded from the study. Data regarding sociodemographic information and knowledge concerning food labelling, as well as FOP nutrition labelling tools were adapted from the Nutritional Knowledge Questionnaire (Turrel & Kavanagh, 2006; Silva et al., 2022). Written informed consent

was obtained previously to data collection. All data was acquired through an anonymous questionnaire, in order to ensure confidentiality, and in accordance with the principles of The Declaration of Helsinki. The School of Sciences and Health Technologies of Lusófona University's Ethics Committee considered that an ethics approval was not required, following discussion of the study protocol.

2.2 Questionnaire

The questionnaire consisted of a total of 19 questions and was organized into three sections: (1) Sociodemographic characteristics, (2) Food Labelling, (3) Perception of FOP Nutrition Labelling Systems. For sociodemographic characterization, the following data was collected: gender, age and academic qualifications. Data concerning knowledge of food labels was collected: reading the food label when purchasing; importance in the decision-making process; main reasons for not considering them. Data regarding knowledge of FOP nutrition labelling systems was collected through the comparison of Nutrition Traffic Light and Nutri-Score, as well as nutrition labelling location on the package, their interpretation and level of simplicity in several foodstuffs (soft drinks, biscuits, cereal bars and

canned food). To avoid bias, the participants did not have prior knowledge of the questionnaire's content.

2.3 Statistical Analysis

Data is expressed by means and standard deviation (SD) for continuous variables and absolute and relative frequencies (%) for categorical variables. Means of variables were compared by Pearson's chi-squared χ^2 tests, for categorical variables, and Student's t-tests, for continuous variables, as appropriate. Data was extrapolated to Microsoft Excel® 2021 program for observation of results and exclusion of omitted cases and were subsequently analysed by SPSS statistical package version 28.0 (IMB Inc., Armonk, New York). A confidence level of 95 % (p <0.05) was considered.

3. Results

The heterogeneous sample is composed by 120 Portuguese individuals, 82 women (68.3 %) and 38 males (31.7 %), with a mean age of 24.20 ± 7.62 years (range between 18 and 55 years). Regarding academic qualifications, the majority of individuals were found to have a higher education (53.3 %). However, no statistically significant associations were found concerning gender (Table 1).

Table 1. *General characteristics of the study population according to gender.*

	All population (n=120)	Gender		P value[a]
		Feminine (n=82)	Male (n=38)	
Age, years	24.20 (7.62)	23.44 (7.17)	25.84 (8.36)	0.108
Academic degree, % (n)				
First grade	1.7	2.4	0.0	
Second grade	0.8	0.0	2.6	0.231
Third grade	44.2	47.6	36.8	
Higher education	53.3	50.0	60.5	

Data expressed in mean (SD) or percentage (n). [a]P values for comparations between groups were tested by t-student or Pearson $\chi 2$, as appropriate.

The information expressed on food labels (understanding, reading and decision at the moment of purchase), knowledge of food labelling systems (nutrition declaration, nutrition traffic light and Nutri-Score) and interpretation's simplicity in regard to gender is presented in Table 2. There was a statistically

significant association between gender and reading of food labels at the time of purchase (p= 0.004). It was also found that the information expressed on food labels significantly affects the decision to purchase (p= 0.015). No other statistically significant associations were found.

Table 2. *Association between the information expressed on food labels (understanding, reading and decision at the time of purchase), knowledge of FOP labelling systems and simplicity in interpreting food labels with gender.*

	Gender		P value[a]
	Feminine (n=82)	Male (n=38)	
Understanding the information on food label, % (n)			
Yes	48.8	57.9	0.353
No	51.2	42.1	

Reading food label at time of purchase, % (n)			
Yes	74.4	47.4	**0.004**
No	25.6	52.6	
Information on food label affects purchase decision, % (n)			
Never	2.4	10.5	
Rarely	9.8	26.3	**0.015**
Usually	80.5	60.5	
Always	7.3	2.6	
Knowledge of the Nutritional Traffic Light tool, % (n)			
Yes	75.6	63.2	0.159
No	24.2	36.8	
Knowledge of the Nutri-Score tool, % (n)			
Yes	73.2	57.9	0.094
No	26.8	42.1	
Easy interpretation of food labels, % (n)			
Nutrition Declaration	25.6	18.4	
FOP	73.2	78.9	0.606
Other	1.2	2.6	

Data expressed in percentage (n). aP values for comparations between groups were tested by Pearson χ2.

Table 3 denotes the association between location of food labels on the package (FOP, side, back, indifferent), reasons for considering (knowledge of the product, interest in the nutritional value, weight loss, interest in practicing a healthy diet, other) or disregarding (lack of time, lack of interest, difficulty of analysis, difficulty of reading, other) food label reading, as well as the simplicity of interpreting and understanding food labels. Statistical significance was found for the location of food labels on the package (p= 0.010), reasons for considering reading food labels (p= 0.021), with the main influencing factor being interest in the nutritional value of the food product (39.2 %), as well as easy interpretation of food labels (p= 0.014). Although no statistically significant associations were found, the lack of time appears to be the main factor (43.8 %) for disregarding food label reading (p= 0.051).

Table 3. *Association between simplicity in interpreting and location on the package of nutrition labelling, as well as reasons for considering and/or disregarding reading of food labels with reading the information expressed on them.*

	Reading food labels		P value[a]
	Yes (n=79)	**No** (n=38)	
Easy interpretation of food labels, % (n)			
Nutritional Declaration	24.1	26.8	**0.014**
FOP (Nutri-Score and Nutrition Traffic Light)	75.9	73.2	
Location of food label, % (n)			
FOP	68.4	70.7	
Side of package	1.3	14.6	**0.010**
Back of package	8.9	2.4	
Indifferent	21.5	12.2	
Reasons for considering reading food labels, % (n)			
Product knowledge	22.8	23.7	
Interest in nutritional value	39.2	21.1	
Lost weight	2.5	13.2	**0.021**
Interest in the practice of healthy eating	35.4	36.8	
Other	0.0	5.3	
Reasons to disregard reading food labels, % (n)			

Lack of time	43.8	27.5	
Lack of interest	7.8	30.0	
Difficult analysis	15.6	12.5	0.051
Excessive information	17.2	22.5	
Difficult reading	6.3	2.5	
Other	9.4	5.0	

Data expressed percentage (n). aP values for comparations between groups were tested by Pearson χ2. Abreviation: FOP, Front-of-Pack.

Table 4 shows the association between the choice to buy different foodstuffs (ketchup sauce, tomato soup, sardines in water, sardines in oil, soda like "Coke", soda like "Coke Zero", dark chocolate cereal bars and whole oat cookies) and academic qualifications. No statistically significant associations were found.

Table 4. *Association between the choice to buy different foodstuffs and academic qualifications, through the Nutri-Score tool (FOP).*

	Academic degree		P value[a]
	Basic education (n=56)	**Higher education** (n=64)	
Purchase option through Nutri-Score, % (n)			
Ketchup sauce			
Yes	1.8	1.6	0.924
No	98.2	98.4	
Tomato soup			
Yes	92.9	89.1	0.472
No	7.1	10.9	
Sardines in water			
Yes	96.4	92.2	0.323
No	3.6	7.8	
Sardines in oil			
Yes	66.1	65.6	0.959
No	33.9	34.3	
Soda like "Coke"			
Yes	1.8	0.0	0.283
No	98.2	100.0	
Soda like "Coke Zero"			
Yes	66.1	57.8	0.353
No	33.9	42.2	
Cereal bar (dark chocolate)			
Yes	8.9	9.4	0.933
No	91.1	90.6	
Whole oat cookie			
Yes	100.0	98.4	0.348
No	0.0	1.6	

Data expressed in percentage (n).aP values for comparations between groups were tested by Pearson χ2.

4. Discussion

Food labelling constitutes a means of communication between the consumer and the food industry (Gomes et al., 2017; Goiana-Da-Silva et al., 2019). However, multiple studies suggest difficulties in interpreting the mandatory nutritional information shown on food labels (Gomes et al., 2017; Gregório et al., 2020).

Multiple studies indicate that women tend to have a greater understanding of food label reading at the time of purchase, as well as a greater concern and importance with their appearance and body image, as opposed to males of different age groups (Voges et al., 2019; Kanellakis et al., 2021; Jiménez-Limas et al., 2022). Thus, and considering the cultural pressure

exerted, women show considerable concern for factors capable of promoting physical body changes, such as diet (Voges et al., 2019; Jiménez-Limas et al., 2022). According to scientific evidence, food label's layout as well as information tends to significantly affect consumer's decisions and intentions of purchase (Kühne et al., 2022; Zafar et al., 2022). The majority of participants, mainly women, reported that purchase decision is usually influenced by information provided in the food labels of that same product. These results are possibly justified given that, in general, women perform a larger number of household chores, such as shopping (Staland-Nyman et al., 2021; Samtleben & Müller, 2022). On the other hand, body dissatisfaction may also be an explanatory reason for the result obtained, since, in addition to being more frequent in women, it is a common phenomenon for both genders (Barbosa et al., 2011; Grogan, 2021). Simultaneously, scientific evidence indicates that reading the information expressed on nutrition labels seems to have a positive impact on consumers' food choices (Giró-Candanedo et al., 2022; Wei et al., 2022).

WHO proposed a FOP nutrition labelling as a strategy to foster consumers' healthier dietary patterns. This simplified labelling system has been designed for an easier interpretation, complementing the traditional nutrition declaration (Neal et al., 2017; Egnell et al, 2018). In the present study, participants reported that FOP systems, i.e. Nutri-Score and Nutrition Traffic Light, was easier to understand than the typical Nutrition Declaration. Moreover, the location for nutrition labels was significantly preferred in the front of the pack as opposed to the side or back, even when participants stated that they did not read food labels when purchasing a product. This might be due to the strategic FOP position, given that is immediately visible and can be effortlessly comprehended at a glance (UNICEF, 2020; Pettigrew et al, 2022). Generally, food choices tend to be influenced by several factors, such as age, gender, lifestyle, personal preferences, financial situations, visual aspects of the packaging and its nutritional information (Egnell et al., 2018; Dumoitier et al., 2019; Kühne et al., 2022). Thus, it is reported that reading nutrition labels tends to be mostly considered for the interest in the nutritional value of foodstuffs. However, knowledge of the product, weight loss and interest in the practice of a healthy diet have a minority influence on label reading. Numerous papers indicate that the use of simplified nutrition labelling systems promotes a better understanding of the information expressed in

it by the consumer, when compared to the traditional nutrition declaration (Hersey et al., 2013; Gomes et al., 2017; APN, 2019;). Although this study does not demonstrate a significant relationship, an association is observed between the simplicity of simplified nutrition labelling systems, particularly Nutri-Score, with gender and label reading.

The use of the Nutri-Score tool, presents a positive impact on consumers' food choices, promoting an increase in consumers' food literacy (Dréano-Trécant et al., 2020; Egnell et al., 2021; Romero Ferreiro et al., 2021). In the analysis at hand, no statistically significant association between educational attainment and the purchase choices of various foodstuffs were found. This phenomenon may emphasise the simplicity of interpretation and comprehension of this food labelling system, in individuals of all academic backgrounds (Goiana-Da-Silva et al., 2019; Hercberg et al., 2021). However, a preference for A-B rated foods compared to D-E rated foods is observed, regardless of the educational level of the individuals. The current complexity of food labels is a factor promoting their reading disregard. The Nutri-Score tool does not account for added additives, processing, flavours, portion size and cooking/preparation method of food products, which may generate controversy in the interpretation of this type of tool (Tarabella & Voinea, 2013; Goiana-Da-Silva et al., 2019). In addition, a preference is observed for purchasing soft drinks of the "Coke Zero" type, which is assessed as "adequate/healthy" according to this simplified labelling system. However, it should be noted that Nutri-Score only considers the amount of simple sugars and not the presence of sweeteners, which explains why light drinks such as Coke Zero are rated as B or C (Egnell et al., 2021). Thus, by making it easier for consumers to read, the Nutri-Score tool might also have a negative impact on the perception of food composition and nutritional quality (Vartanian et al., 2007; Mullee et al., 2019). Hence, when using simplified nutrition labelling systems, it is important to consider the impact, both positive and negative, of their applicability (Goiana-Da-Silva et al., 2019; Matias et al., 2020; Hafner & Pravst, 2021).

The Nutri-Score is an easily recognized and interpreted tool, regardless of the nutritional literacy of individuals, nevertheless, it should not be seen as a substitute for currently existing nutritional information (Hafner & Pravst, 2021; Hercberg et al., 2021; Martini et al., 2022). Despite the usefulness and effectiveness of this approach in the widespread interpretation of

food labels, there is a gap in Portuguese consumers' nutritional literacy. Therefore, it is essential to conduct and promote food education campaigns amongst the population (Franco-Arellano et al., 2020; UNICEF, 2020; Pettigrew et al., 2022).

To the best of our knowledge, this is one of the few studies assessing the impact of FOP nutrition labelling systems, mainly Nutri-Score, on Portuguese consumers' food preferences. Nonetheless, it's sample size, the self-reporting of the data (may result in bias and influence the results) and the fact that it is a cross-sectional study, not being possible to identify a cause-effect relationship, constitute limitations.

5. Conclusion

This analysis shows a statistically significant association between reading food labels at the moment of purchase and gender, revealing that the information expressed on nutrition labels affects consumers' decisions at the moment of purchase. Reasons for considering food labels, namely the overall nutritional interest of the product, show a significant association with reading food labels. Moreover, a FOP nutrition labelling was preferred concerning location and when compared to the traditional Nutrition Declaration system, both for individuals who typically read and do not read food labels when purchasing food.

Future studies should optimise and assess the relationship between the impact of the application of simplified nutrition labelling systems, such as Nutri-Score, on consumers' food choices. Considering not only the nutritional value of the food, but also individuals' preferences, customs and eating habits. Food education campaigns amongst the population will be necessary to minimize existing disparities in nutritional literacy.

Notes

Availability of Data and Materials:

All data and materials are available in this manuscript. The questionnaire applied to the participants of this study are available upon request to the authors.

Authors' Contributions

Conceptualization: JM, DG, MLP, MJC, PP, MN and RC; Designing the study: JM and RC; Analyzing the data: JM and RC; Drafting, writing, reviewing and approving the final manuscript: JM, DG, MLP, MJC, PP, MN and RC. All authors have read and approved the manuscript.

Consent for Publication

All the authors consent to the publication of the present paper.

Ethical Approval: Not Applicable.

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