



Influence of food literacy and concern for healthy eating on evaluations of snacks with Front-of-Pack Nutrition Labeling: The Nutri-Score compared to Calorie Information

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Abstract

Title of the dissertation: “Influence of food literacy and concern for healthy eating on evaluations of snacks with Front-of-Pack Nutrition Labeling: The Nutri-Score compared to Calorie Information.”

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Obesity is a global problem and the increase in unhealthy eating habits is a major driver. To address this, Front-of-Pack Nutrition Labeling (FOPNL) systems – e.g., the Nutri-Score (voluntary in the EU) and Calorie Labelling (mandatory in the US) –, are being deployed to steer consumers into making more informed and healthier food choices. While previous research has investigated the influence of FOPNL on consumer behavior, there has been limited exploration of how individuals’ level of food literacy and attitude towards healthy eating may affect their impact.

This dissertation assessed the effects of consumers’ confidence in own food skills and concern for healthy eating on their evaluations of three snack stimuli with a Calorie Information/100g or a Nutri-Score label. An experiment (3x2 mixed design) was administered via an online questionnaire, resulting in 143 valid responses. Data were analyzed with mixed ANOVA and linear regression.

No major differences were observed in snack evaluations between the two FOPNL, with participants seemingly relying more on their own perceptions and beliefs about the nutritional quality of the products to judge them than on labelling. Confidence in own food skills/concern for healthy eating significantly moderated the effect of type of FOPNL on the health/taste evaluations of a nut mix, a snack deemed both high calorie and healthy.

Overall, findings highlight the need for food policy officers and marketing practitioners to carefully assess the extent to which product and individual characteristics may limit the effectiveness of different FOPNL systems.

Keywords: Nutritional labelling, Front-of-Pack labelling, Nutri-Score, Calorie labeling, food literacy, attitude towards healthy eating

Resumo

Título da dissertação: "A influência da literacia alimentar e da preocupação com a alimentação saudável na avaliação de lanches com Rotulagem Nutricional Simplificada: Comparação entre os sistemas Valor Energético e Nutri-Score."

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A obesidade é um problema global cujas causas passam por hábitos alimentares inadequados. Para fomentar escolhas alimentares mais informadas e saudáveis, Rotulagem Nutricional Simplificada (RNS) está a ser introduzida na frente de embalagem de produtos processados. Embora o impacto de sistemas como o *Nutri-Score* e o Valor Energético tenha sido já avaliado, o modo como a literacia alimentar e a atitude face à alimentação saudável poderão condicionar o seu efeito nas escolhas do consumidor não foi explorado.

Esta dissertação avaliou os efeitos dos níveis de literacia alimentar e de preocupação com a alimentação saudável dos consumidores nas suas avaliações de três embalagens de lanches processados, rotuladas na frente com o respetivo Valor Energético/100g ou *Nutri-Score*. Um questionário aplicando um delineamento experimental misto (3X2) foi administrado online, recolhendo-se 143 respostas válidas. Os dados foram analisados recorrendo a análises de variância mista e regressão linear.

Não existiram diferenças relevantes nas avaliações dos estímulos entre as duas formas de RNS, tendo os participantes confiado sobretudo nas suas perceções e crenças relativas ao valor nutricional dos lanches para avaliar os avaliar. A confiança nas competências alimentares/preocupação com a saúde moderou significativamente o efeito do tipo de RNS nas avaliações de saúde/sabor de uma mistura de frutos secos, um lanche tido como simultaneamente rico em calorias e saudável.

Os resultados apontam para a necessidade dos responsáveis pela política alimentar e gestão das marcas avaliarem em que medida as características dos produtos e dos consumidores condicionam a eficácia dos diferentes sistemas de RNS.

Palavras-chave: Rótulos nutricionais, Rotulagem Nutricional Simplificada, *Nutri-Score*, Valor Energético, literacia alimentar, atitude face à alimentação saudável

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List of abbreviations

FOPNL	Front of pack nutrition label
FOP	Front of pack
GDA	Guideline Daily Amounts
RI	Reference Intakes
NS	Nutri-Score
CL	Calorie label
WHO	World Health Organization
ADL	Activities of Daily Living
FS	Food Skills
CS	Cooking Skills

1 INTRODUCTION

This chapter briefly introduces the main topic and the aim of this dissertation. First, the problem statement and some background information on food labelling, Front-of-Pack Nutrition Labeling (FOPNL), food literacy and healthy eating are presented. Next, the aim and scope of study, and research questions, are defined. This is followed by a brief description of the research methods used. Finally, the scientific relevance of the study is explained, and a brief overview of the dissertation provided.

1.1 Background & problem statement

Obesity has increased three-fold worldwide since 1975, with over 1.9 billion adults suffering from overweight in 2016 (World Health Organization, 2021). The cause of obesity is an imbalance between calorie intake and expenditure, caused by the increase in consumption of high-fat and high-sugar foods compounded with the decrease of physical activity due to sedentary work and urbanization (World Health Organization, 2021). Not only does obesity have an impact on the health of people, but it is also a significant cost to the health care system (Polyzos & Mantzoros, 2019). Medical costs for overweight people are estimated to be 30% higher than for people of normal weight (Polyzos & Mantzoros, 2019). However, the current situation and number of people suffering from obesity contradicts to some extent the modern trend for healthy and sustainable eating, with growing numbers of consumers seeking to select healthier and eco-friendlier options when shopping for groceries (Grunert, 2017). A recent study by McKinsey reveals that consumers are demonstrating increased concern for both their health and the environment, which is reflected in their willingness to spend more money on health-conscious and eco-friendly substitutes (McKinsey, 2021).

The nutritional composition of individual food items enables consumers to make informed choices for a healthier diet at the time of purchase (Grunert & Wills, 2007; Hercberg et al., 2022b). To promote healthier eating, consumer advocacy groups, scholars and food policy officers across the globe are advocating for simplified nutrition labelling on the front of food packaging, in addition to the already mandatory nutrition and calorie information on the back of packaging (Dubois et al., 2021). The main goal of Front-of-pack Nutritional Labeling (FOPNL) is to provide synthetic and easy-to-understand information about the nutritional

quality of foods without requiring consumers to read the detailed nutritional labeling on the back of the package (Braesco & Drewnowski, 2023).

Several FOPNL systems have been introduced worldwide over the last decades (Kanter et al., 2018). In 2006, the European Food and Beverage Industry Association developed and introduced a system called "Guideline Daily Amounts" (GDA), which was later renamed "Reference Intakes" (RI). Soon the GDA became one of the most widely used FOPNL systems in Europe (Storcksdieck & Wills, 2012). A similar system is in place in the United States, known as the Nutrition Facts label (Kontopoulou et al., 2022). Another form of mandatory nutrition information, Calorie Labelling, is being introduced in menus of quick-service restaurants and vending machines in this country (U.S. Food and Drug Administration, 2023).

The GDA system is a non-directive system that only provides information on the nutrient content in absolute values, which are normally given per portion, per 100 g or as a percentage of the recommended daily intake (Arrúa et al., 2017). The GDA scheme therefore only includes numeric information about the content of nutrients in a portion. This system usually includes the recommended daily amounts of energy, fat, saturated fat, sugar, and salt that a portion of food contains (Boztuğ et al., 2015). The simplified form of this label indicates only the calorie information per portion or per 100 g on the front of the food packaging. The GDA and similar systems have in common the emphasis given to information about the energetic content of foods relatively to other nutritional characteristics.

An increasingly popular FOPNL in Europe is the Nutri-Score, a simpler color-coded, graded scheme (Grunert & Wills, 2007). It consists in a five-color grading system ranging from dark green to dark orange, with each color corresponding to one letter from the alphabet between A and E. Its overarching goal was to optimize the clarity and accessibility of a food's nutritional quality for consumers (Hercberg et al., 2022b). Rather than categorizing foods as simply "healthy" or "unhealthy", this graded logo conveys semi-quantitative data about a product's overall nutritional composition compared to similar items, indicating whether it is more or less beneficial to good health (Hercberg et al., 2022b). Therefore, the Nutri-Score considers not only factors that are advantageous (such as the content of fruits, vegetables, nuts, fiber, protein, rapeseed oil, walnut oil and olive oil), but also detrimental ones (namely, the presence of energy, total sugar, saturated fatty acids and sodium) to determine a score on a scale that spans from the healthiest grade to the least healthy one (Julia et al., 2018).

Most of the extant research on FOPNL addresses consumers' perceptions and evaluations of the different systems in place (Ikonen et al., 2020). Another area of significant research interest is the assessment of the efficacy of the Nutri-Score in lowering the intake of fat, salt, sugar, or calories of individuals by modifying their food choices (Crocker et al., 2020). Indeed, there is some evidence that important health benefits at population level may be achieved by implementing FOPNL. However, its effectiveness is likely highly dependent on whether the consumer is able to understand and use the information conveyed by the labelling to adjust their food habits (Grunert et al., 2010). Research has shown that consumers may understand the information conveyed by FOPNL differently, depending on their socio-demographic group and the design of labels (Moore et al., 2018; Campos et al., 2011). An adequate level of health literacy (Murimi, 2013) and numeracy skills (Malloy-Weir & Cooper, 2017) are equally important characteristics linked to the use and understanding of nutritional labelling information. Within the larger domain of health literacy, food literacy has been defined as "the ability to develop into a positive interrelationship with food as well as individual food skills and behaviors within a complex food system" (Vidgen & Gallegos, 2014). Chiefly among the beliefs, attitudes and competences contributing to food literacy are food and nutrition knowledge, food planning, shopping, and preparation skills, as well as the levels of self-efficacy and self-confidence in one's knowledge and abilities in the food domain. Expectedly, a higher food literacy should be associated with a higher ability to understand and motivation to use nutritional labelling information to guide food decision and pursue healthier eating habits (Vidgen & Gallegos, 2014). However, there is to date scarce research testing this hypothesis.

1.2 Aim & Scope

This dissertation investigated the influence of food literacy and concern for healthy eating on the evaluation of food products displaying different FOPNL. To this end, effects on the evaluation of snacks displaying either a Calorie Label or a Nutri-Score were experimentally compared. This comparison is relevant since the Nutri-Score is a directive label combining several criteria regarding a product's overall nutrition composition relatively to similar foods (Lenzi et al., 2011), while Calorie Labelling is a non-directive format that provides only information on the energy content of foods, and in absolute terms (Arrúa et al., 2017). Consequently, it is interesting to explore whether their impact on food judgements varies depending on consumers' level of food skills, on one hand, and their level of concern for eating healthy, on another.

In order to achieve the aims of this dissertation, the following research questions were addressed:

RQ1: *Is the European Nutri-Score more or less helpful to consumers than the North American Calorie Labelling when trying to ascertain the nutritional quality and healthiness of foods, and their taste?*

RQ2: *Is the effect of the Nutri-Score vs Calorie Labeling on consumers' evaluations of foods influenced by their levels of food literacy and concern for healthy eating?*

Processed snacks were chosen as study category given that they are familiar foods that can offer both high and low nutritional quality, as well as be associated with both healthy and unhealthy eating habits, depending on the type of product considered. Moreover, processed snacks with (voluntary) Nutri-Score information can often be encountered for sale in grocery stores in Europe, while the same types of foods with (mandatory) Calorie Labelling are now being sold in vending machines across the United States. This makes of comparing the two FOPNL systems within this category an interesting topic for research.

1.3 Research methods

For the purpose of answering the research questions mentioned above, a deductive research approach was used. More precisely, an explanatory research approach was followed to explain a relationship between variables and to generalize the results (Saunders et al., 2007) Therefore, quantitative primary data were collected through an online experiment, developed using Qualtrics, in which the main concern was to test if different levels of food skills and health orientation affect the evaluation of foods labelled with the Nutri-Score vs calorie information. The analysis was completed using SPSS statistical software, which was used to perform statistical tests and analyses, namely descriptive statistics, measures of central tendency (mean), measures of variability (standard deviation, maximum value, and minimum value), measures of reliability (Cronbach's alpha), mixed ANOVA and linear regressions.

1.4 Relevance

This research is significant as it addresses a growing global concern: the increasing occurrence of obesity (World Health Organization, 2021) and rising consumer demand for healthier and more sustainable food (McKinsey, 2021). The Nutri-Score, as a front-of-pack nutrition label, has the potential to help consumers make healthier choices at the point of purchase and to encourage manufacturers to improve the nutritional quality of their products (Hercberg et al., 2022b). Further the Nutri-Score is the only proposed labelling system that fully conforms to the concepts and procedures specified by the World Health Organization (WHO) Europe for validation studies needed to decide and evaluate a front-of-pack nutrition label (Hercberg et al., 2022b).

This study investigates how different levels of food literacy and concern for healthy eating impact the evaluation of different FOPNL systems. Findings therefore provide information on the effects of nutritional labelling might be conditional to individual nutrition knowledge and food-related attitudes - an aspect that has received little attention in prior research. On a practical level, the findings of this dissertation may have implications for policy makers, regulators, business practitioners and marketers seeking to promote healthier eating habits. Namely, the insights gained can assist in developing and implementing more effective FOPNL strategies to facilitate informed and health-conscious food choices by consumers.

1.5 Dissertation outline

To pursue the objectives outlined above, Chapter 2 offers a review of literature review on nutrition labelling in general, on consumer evaluations and the effectiveness of FOPNL, particularly Nutri-Score and Calorie Information, and on the relationship between food literacy, concern for healthy eating and impact of FOPNL on consumers' food evaluations. This section ends with the proposal of a conceptual model to guide the research and associated hypotheses to be tested. Chapter 3 describes the research methodology applied to collect and analyze the data needed to test the proposed hypotheses, while Chapter 4 presents and discusses the results found. Lastly, Chapter 5 summarizes the main conclusions and implications of the research conducted, outlines its main, and makes recommendations for future research in the field.

2 REVIEW OF LITERATURE & CONCEPTUAL FRAMEWORK

This chapter provides the literature background and a theoretical framework for research into FOPNL. Its first section deals with the rationale for the introduction of FOPNL in addition to mandatory back-of-pack nutritional labelling for processed foods. The second and third sections present and discuss two specific FOPNL systems – the Nutri-Score and Calorie Labelling. The fourth section reviews the general effectiveness of nutritional labels according to extant studies. The fifth section introduces the concepts of food literacy, food skills and cooking skills, and discusses their relationship with individuals' understanding and use of nutritional labelling. Finally, the conceptual frameworks underlying this dissertation and the research hypotheses formulated are presented.

2.1 Nutritional labelling

The obesity epidemic of the 21st century has resulted in an urgent need for action in the food information system and led governments to get involved (Polyzos & Mantzoros, 2019). The EU Regulation No. 1169/2011 entered in full application in Europe by end of 2014, requiring most pre-packaged foods to include a nutrition declaration so that consumers can make well-informed and health-conscious choices (Nohlen et al., 2020). The nutrition declaration must indicate the energy value and the amounts of fat, saturates, carbohydrates, sugars, protein, and salt of the food. This mandatory nutrition declaration is usually located on the back of the food packaging. An easy-to-read table format is usually chosen to present this information and the information must be given per 100g or 100ml (Nohlen et al., 2020).

In addition to the mandatory back-of-pack labelling, FOPNL is becoming increasingly available on packaged foods worldwide (Braesco & Drewnowski, 2023). There is growing evidence that this type of nutritional labelling is both better understood and more appreciated by consumers than back-of-pack labelling (Grunert & Wills, 2007). FOPNL is more likely to be noticed and hence can help consumers to differentiate easier between healthier and less healthy items (Al-Jawaldeh et al., 2020). In view of this, the WHO is promoting FOPNL as a way to control the global increase in obesity and non-communicable diseases linked to inadequate nutrition and eating habits (World Health Organization, 2014).

FOPNL aims to simplify nutrition information on packaging, in order to help the consumer make healthier food choices. They provide at-a-glance nutritional information about a food without the need to look at the more detailed nutritional table on the back of the pack (Braesco & Drewnowski, 2023). FOPNL is being introduced in a growing number of countries to achieve

public health objectives, such as guiding consumers towards healthier food choices, improving the overall quality of consumers' diets and ultimately leading to better and improved health outcomes. But ultimately it also very much seeks to pressure manufacturers to improve the nutritional quality of their food products preemptively (van der Bend & Lissner, 2019). At least around 30 different FOPNL systems have been accepted by the governments around the world (Jones et al., 2019).

FOPNL can be classified into two main types: fact-based or nutrient-specific information and evaluative summary systems. Fact-based formats typically derive from guidelines about the recommended daily intake amounts for specific nutrients, with a focus on energy value (kcal) and nutrients with high impact on weight status and health (e.g., sugar, salt, fiber). They can be either quantitative, evaluative or both. At the beginning, they used to be tabular and rather neutral, without any color scheme, but later diverted into more sophisticated and colored versions, like the traffic light system, or rather reverted to single ingredient black warning octagonal signs (Braesco & Drewnowski, 2023). Meanwhile, evaluative summary formats result from algorithms that assess the complete nutritional profile of foods, especially their energy content and micronutrient composition, to come up with an overall assessment of their healthiness. Namely, the algorithm generates a symbol, score or letter grade for a food that represents its health value to the consumer. The aim is to increase consumers' understanding of the overall health value of a food product (Braesco & Drewnowski, 2023).

2.2 The Nutri-Score

One of the most popular FOPNL in Europe is the Nutri-Score, an evaluative summary system. This format was developed by independent French researchers and selected for implementation by the French public health authorities mainly due to its holistic view on nutrition and health, simplicity, and appeal (Julia et al., 2018). In 2017, the Nutri-Score label was chosen as the official nutrition label in France (Julia et al., 2018). Some studies have since shown that the Nutri-Score can lead consumers to make more accurate predictions about the nutritional quality of different food products than most other FOPNL systems (Dubois et al., 2021). It is also one of the few FOPNL developed in a way that fully conforms to the concepts and procedures of the World Health Organization (WHO) Europe for validation studies that must be carried out to evaluate and potentially adopt these nutrition labelling systems (Hercberg et al., 2022a).

In addition to France, other European countries have also decided to implement the Nutri-Score in their markets. Germany introduced the Nutri-Score in autumn 2020 (Bundesministerium für Ernährung und Landwirtschaft, n.d.), and since then Belgium, Luxembourg, Switzerland, the

Netherlands and Spain have followed suit (Bundesministerium für Ernährung und Landwirtschaft, 2023).

The Nutri-Score label, also known in its former version as the 5-color Nutritional label (5-CNL) (Julia & Hercberg, 2017), consists of a five-color scale ranging from dark green to dark orange, with each color being complemented by letters, ranging from A to E (Figure 1). This system aims to provide semi-quantitative information about the relative overall composition of the food compared to other similar products, rather than classifying products into healthy and unhealthy in absolute terms (Hercberg et al., 2022a).



Figure 1: The Nutri-Score FOPNL system. Source: Adobe Stock Images.

The Nutri-Score relies on an algorithm that assigns positive points (0-10) for unhealthy nutrients, such as energy (kJ), total sugar (g), saturated fats (g) and sodium (mg), and negative points for healthy characteristics or favorable nutrients, such as fruit, vegetables, legumes, nuts, fiber, and protein. To calculate the overall score for the nutritional quality of a food, the positive points, ranging from 0 to +40, are added to the negative points, ranging from 0 to -15. The Nutri-Score can therefore range from -15 for the healthiest option to +40 for the less healthy option. The scores are then made to correspond to the five colors and letters displayed in the label (Figure 2). The latter are added to provide an objective indicator that is easy to read and understand, and to make the label suitable to the color-blind (Szabo De Edelenyi et al., 2019).

Foods (points)	Beverages (points)	Color
min to -1	water	green
0 to 2	min to 1	light green
3 to 10	2-5	yellow
11 to 18	6-9	orange
19 to max	10 to max	dark orange



Figure 2: Correspondence between the Nutri-Score points computed for foods and beverages and the Nutri-Score scale of colors and letters. Source: Adobe Stock Images.

2.3 Calorie Labelling

In 2006, the European Food and Beverage Industry Association introduced a system called "Guideline Daily Amounts" (GDA), which was later renamed "Reference Intakes" (RI). Soon the GDA became one of the most widely used FOPNL systems in Europe (Storeksdieck & Wills, 2012). A similar system is used in the United States, the Nutrition Facts label (Kontopoulou et al., 2022). One form of mandatory nutrition information, Calorie Labelling, is being introduced in menus of quick-service restaurants and vending machines in this country (U.S. Food and Drug Administration., 2023). GDA labelling (Figure 3) indicates the amount of calories, sugar, fats and salt in a portion of a food and the percentage of these nutrients in the recommended daily intake (Boztuğ et al., 2015). Calorie Labelling is a simplified format derived from GDA that provides only information on the energy content of foods (Arrúa et al., 2017). Both formats represent simple food labeling schemes seeking to enable the consumer to better understand the impact of individual food to their daily diet. They are thus non-directive systems, containing only numerical information about the content of nutrients in a portion without any interpretation aid (Deliza et al., 2020). This objective information is provided in absolute values (not relatively to other foods), per portion or per 100 g, or yet as a percentage of the recommended daily intake (Arrúa et al., 2017)

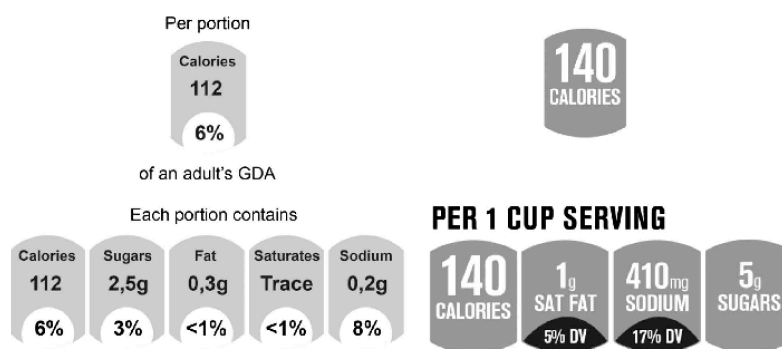


Figure 3: Different forms of Guided Daily Amounts (GDA) nutritional labelling. Source: Research Gate.

GDA for adults are based on the average nutrient requirements of healthy men and women of with normal weight (European Food Information Center (EUFIC), 2007). In particular, the GDA value for energy intake is an average of 2 000 kcal for women and 2 500 kcal for men. These energy values are the reference basis for calculating the recommended daily intake of the respective nutrients. In cases where it is not possible to provide information for both men and women, the GDA values for women are given under "GDA value for adults" in order to discourage excessive consumption (European Food Information Center (EUFIC), 2007).

2.4 Effectiveness of FOPNL

FOPNL seek to provide nutrition information in a form that is more comprehensible to consumers, in order to both encourage them purchase healthier food and lead the food and beverage industry to reformulate their products (Braesco & Drewnowski, 2023). Their application remains largely voluntary and unregulated. This fact, along with the global nature of modern food brands, results in various FOPNL being nowadays present in the market. But according to the several reviews of evidence so far conducted, their impact on consumers' food choices, diet and health remains uncertain, and it is unclear which of the current systems in place is actually more effective (Ikonen et al., 2020).

The results of a fairly recent meta-analysis examining the results of 114 studies (Ikonen et al., 2020) indicate that FOPNL may indeed help consumers to identify healthier products. However, their ability to actually persuade consumers to make healthier food choices when shopping seems to be limited. A more recent review compared the effectiveness of the four formats of FOPNL most commonly (Braesco & Drewnowski, 2023), concluding that despite a growing number of studies, the scientific evidence remains limited and is insufficient to explain the ambiguous effects of improved food choices and supply on consumer health, even though some studies have shown statistically significant trends. Overall, the positive claim that FOPNLs are effective needs to be contextualized and balanced in terms of study design and characteristics (Braesco & Drewnowski, 2023).

Another study systematically reviewed different findings from interventions on the effect of FOPNL on actual food purchases (An et al., 2021). Its results led to conclude that any significant effects on encouraging consumers to buy healthy food products is likely to be small, at least at this time (An et al., 2021). The Joint Research Center (JRC) from the European Commission published a comprehensive review about the impact of FOPNL schemes in 2020, updating this report in 2022. The review studied effects on consumers' understanding of food labels, food purchases, diet and health benefits, and food reformulation initiatives. Importantly, this work found only found a small positive effect of FOPNL on the actual shopping behavior of consumers, as well as on the reformulation of food products (Nohlen et al., n.d.).

Yet other studies were able to draw more promising conclusions. One systematic review and network meta-analysis found that color-coded FOPNL schemes as well as black warning signals could be effective in guiding consumers behavior towards healthier products, by respectively changing the perceptions of the healthiness of products and triggering negative, aversive emotions (Song et al., 2021). Another systematic review and meta-analysis found a significant

overall effect of FOPNL compared to no FOPNL for sugar and sodium content of purchases and a change in trend for lower energy and saturated content (Crocker et al., 2020).

Remarkably, all these different reviews interpreted the same original studies in really different ways, often with opposing overall results. A reason for this outcome is probably due to the importance attached to the problems in conducting the studies (methodological shortcomings) and the size or significance of the effects found (Braesco & Drewnowski, 2023). To be able to make any definitive statements about the overall effectiveness of FOPNL it is always important to consider how the studies were done and what specific features and outcomes of FOPNL they looked at.

2.5 Food literacy, food and cooking skills and nutritional labelling

Search, perception, understanding, use and effects of FOPNL are influenced by a variety of factors related to consumer characteristics, including demographics like age, gender and education, health status, interest and attitudes towards nutrition and healthy eating, and food literacy, particularly food skills and knowledge of nutrition issues (Grunert & Wills, 2007). Within the larger domain of health literacy, food literacy refers to people's "ability to develop into a positive interrelationship with food as well as individual food skills and behaviors within a complex food system" (Vidgen & Gallegos, 2014). The relevance of this ability for the development of healthy lifelong relationships with food by individuals and ultimately to the advancement of diet quality and health status at population level has been described as follows:

"Food literacy is the scaffolding that empowers individuals, households, communities, or nations to protect diet quality through change and strengthen dietary resilience over time" (Vidgen & Gallegos, 2014).

More concretely, food literacy entails the set inter-related knowledge, skills and behaviors required to plan, manage, select, prepare, and eat food to meet needs and determine intake (Figure 4). Chiefly among the beliefs, attitudes and competences contributing to increase food literacy are food and nutrition knowledge and food planning, shopping, and preparation skills, as well as the levels of self-efficacy and self-confidence in one's knowledge and abilities in the food domain. Within this framework, these are all seen as essential individual tools for building and maintaining a healthy and lasting relationship with food.

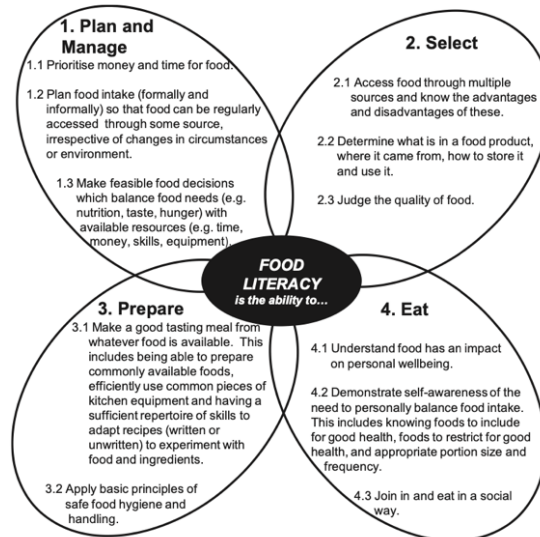


Figure 4: The four key domains of food literacy (Vidgen & Gallegos, 2014).

The concept of Activities of Daily Living (ADL) collectively describes individuals' ability to complete basic tasks such as eating, dressing, toileting, and some other chores of daily life (Edemekong et al., 2023). ADLs are necessary and usual for most healthy and young people to perform without assistance. The skill to select, acquire, manage, and cook one's own meals is seen as one of the essential ADL (Mechling et al., 2008), with these activities constituting some of the key domains of food literacy.

Maintaining a healthy and balanced diet involves a variety of skills relevant to meal planning and the management of food selection and preparation (Vidgen & Gallegos, 2014). Food skills refer to broadly food-related activities such as meal planning, preparation, shopping, budgeting, resourcefulness, nutritional labelling understanding and use, as well as consumer awareness of, and motivation to adopt an healthy eating pattern (Lavelle et al., 2017). Applying food skills therefore enables individuals to plan and prepare meals before cooking (Fultz et al., 2022). In turn, cooking skills are usually described as a collection of specific, practical skills used in the preparation of meals, such as chopping, mixing, heating, etc. Cooking skills, by definition, include the ability to understand how food will behave during the cooking process (Short, 2003).

The knowledge, attitudes and skills involved in household food preparation have become significantly more important in western countries due to changes in food consumption (Blake et al., 2011). The growing desire for easy-to-prepare foods reflects how our lifestyles are changing and impacting our desires. Due to a change in the demanded lifestyle the food industry can see a change too: an increased demand for convenience food (Lavelle et al., 2017).

Convenience foods enable people to save time and effort in various food-related tasks, such as shopping, preparing meals, cooking, eating, and managing things after a meal (Buckley et al., 2007). The increasing popularity of convenience products goes hand in hand with the fact that the dietary quality is declining. This underlines the assumption that a growing group of people does not have the necessary food skills, cooking skills and food preparation knowledge to prepare healthy meals at home (Soliah et al., 2012). However, preparing food at home and consuming homemade meals are activities associated with better quality of nutrition for both adults and children (Soliah et al., 2012). For this reason, interventions to enhance individuals' food and cooking skills have gained popularity in public health (McGowan et al., 2017). By facilitating nutritional labelling understanding and use, while increasing consumer awareness of, and motivation to adopt healthier dietary habits, FOPNL can be seen as a form of intervention seeking to increase people's food literacy. On the other hand, one's level of food skills in the domains of nutrition knowledge as well as food planning and shopping activities is likely to determine how FOPNL will be noticed, interpreted, and applied in food evaluations and choices. Consequently, higher food literacy, in particular food skills, should be associated with a higher ability to understand and motivation to use nutritional labelling information to guide food decision and pursue healthier eating habits (Vidgen & Gallegos, 2014).

2.6 Conceptual model

Figure 5 depicts the conceptual model developed to map the main concepts studied in this dissertation and their interrelationships. The operationalization of concepts and relationships into specific variables and hypotheses to be tested through data collection and analysis is presented in Figure 6. Based on these models and the literature review performed, the following research hypotheses were formulated:

H1: The nutritional quality and healthiness of food products are more accurately or positively evaluated when these are labelled with the Nutri-Score than with Calorie Information, whereas the reverse occurs relatively to evaluations of energy content and taste.

H2: Concern for healthy eating favors more positive evaluations of the nutritional quality and healthiness of food products labelled with the Nutri-Score compared to Calorie Information.

H3: Better food skills favor more positive evaluations of the nutritional quality and healthiness of food products labelled with Calorie Information compared to the Nutri-Score.

H1-H2 derive from Nutri-Score being an evaluative summary system aiming to increase consumers’ understanding of the overall health value of a food product, while Calorie Labelling is a nutrient-specific format with a focus on energy value (kcal). The latter tends to be directly associated to evaluations of food taste. H3 derives from the assumption that individuals with higher food skills, and hence higher food literacy, will already have a good level of nutritional knowledge and a good understanding of what foods constitute healthy dietary choices. These individuals are likely to appreciate and derive more value from facts-based nutritional labelling to inform their food choices than from evaluative summary systems holistically describing the healthiness of different food products.

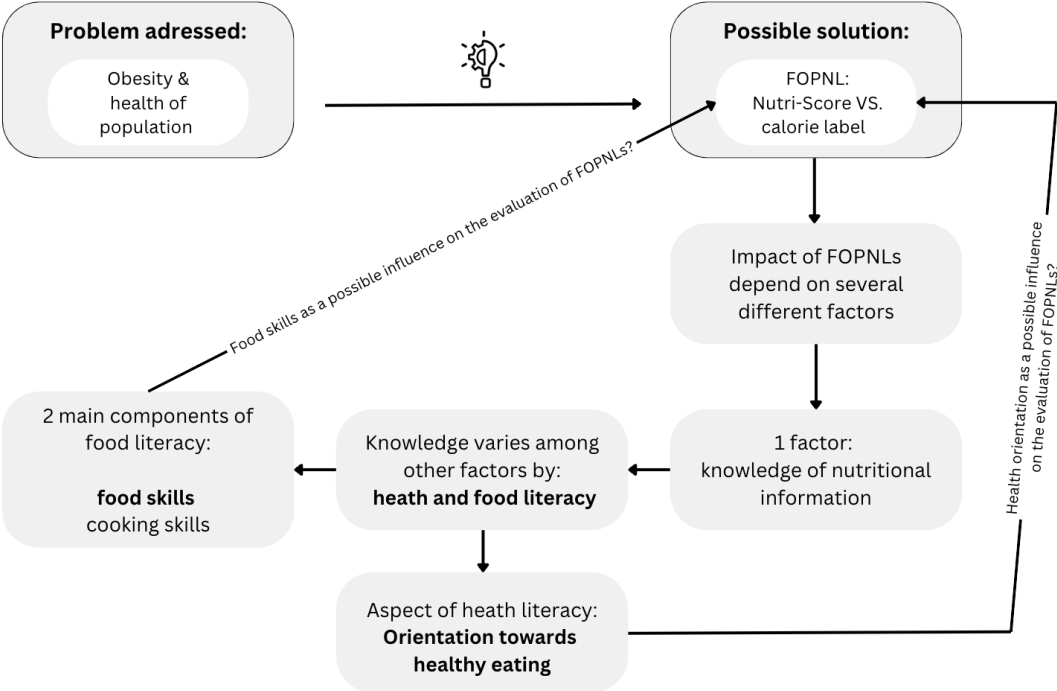


Figure 5: Conceptual model mapping the main concepts studied in this dissertation and their interrelationships.

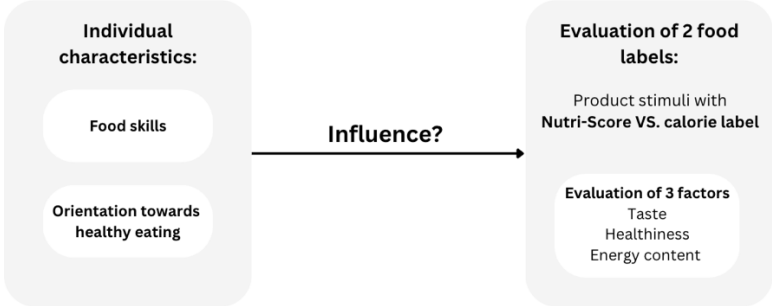


Figure 6: Variables and their relationships tested through data collection and analysis in an experimental study.

3 METHODOLOGY

This chapter describes the research methods used in this dissertation, with the aim of ensuring a strong scientific methodology to provide a suitable data set for the evaluation of the hypotheses. First, the research approach is outlined, then the study with the experimental design is explained, followed by the selection of the population and the sample. Next, the recruitment and the valid sample are clarified, the characteristics of the sample are explained and finally some preliminary descriptive statistics are presented.

3.1 Research approach

This dissertation aimed to investigate the influence of food literacy and concern for healthy eating on the evaluation of food products displaying different FOPNL. To this end, effects on the evaluation of foods displaying either a Calorie Label or a Nutri-Score had to be compared. In view of these aims, an explanatory research approach was undertaken. Such approach entails the empirical test of research hypotheses formulated *a priori* and the establishment of causal relationships between the concepts or variables that compose them (Saunders et al., 2007). Furthermore, hypotheses were tested using deductive quantitative research methods. To this end, quantitative primary data was collected through an online survey and an experiment administered through Qualtrics' survey software, and subsequently subject to descriptive and multivariate statistical analyses.

3.2 Study design

3.2.1 Experimental design

The study employed a 3 X 2 mixed design to construct six food packaging stimuli displaying a FOPNL, which were shown to subjects in the context of an online survey (Figure 7). The first factor manipulated was the type of food product tested (a snack), with 3 levels: Nut Mix, Cheese Flips and Crunchy Peas (within-subject factor, randomized order of presentation). These products were selected from available market offers based on their varied composition and nutritional quality which implied a substantial variation in the nutritional information conveyed by the FOPNL. Processing, packages, and type of snack were otherwise kept similar, as the goal was to control for type of product effects, these not being the focus of the study of the hypotheses. Care was also taken to choose vegan-friendly products, to control for the effects of

potential food restrictions. The second factor manipulated was the FOPNL system (Nutri-Score vs. Calorie Label, between-subject factor, randomized allocation). The resulting six food packaging images hence comprised the Nut Mix with the Nutri-Score A and 656 kcal per 100g, the Cheese Flips with the Nutri-Score B and 370 kcal per 100g and the Crunchy Peas with the Nutri-Score C and 451 kcal per 100g. To mimic closely how each tested FOPNL is present in actual commercial offers in Western countries, the Calorie label was displayed in the top corner of each snack pack, while the Nutri-Score appeared in the bottom, left or right of center; other claims and design features were kept similar.



Figure 7: Experimental stimuli.

Stimuli (type of snack, composition, nutrition composition) were sampled from packages of commercial products from the same brand called "BitesWeLove" (Bites We Love, 2020). This brand was selected because it is one of the few in the European market to use the Nutri-Score label and the calorie label on the same product at the same time. To avoid potential brand familiarity effects, brand references were removed from the images using Photoshop.

The main dependent variables measured were the ratings of the stimuli in terms of their healthiness, taste, and energy content (shown in random order across products and participants), measured on a seven-point Likert scale from 1=strongly disagree to 7=strongly agree. Rankings of the products according to their nutritional quality and variations in attitude towards FOPNL were also assessed. In addition to the experimental factors, familiarity with FOPNL and

psychometric measures of concern about healthy eating and food skills were treated as independent variables.

3.2.2 Survey design and administration

Data was collected through the administration on an online survey using the platform Qualtrics. At the beginning of the survey, respondents had to read a short introduction with general information about the study and provide informed consent to participation. This was followed by three screening questions to verify whether respondents met the study's population requirements. Next, the experimental design was administered: the three products with the treatment FOPNL were presented in random order, one by one, with respondents being asked to evaluate each of them in terms of their healthiness, taste, and energy content on a seven-point Likert scale ranging from 1= "Strongly disagree" to 7= "Strongly agree". Next, respondents were asked to rank the three stimuli according to their relative nutritional quality, from the product with the highest nutritional quality (1) to the one with the lowest nutritional quality (3). Stimuli images were displayed to facilitate the ranking. Finally, respondents were questioned about how familiar they were with the FOPNL displayed in the stimuli in their experimental condition on a 5-point ordered labelled response scale.

The second part of the survey started with respondents rating three items about the usefulness, trustworthiness, and helpfulness of nutrition labelling on a seven-point Likert scale ranging from 1= "Strongly disagree" to 7= "Strongly agree". Subsequent analysis of the ratings showed these items to compose a reliable aggregated measure (Cronbach's $\alpha = 0.859$) of attitude towards nutritional labelling. The mean of this measure was 4.7 [IC95% = 4.6-4.8] indicating that respondents had on average a very positive evaluation of the value of nutritional labelling. Short versions of psychometric measures of concern about healthy eating (Moorman, 1990; Moorman & Matulich, 1993; Schifferstein & Oude Ophuis, 1998) and confidence in own food skills (Lavelle et al., 2017) were also administered in the second part of the survey. Order of presentation of measures and their items was randomized across respondents. Ratings of both measures were provided on seven-point Likert scales ranging from 1= "Strongly disagree" to 7= "Strongly agree", and from 1= "Strongly unconfident" to 7= "Strongly confident", respectively. Analysis of the ratings showed that three of the five items composing the concern about healthy eating measure, two of which were reverse coded, did not correlate late with the remaining ones, being thus excluded from the final measure. Cronbach's α for the remaining items was 0.731. The mean of this measure was 4.9 [IC95% = 4.8-5.1] indicating that

respondents were on average quite concerned with healthy eating. Lastly, the analysis of the ratings of the 11 items composing the confidence in own food skills' measure confirmed that these items composed a reliable aggregated measure (Cronbach's $\alpha = 0.747$). The mean of this measure was 5.2 [IC95% = 4.6-5.7] indicating that although the confidence of respondents in their own foods skills was on average quite high, there was still considerable heterogeneity in the sample regarding this construct.

The third and last section of the survey registered respondents' demographics, specifically their nationality, gender, highest level of education completed, employment status over the last 12 months and household income before tax over the last 12 months (in euros). A complete copy of the survey is provided in Appendix 1.

3.3 Population, sample, and recruitment

3.3.1 Population

The study population was defined as European residents with internet access, ranging from 18-67 years old, with neither food allergies nor gluten intolerance. To ensure that this target was selected, the survey entailed three initial screening questions about age, known food allergies and type of diet followed. Respondents reporting not meet one or more of the population requirements were sent to the end of survey, informed that they did not match the required study population, thanked, and dismissed. Data already collected were not entered in the analyses.

3.3.2 Sample and recruitment

The survey was disseminated to author contacts by personal communication, email, and social media, in order to recruit eligible participants. In this way, a voluntary (i.e., convenience) sample of $n=193$ individuals accepted the author's invitation to complete the study and provided informed consent to participation. A total of 143 respondents met the population requirements and completed the entire study, constituting thus the valid sample size and supplying data for the analyses. Table 1 tallies the number of participants whose data were not included in the analyses and the reasons for this.

Table 1: Respondents excluded from the final study sample and reasons.

Accessed survey	Did not provide consent	Not meeting age requirement	Reporting food allergies or gluten intolerance	Reporting a gluten-free diet	Incomplete answers	Valid sample size
193	1	4	26	2	17	143

A post-hoc study power analysis was conducted using G-Power. The study followed a mixed design approach with within-subject factors and between-subject factors. ANOVA: repeated measures, within-between interaction was chosen as the statistical test for the power analysis given the proposed research hypothesis. The number of valid responses was then entered, and G-Power calculates the statistical validity of this study. Results are shown in Appendix II, indicating that for an α of 0.05% and a medium effect size f of 0,25, $n=143$ should provide sufficient power for the intended analysis.

Table 2 presents the demographic, socioeconomic and dietary characteristics of the study sample.

Table 2: Characteristics of the study sample ($n=143$).

Age		
Mean [IC95%] = 28.0 years [26.9; 29.2]		
Range = [20-64 years]		
Variables	Frequencies	Percentages
Nationality		
German	112	78,3 %
Other	31	21,7 %
Total	143	
Gender		
Male	58	41.7%
Female	81	58.3%
Total	139	
Highest level of education		
Lower educational level (High school & vocational school)	13	9,1 %
Mid educational level (bachelor's degree)	83	58.0 %
Higher educational level (master's & PhD / doctorate)	47	32,9 %
Total	143	
Employment status over last 12 month		
Working (full time & part time summarized)	76	53.2 %
Student (students & working student summarized)	63	44,0 %
Not working (unemployed, looking for work & retired summarized)	4	2,8 %
Total	143	
Total household income before taxes		
Low (< 25.000 €)	70	60.5 %
Middle (25.000 – 49.999 €)	37	32.0 %
High (\geq 50.000 €)	9	7.5 %
Total	115	
Dietary pattern		
Omnivorous	77	53.8%
Meat-restricted	66	46.2%
Total	143	

The average age of respondents was 28 years, with a range of 20-64 years. Of the 143 responses, just over half were female and the rest were male. As expected, the majority of participants in the online survey were of German nationality, with the remaining people coming from all over Europe. Almost 60% of the sample group had an intermediate level of education, i.e., they have a bachelor's degree. Slightly more than 30% had a master's degree or a doctorate, while the rest belong to the group with a lower level of education. More than half of the sample was employed full-time or part-time in the last 12 months. The other half consists of full-time students or students with a student job; less than 3% of the total sample were retired or not employed and

looking for a job. The majority of the sample, namely 60%, had a rather low income of maximal 25.000 euros before taxes. Another third indicated to have an income between 25.000 – 49.999 euros and the remaining have an income above 50.000 euros. Regarding the dietary pattern slightly over 50% of the sample reported to be omnivorous, with most of the remainder reporting to restrict meat consumption.

3.4 Analysis

Sixty-nine of the 143 valid respondents were exposed to three snacks labelled with the Calorie Information, while 74 were exposed to the same stimuli with the Nutri-Score. Treatment allocation and product order presentation was randomized across respondents. Descriptive statistics were used to explore differences between products and treatments in the healthiness, taste, and energy content evaluations of stimuli, in their rankings according to their nutritional quality and in participants' familiarity with the corresponding FOPNL. The main dependent variables to be tested were the evaluations of the products displayed either with the Calorie Information or the Nutri-Score label in terms of their healthiness, taste, and energy content. Given that the study employed a mixed design with a within-subject factor (type of snack) and a between-subject factor (type of label), a mixed ANOVA was then conducted. Results showed that within-between interactions were not significant for any of the dependent variables tested (i.e., no significant product-on-label effects were present). Given these findings, and to test whether concern for healthy eating or food skills moderated the effects of FOPNL on any product evaluations, interaction terms were computed and entered together with the label factor and measures as predictors in separate simple linear regressions with evaluations as regressors.

4 RESULTS & DISCUSSION

This chapter presents and discusses the results of the statistical analyses conducted on the data collected during the experimental study, including the test of the research hypotheses earlier proposed.

4.1 Ranking of snacks according to nutritional quality

The results of the rankings of the three snack stimuli according to their nutritional quality by respondents are presented in Table 3, per type of FOPNL.

Table 3: Ranking of the three snacks tested according to their nutritional quality ($n=143$), per treatment.

	Calorie Labelling ($n=69$)			Nutri-Score ($n=74$)		
	Expected rank	Actual rank frequencies	Percentage in each rank	Expected rank	Actual rank frequencies	Percentage in each rank
Mixed Nuts	3 (656 kcal)	1st = 63 (3→1)	91.3	1 (A)	1st = 71 (1→1)	96.0
		2 nd = 2	2.9		2 nd = 1	1.3
		3 rd = 4	5.8		3 rd = 2	2.7
Cheese Flip-Its	1 (370 kcal)	1 st = 4	5.8	2 (B)	1 st = 2	2.7
		2nd = 51 (1→2)	73.9		2 nd = 30	40.5
		3 rd = 14	20.2		3rd = 42 (2→3)	56.8
Crunchy Peas	2 (451 kcal)	1 st = 2	2.9	3 (C)	1 st = 1	1.3
		2 nd = 16	23.1		2nd = 43 (3→2)	58.2
		3rd = 51 (2→3)	73.9		3 rd = 30	40.5

An overwhelming majority of respondent ranked the Mixed Nuts in the first position in terms of nutritional quality, irrespectively of the FOPNL displayed. This is spite of this snack displaying the highest energy value in the Calorie Labelling condition. This could be due to respondents misunderstanding term "nutritional quality", which could have been better explained in the questionnaire. Another reason for the counter-intuitive ranking could be the respondents assuming that nuts are generally healthier than cheese-flavoured or chocolate-flavoured snacks. This theory would imply mean that study respondents disregarded the information conveyed by the Calorie label, and rather made the ranking according to their existing knowledge and assumptions about the snacks pictured.

Somewhat more in line with what could be expected, based on the remaining stimuli in the Calorie Labelling condition, the Cheese Flip-Its, with the lowest energy content (370 kcal per 100g), were the snack with the second highest nutritional quality by nearly three-quarters of respondents, followed by the Crunchy Peas with 451 kcal per 100g in third place. In fact, these two stimuli were ranked at least in the correct order by most respondents.

Just like the ranking of snack products with the Calorie label, the ranking of products with the Nutri-Score also appeared to cause some uncertainty among respondents. The Cheese Flip-Its were supposed to be ranked second since they displayed a Nutri-Score of B, followed by the Crunchy Peas with a Nutri-Score of C. Contrary to this expectation, the products were mostly ranked the other way round. Notice however that there was considerably more variation in the rankings of these two snacks than in the Calorie Labelling condition. This outcome could be at least in part due to the less salient placement of the Nutri-Score in the packages, compared to the Calorie Information. However, this placement did not seem to affect as much the ranking of the Mixed Nuts.

Table 4 presents the ratings of the familiarity of respondents with the FOPNL displayed in the snack stimuli. The majority (ca. 60%) of respondents thought they were both familiar and knowledgeable about either type of nutritional labelling. Noticeably, nearly 25% of them stated that they are used to see the Nutri-Score scheme on products, know what it means and use it a lot to decide which foods to buy, against only 13% in the case of the Calorie Labelling. This is in line with the fact of Nutri-Score being much more commonly used in the EU than Calorie Labelling.

Table 4: Familiarity of respondents with the treatment FOPNL scheme.

<i>Are you familiar with the nutritional label displayed on the products?</i>	Familiarity with Calorie Labelling (n=69)	Percentage	Familiarity with Nutri-Score (n=74)	Percentage
1 “No, I have never noticed it before.”	4	5.8	1	1.3
2 “I have noticed it a few times, but I wasn’t sure about the meaning.”	12	17.4	12	16.2
3 “I am used to see it and I have a good idea about what it means.”	44	63.8	43	58.2
4 “I am used to see it, I know what it means, and I use it a lot to decide which foods to buy.”	9	13.0	18	24.3

4.2 Effects of FOPNL on snack evaluations and attitude towards nutritional labelling

Table 5 presents the means with 95% CI of respondents' evaluations of the snacks with regards to their taste, healthiness, and energy content, as well as their overall evaluation of the value of nutritional labelling, per type of FOPNL.

Table 5: Means with 95% CI of evaluations of the snacks per type of FOPNL.

		Mean [IC95%] <i>1 = Strongly disagree to 7 = Strongly agree</i>	
	Evaluations	Calorie Label (n=69)	Nutri-Score (n=74)
Mixed Nuts (A, 656 kcal)	Taste	4.9 [4.6; 5.2]	5.4 [5.1; 5.6]
	Healthiness	5.9 [5.7; 6.2]	6.1 [5.9; 6.3]
	Energy Content	6.1 [5.9; 6.4]	6.0 [5.7; 6.2]
Cheese Flip-Its (B, 370 kcal)	Taste	5.1 [4.7; 5.5]	5.2 [4.8; 5.5]
	Healthiness	3.3 [3.0; 3.6]	3.5 [3.1; 3.8]
	Energy Content	4.8 [4.5; 5.1]	4.5 [4.1; 4.9]
Crunchy Peas (C, 451 kcal)	Taste	5.7 [5.4; 6.0]	5.5 [5.2; 5.8]
	Healthiness	3.1 [2.8; 3.4]	3.1 [2.8; 3.4]
	Energy Content	5.5 [5.3; 5.7]	4.9 [4.5; 5.3]
Attitude towards nutritional labelling ($\alpha = 0.859$)	<i>I fully trust the information given through nutritional labels</i>	4.9 [4.6; 5.1]	4.5 [4.1; 4.8]
	<i>A nutritional label is really useful for my food decision in the supermarket</i>		
	<i>Food labels help me a lot to have a healthy and well-balanced nutrition</i>		

The Crunchy Peas had the highest taste ratings, on average, irrespectively of type of FOPNL, but differences in this variable were not significant across snacks. Meanwhile, the Mixed Nuts had by far the highest healthiness ratings, which aligns well with the rankings of the nutritional quality earlier presented. In contrast, the Crunchy Peas were deemed to be the least healthy product, followed closely by the Cheese Flip-Its, but without significant differences. The Mixed Nuts also had the highest ratings in energy content, on average, irrespectively of the label attached. This finding does not align with the ranking results presented earlier. Finally, respondents exposed to the snacks labelled with Calorie Information were on average more positive about nutritional labelling than those exposed to the Nutri-Score. However, these differences were not significant.

Importantly, the results in Table 5 show that the type of FOPNL did not seem to have a significant impact on respondents' evaluations, for almost all the snacks and attributes assessed. This can be seen by looking at the lack of overlap between confidence intervals. There are two exceptions: the taste of the Mixed Nuts and the energy content of the Crunchy Peas. On average, respondents exposed to the Nutri-Score rated the taste of the Mixed Nuts significantly higher

than those exposed to the Calorie Labelling. Meanwhile, those exposed to the Nutri-Score rated the energy content of the Crunchy Peas significantly lower than those exposed to the Calorie Labelling. These findings were confirmed by the results of the Mixed ANOVA performed, the results of which are presented in Appendix 3. For ease of visualization, Figures 8-10 plot respectively the differences in the estimated marginal means of taste, healthiness and energy value evaluations of the three snacks between the two types of FOPNL tested.

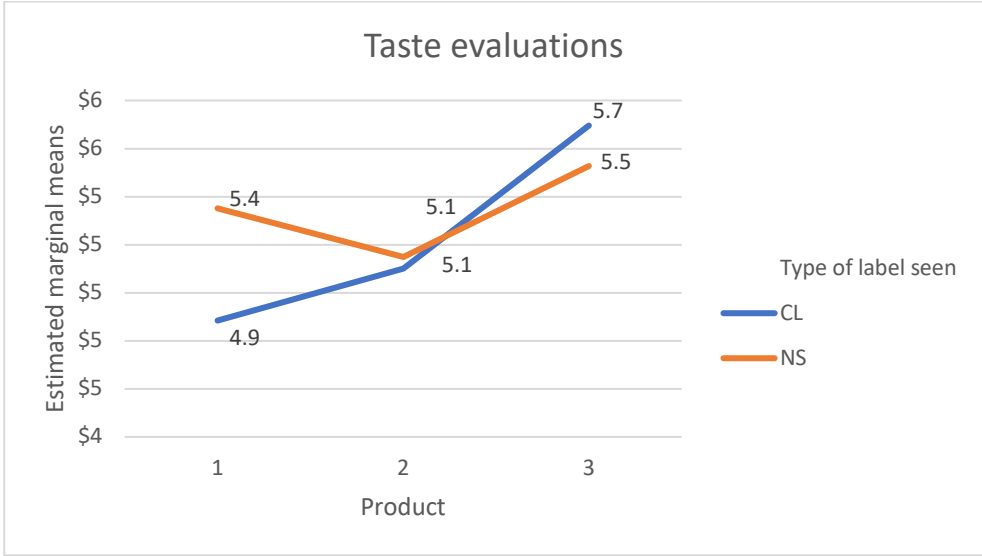


Figure 8: Mixed ANOVA estimated marginal mean differences in the evaluations of the taste of the snack stimuli (1= Mixed Nuts; 2= Cheese Flip Its; 3= Crunchy Peas) according to type of FOPNL (Blue: Calorie Labelling; Orange: Nutri-Score) (n=143, ratings on a 7-point Likert type scale).

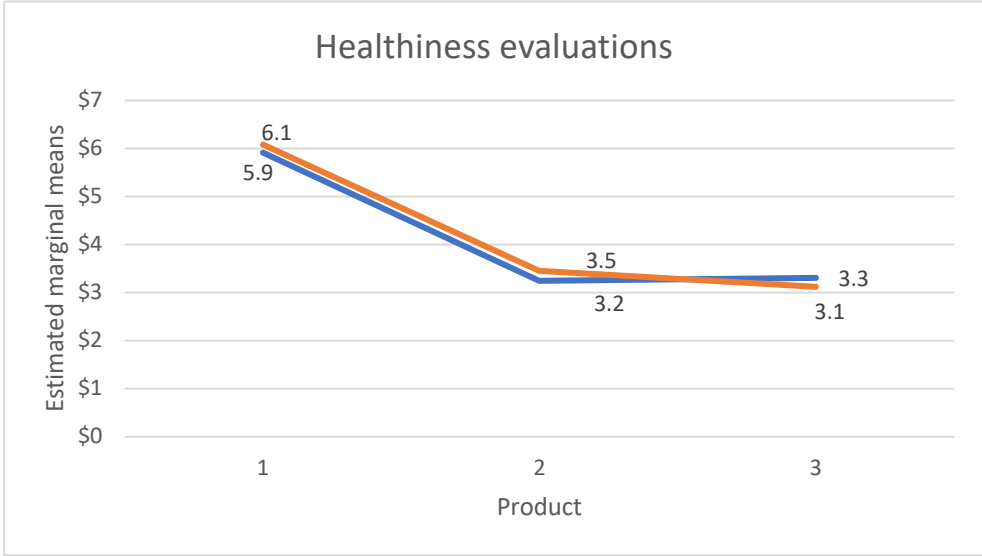


Figure 9: Mixed ANOVA estimated marginal mean differences in the evaluations of the healthiness of the snack stimuli (1= Mixed Nuts; 2= Cheese Flip Its; 3= Crunchy Peas) according to type of FOPNL (Blue: Calorie Labelling; Orange: Nutri-Score) (n=143, ratings on a 7-point Likert type scale).

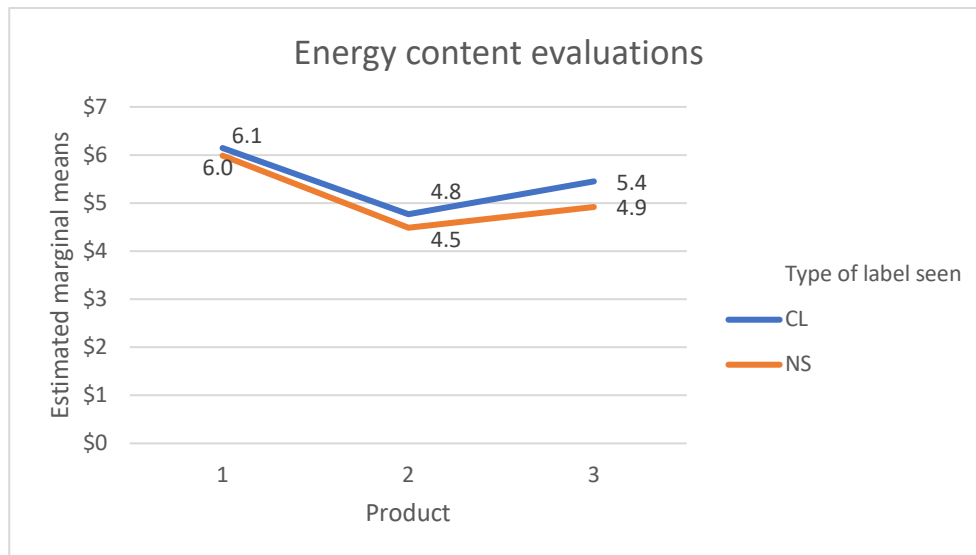


Figure 10: Mixed ANOVA estimated marginal mean differences in the evaluations of the energy value of the snack stimuli (1= Mixed Nuts; 2= Cheese Flip Its; 3= Crunchy Peas) according to type of FOPNL (Blue: Calorie Labelling; Orange: Nutri-Score) (n=143, ratings on a 7-point Likert type scale).

4.3 Influence of concern with healthy eating and confidence in own food skills

Simple linear regressions entering type of FOPNL, of concern for healthy eating/food skills and interaction terms as independent variables and ratings of taste, healthiness and energy value as dependent variables were estimated for each type of snack tested. Results showed that only two interactions were significant at $p = 0.05$, and both in the case of the Mixed Nuts: concern for healthy eating moderated the effects of FOPNL on the ratings of healthiness, while food skills moderated these effects on the ratings of taste. For ease of visualization, Figures 11-12 plot the variations in the means of the ratings of healthiness and taste of Mixed Nuts with the terciles of respondents' reported concern for healthy eating and confidence in own food skills.

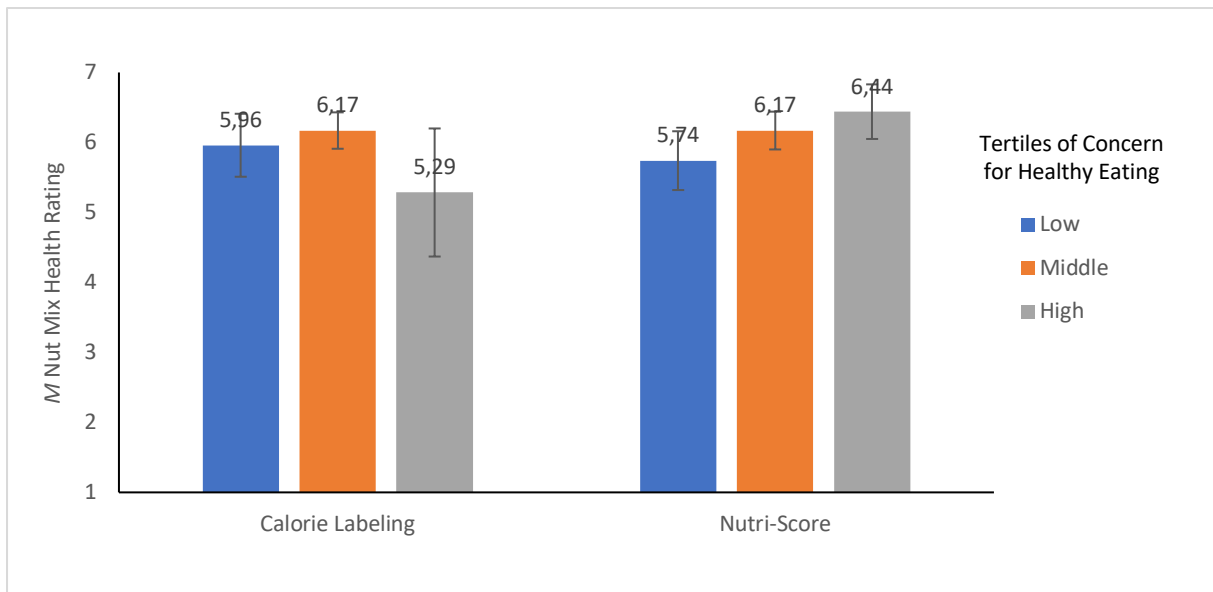


Figure 11: Variations in the means of evaluations of the healthiness of Mixed Nuts with tertiles of concern for healthy eating (n=143, ratings on a 7-point Likert type scale).

Results shown in Figure 11 indicate that while respondents' ratings of the healthiness of the Mixed Nuts increased with increasing levels of their concern for healthy eating, for those exposed to snacks labelled with the Nutri-Score, the same did not happen for those exposed to the Calorie Information. This difference in response is stronger when comparing respondents with a low versus high level of concern for healthy eating: on average, the healthiness rating of respondents seeing the Calorie Labelling on the front-of-pack decreases, while increasing for those seeing the Nutri-Score increases them.

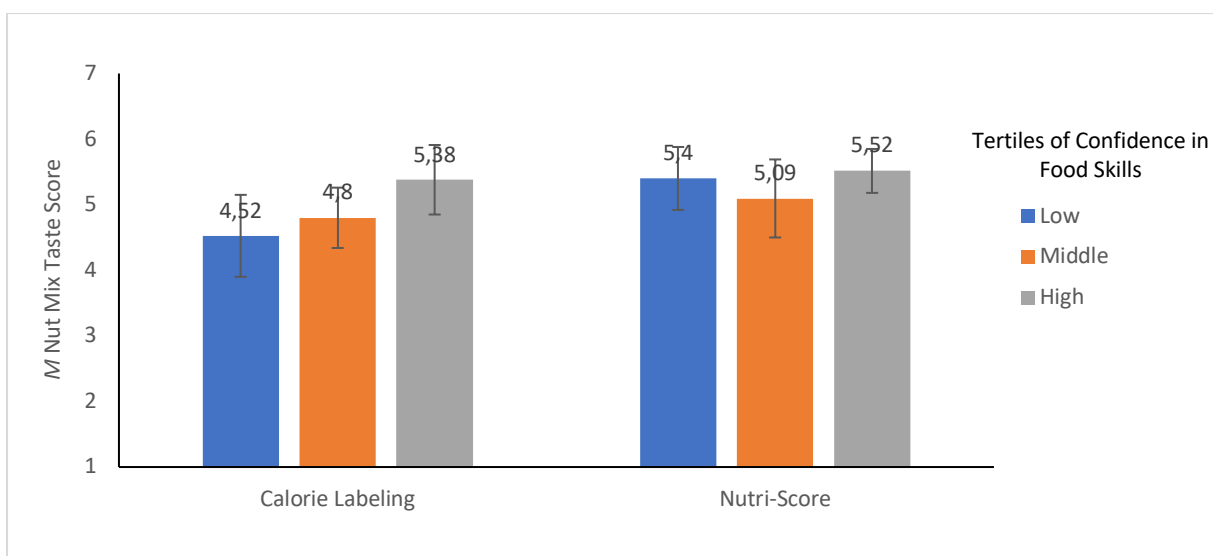


Figure 12: Variations in the means of evaluations of the taste of Mixed Nuts with tertiles of confidence in own food skills (n=143, ratings on a 7-point Likert type scale).

On the other hand, the results shown in Figure 12 indicate that while respondents' ratings of the taste of the Mixed Nuts increased with increasing levels of confidence in own food skills, for those exposed to snacks labelled with Calorie Information, they remained fairly constant among those exposed to the Nutri-Score. The difference in response in the case of exposure to snacks labelled with Calorie Information is strongest when comparing respondents with high level of confidence in own skills with the remainder.

4.4 Discussion

Respondents' knowledge or beliefs about the nutritional quality of foods did not seem to be much informed by nutrition labelling contents, no matter what FOPNL system was used. This can be concluded because the rankings of the three snacks tested according to their nutritional quality differed widely from what would be expected, given the type of information provided by either the Calorie Labelling or the Nutri-Score. This is likely to imply that respondents were not heading too much to this information and rather relied more on their own previous ideas and beliefs about what is healthy and what is not and what is of good nutritional quality and what is not. The level of familiarity of participants with the treatment labels did not differ among them. So, it is unlikely that this influenced the ranking.

Overall, the Mixed ANOVA results showed that within-subject interactions were not significant for any of the main dependent variables tested (i.e., no significant product-on-label effects were present). This implies that, contrary to part of Hypothesis H1, the Nutri-Score did not increase the perceived healthiness of a food relatively to Calorie Labelling, as was predicted. Moreover, the attitude towards nutritional labelling was generally more positive when snacks were labelled with Calorie information. So, the Nutri-Score does not seem to be a better system to inform people about healthier food choices and shows therefore no great improvement to Calorie Labelling in that respect. However, in relation to Calorie Labelling, the Nutri-Score has the potential to change other evaluations of products, related to hedonic and nutritional qualities, which may not have been intended. This could be seen in the case of the taste evaluations of the Mixed Nuts or energy content ratings of the Crunchy Peas. Therefore, the conclusion is that Hypothesis 1, stating: *The nutritional quality and healthiness of food products are more accurately or positively evaluated when these are labelled with the Nutri-Score than with*

Calorie Information, whereas the reverse occurs relatively to evaluations of energy content and taste, was for a large extent not confirmed by study findings.

The simple linear regression results of concern for healthy eating/food skills and interaction terms as independent variables and ratings of taste, healthiness and energy value as dependent variables showed that there were only two significant findings: the score on the healthy eating scale and the score on the food skills scale have a significant influence on their ratings of the mixed nuts. Besides these two exceptions the influence of participants' interest in healthy eating and confidence in food skills has no overall significant influence on their ratings of the snack products.

The participants with higher healthy eating have an increased rating of healthiness of the mixed nuts displayed with the Nutri-Score. The participants exposed to the snack products with the Calorie label evaluated the healthiness of mixed nuts with terciles of concern for healthy eating differently as can be seen in Figure 11. So, for this specific case about the mixed nuts, the evaluations of the healthiness and with terciles of concern for healthy eating Hypothesis 2, is true. Which means that the participants with a greater interest in healthy eating did recognize the label display on the mixed nuts and evaluated the healthiness of this product accordingly. Since the mixed nuts are labelled with the Nutri-Score A and have 656 kcal per 100g which is in comparison to the other two snack products the highest energy value in the Calorie Labelling condition.

The second exception is that the score on the food skills scale have a significant influence on the taste ratings of the mixed nuts in this study. The taste of the mixed nuts increased among the participants who saw the Calorie label and have higher confidence in food skills. For the Nutri-Score the respondents' ratings of the taste of the Mixed Nuts remained fairly constant with the different levels of food skills. This result is interesting and should be further studied since it is surprising that the taste rating with higher food skills and the use of the calorie label (656 kcal per 100g) is higher than the use of the Nutri-Score.

5 CONCLUSIONS

After analyzing all the data and testing the hypotheses, this chapter explains the conclusions and key findings of this study. In addition, the results provide important insights as well as impulses for future research and the limitations encountered during the study.

5.1 Conclusions and implications

Obesity is a global problem and the increase in poor eating habits is a major cause (World Health Organization, 2021). To address this issue, front-of-pack nutrition labelling (FOPNL), such as Calorie labelling or Nutri-Score, is being introduced by regulators around the world to help consumers make informed, healthier choices (Dubois et al., 2021).

Based on the background information, the aim of this study was to investigate the influence of individual food skills and the orientation towards healthy eating on the evaluation of nutritional labelling (Calorie Labelling vs Nutri-Score). To this end, a literature review was first conducted to determine the current state of research in this area. Based on this research, three hypotheses were formulated. In order to test the research question and hypotheses, an online experiment was conducted in the form of an online survey in which 143 participants took part. In the experiment conducted, the effect of the two different labels (Calorie Labelling vs Nutri-Score) was tested by adding the stimuli to three different snack products (Mixed Nuts, Cheese Flip-Its and Crunchy Peas) and asking the participants to rate the products in random order with one of the labels in terms of their taste, healthiness, and energy content (a measure of nutritional quality). In addition, the online questionnaire asked about individuals' level of concern about healthy eating and confidence in own food skills.

The results of the online experiment showed that the participants in the study generally ignored the label and tended to judge the displayed products according to their own knowledge and beliefs. In rare cases, participants used the labels in unexpected ways, such as the taste of nuts or the energy content of crunchy peas. The mixed nuts are an interesting aspect for further studies, because in the case of the mixed nuts there were the only two significant findings in relation to the participants' interest in healthy eating and confidence in food skills.

Although this study did not deliver the expected results regarding the superiority of the Nutri-Score, as an evaluative summary system of food's nutritional and health value, over more descriptive, single ingredient fact-based FOPNL systems, it did provide some unexpected findings. For example, that labels can even influence how people think about the label itself if they do not align with people's beliefs or prior knowledge which can be seen in the example of

the mixed nuts. Further the evaluation of the label can depend heavily on the product displayed and not on the used label.

These results of the study provide valuable insights for scientific and business practice. Overall, the literature review has already made it evident that the actual effect of FOPNLs is still unclear. This dissertation found that the labels do not really work as expected and people trust their own mind and knowledge more than the nutritional information on the snack products. Therefore, it is difficult to educate consumers through nutritional labelling or stickers. Changing people's mindset obviously requires more than just food labelling, especially given that their motivations and self-efficacy to eat healthily and mastery of the necessary food knowledge and skills necessary to accomplish are very heterogeneous. The finding of this study in what respects the testing of hypotheses H2 and H3 indicate that these individual differences play an important role in moderating the effects of FOPNL on evaluations of the healthiness and taste of some foods.

One solution to overcoming these difficulties while tacking differences in individuals could be personal counselling in the form of coaching. This solution would be relevant for people who are very overweight or obese. It is important for policy makers and nutritionists to note that systems such as the Nutri-Score or calorie labelling could be useful, but the systems need to be more universal so that they are not so extremely dependent on the product. For companies that produce snack products or food products in general and are considering adding food labelling to their product, it is crucial to test how it is really perceived by consumers before adding the labelling. Because as seen in this study, the evaluation and perception of labelling often deviates from expectations. Therefore, food producer and nutritionist must be choosing and testing the label carefully before adding it to any product.

5.2 Limitations and future research

The dissertation is aiming to develop a deeper understanding of the correlation of food skills, health orientation and the evaluation of two food labels. Although a detailed literature review and data analysis process was conducted, this dissertation shows several limitations that need to be addressed.

The conducted study here consisted of two groups within the experiment: one group was exposed to the snack products with the Nutri-Score label and the other group saw the calorie label display on the packages. Future research could be done by adding one control group to

the experiment who is going to evaluate the products and items without the display of any labels. This would enable a more detailed analysis of what exactly consumers already think about the products without the additional influence of labels. As this dissertation has identified the importance of expectations and prior beliefs in consumer decision making, this is another important and interesting factor to be analyzed in future research.

Another aspect that limits this study is the fact that the majority of the sample belongs to the German population and is therefore not representative of all Europeans. As a consequence, more nationalities would have to be consulted and analyzed for more far-reaching research findings. Another interesting area that should be investigated further is the participants' body mass index and their respective eating and dieting behavior. These are both aspects that can influence the evaluation of the products and labels.

The images included in the online experiment also offer some potential for improvement. The Nutri-Score label was located on the bottom of the three snack packages. However, there is a limitation here, as the Nutri-Score label was positioned in the lower quarter of the packaging for all three products, but on the left-hand side for the nut mix and crunchy peas and on the right-hand side for the cheesy flips. This means that the label may have been perceived differently for the three products. This restriction is even more extreme in the comparison between Nutri-Score and calorie label. In contrast to the Nutri-Score, the calorie label was placed in the upper quarter of the packaging on the right-hand side. For subsequent studies, it could be ensured that the comparable labels are placed in exactly the same position on the packaging, so that the visibility and perception is not influenced by different positions. Nevertheless, it should be noted that this is not how foods are currently being labelled in the market most of the times.

A general limitation of the exposure of the labelled images is that this study does not include an element that measures whether participants actually paid attention to and recognized the labels. In the literature review, some studies that monitor label perception include the eye tracking function. This could also be a technique that could be included in future studies to actually measure whether or not participants pay attention to the labels displayed.

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Appendix

Appendix 1: The Survey Flow

Standard: Introduction to the survey (2 Questions)

Standard: Part 1: Screening Questions (3 Questions)

Standard: Intro Part 2 (1 Question)

BlockRandomizer: 1 - Evenly Present Elements

Block: Calorie Label (5 Questions)

Block: Nutri Score (5 Questions)

Standard: Part 2: General questions about nutritional labels. (1 Question)

Standard: Part 3: Person differences – food skills & health orientation scales (2 Questions)

Standard: Part 4: Demographics (5 Questions)

Page Break

Start of Block: Introduction to the survey

Dear participant,

Thank you for participating in my **study about food consumption and nutrition**. I am Luisa Geiger, and I am conducting this study as part of my master's thesis at the Católica Lisbon School of Economics under the supervision of Ana Isabel Costa.

The survey, which takes about 8 minutes to complete, consists of a few questions. Your honest answers are crucial, and please be assured that the data collected will be treated confidentially and anonymously. The information will be used exclusively for research purposes as part of this thesis.

Please answer the survey in one take without any interruptions.

If you have any questions or comments, please feel free to contact me at s-lgeiger@ucp.pt.

I highly appreciate your input. Thank you for taking the time to participate in this study.

Agreement Do you consent to participate this study?

YES, I consent. (1)

NO, I do not consent. (2)

Skip To: End of Survey If Agreement = 2

End of Block: Introduction to the survey

Start of Block: Part 1: Screening Questions

Age Please tell us your age:

▼ Less than 18 years (51) ... More than 65 years (52)

Skip To: End of Survey If Age = 51

Skip To: End of Survey If Age = 52



Food alg Do you have any food allergies?

- Yes (0)
- No (1)

Skip To: End of Survey If Food alg = 0

T Diet What is your type of diet?

- Omnivorous (eat everything) (5)
- Flexitarian (7)
- Vegetarian (2)
- Vegan (1)
- Gluten Free (3)
- Other (6) _____

Skip To: End of Survey If T Diet = 3

End of Block: Part 1: Screening Questions

Start of Block: Intro Part 2

Intro We will now ask you to give us your opinion about some snack products you might find in the market.

We will show you 3 different kind of snacks and ask you to evaluate each one of them independently according to your personal preference.

The given 3 snacks may differ in flavour, composition or nutritional value as you will be able to see by the information provided on the packaging. Please view now each one of them carefully, consider all its characteristics, and give us your honest opinion about it.

End of Block: Intro Part 2

Start of Block: Calorie Label



Nuts CL

	Strongly disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree nor disagree (4)	Somewhat agree (5)	Agree (6)	Strongly agree (7)
This product is tasty (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
This product is healthy (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
This product has a high energy content (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



Flips CL

	Strongly disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree nor disagree (4)	Somewhat agree (5)	Agree (6)	Strongly agree (7)
This product is tasty (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
This product is healthy (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
This product has a high energy content (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



Crunchy P CL

	Strongly disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree nor disagree (4)	Somewhat agree (5)	Agree (6)	Strongly agree (7)
This product is tasty (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
This product is healthy (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
This product has a high energy content (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



Rank NS Please "drag-and-drop" to rank these 3 products according to their relative nutritional quality, from from **the highest nutritional quality (1) to the lowest nutritional quality (3):**

- _____ (1)
- _____ (2)
- _____ (3)



Fam. CL

Are you familiar with this type of nutritional labelling called "Calorie Labeling"?

- No, I never noticed it before. (1)
- I noticed it a few times, but I wasn't sure about the meaning. (2)
- I am used to see it and I have a good idea about what it means. (3)
- I used to see it, I know what it means, and I use it a lot to decide which foods to buy. (4)

End of Block: Calorie Label

Start of Block: Nutri Score



Crunchy Peas NS

	Strongly disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree nor disagree (4)	Somewhat agree (5)	Agree (6)	Strongly agree (7)
This product is tasty (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
This product is healthy (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
This product has a high energy content (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



Nut Mic NS

	Strongly disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree nor disagree (4)	Somewhat agree (5)	Agree (6)	Strongly agree (7)
This product is tasty (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
This product is healthy (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
This product has a high energy content (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



Flips NS

	Strongly disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree nor disagree (4)	Somewhat agree (5)	Agree (6)	Strongly agree (7)
This product is tasty (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
This product is healthy (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
This product has a high energy content (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



Rank NS Please "drag-and-drop" to rank these 3 products according to their relative nutritional quality, from from **the highest nutritional quality (1) to the lowest nutritional quality (3)**:

- _____ (1)
- _____ (2)
- _____ (3)



Fam NS

Are you familiar with this type of nutritional labelling called "Nutri-Score"?

- No, I never noticed it before. (1)
- I noticed it a few times, but I wasn't sure about the meaning. (2)
- I am used to see it and I have a good idea about what it means. (3)
- I used to see it, I know what it means, and I use it a lot to decide which foods to buy. (4)

End of Block: Nutri Score

Start of Block: Part 2: General questions about nutritional labels.



Food label eval. Please indicate to which extent you **agree or disagree** to the following statements regarding food labeling:

	Strongly disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree nor disagree (4)	Somewhat agree (5)	Agree (6)	Strongly agree (7)
I fully trust the information given through nutritional labels. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A nutritional label is really useful for my food decision in the supermarket. (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Food labels help me a lot to have a healthy and well-balanced nutrition. (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

End of Block: Part 2: General questions about nutritional labels.



Food Skills Please indicate how confident you feel in performing each of the following activities: scale from **“Strongly Confident”** to **“Strongly Unconfident.”**

	Strongly unconfident (1)	Unconfident (2)	Somewhat unconfident (3)	Neither unconfident nor confident (4)	Somewhat confident (5)	Confident (6)	Strongly confident (7)
Planning meals in advance (12)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Preparing meals in advance (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Following recipes when cooking (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cooking a healthy meal with only few ingredients on hand (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Shopping for food with a grocery list (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Shopping for food with specific meals in mind (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Shopping for healthy food (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reading the best-before date on food (8)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Reading
the
storage
and use-
by
informatio
n on food
packets
(9)



Reading
the
nutrition
informatio
n on food
labels (10)



Adjusting
your
meals to
nutrition
advice
about a
healthy
diet (13)



Health scale Please indicate to which extent you **agree or disagree** to the following statements:

	Strongly disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree nor disagree (4)	Somewhat agree (5)	Agree (6)	Strongly agree (7)
I am somebody who eats healthy almost all the time (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am somebody who is very concerned about the impact of food on health (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I don't want to worry all the time about whether I am eating healthy or not (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I think that people should not spend too much time or energy on trying to eat healthy (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I feel like I should become more knowledgeable about healthy eating (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

End of Block: Part 3: Person differences – food skills & health orientation scales

Start of Block: Part 4: Demographics

Nationality Please state your nationality:

Page Break

Gender How would you describe yourself?

- Male (1)
 - Female (2)
 - Non-binary / third gender (3)
 - Prefer not to say (4)
-

Page Break

Education What is the highest level of education you have completed?

- No formal education (1)
 - High school diploma (2)
 - Vocational school (3)
 - Bachelors degree (4)
 - Masters degree (5)
 - Doctorate / PhD (6)
-

Page Break

Employment What best describes your employment status over the last 12 months?

- Working full time (1)
- Working part time (2)
- Student (6)
- Working student (3)
- Unemployed and looking for work (4)
- Stay at home parent (5)
- Retired (7)
- Other (8) _____

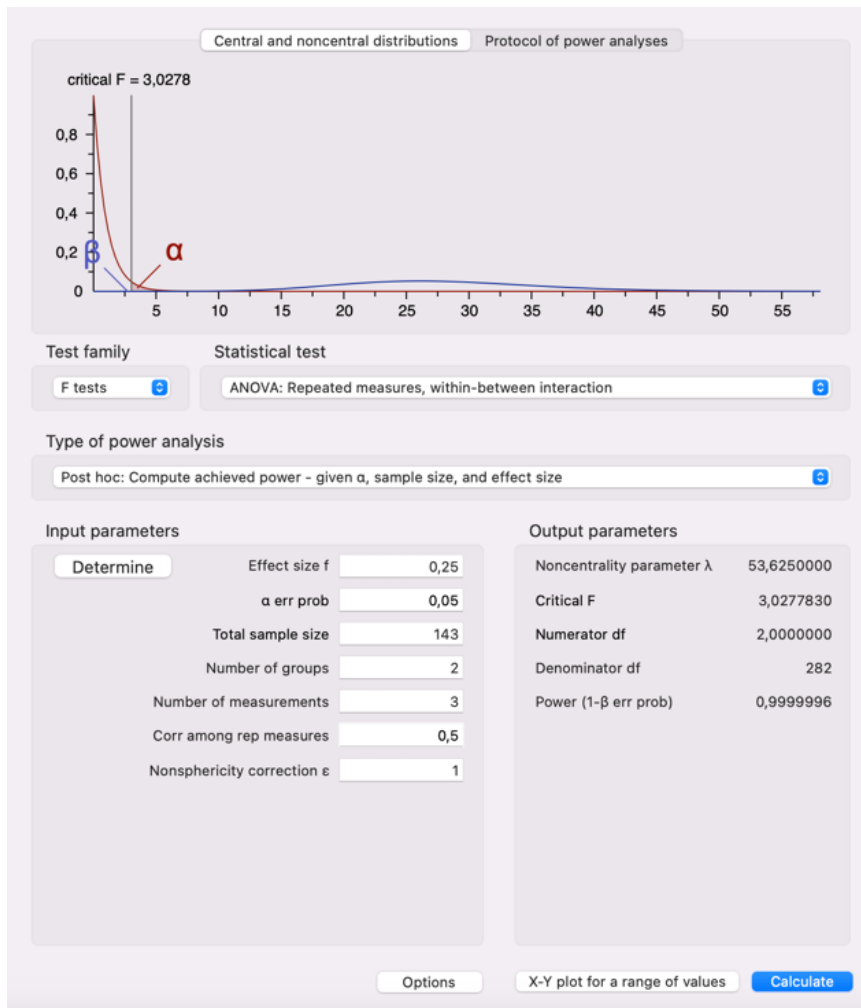
Page Break

Income What is your total household income before taxes during the past 12 month in Euro?

- Less than 25.000€ per year (1)
- 25.000 – 49.999 € per year (2)
- 50.000 – 99.999 € per year (3)
- 100.000 – 199.999 € per year (4)
- More than 200.000 € per year (5)
- Prefer not to say (6)

End of Block: Part 4: Demographics

Appendix 2: G-Power results



Appendix 3: Relevant SPSS output

Scale reliability: Cronbach alpha

Label evaluations (3 items):

Estatísticas de confiabilidade

Alfa de Cronbach	Alfa de Cronbach com base em itens padronizados	N de itens
,859	,859	3

Estatísticas de item de resumo

	Média	Mínimo	Máximo	Intervalo	Máximo / Mínimo	Variância	N de itens
Médias de item	4,662	4,566	4,846	,280	1,061	,025	3
Variâncias de item	2,307	2,202	2,360	,158	1,072	,008	3

Healthy eating orientation (2 items):

Estatísticas de confiabilidade

Alfa de Cronbach	Alfa de Cronbach com base em itens padronizados	N de itens
,722	,731	2

Descritivas

COMPUTE Mean_HealthyEatingConcern=MEAN (Health_scale_1, Health_scale_2)	Estatística		Estadística do teste Padrão
	Média		4,9406
95% de Intervalo de Confiança para Média	Limite inferior	4,7606	
	Limite superior	5,1205	
5% da média aparada		4,9578	
Mediana		5,0000	
Variância		1,185	
Erro Padrão		1,08850	
Mínimo		2,50	
Máximo		7,00	
Amplitude		4,50	
Amplitude interquartil		1,50	
Assimetria		-,315	,203
Curtose		-,457	,403

Food skills (11 items):

Estatísticas de confiabilidade

Alfa de Cronbach	Alfa de Cronbach com base em itens padronizados	N de itens
,745	,747	11

Estatísticas de item de resumo

	Média	Mínimo	Máximo	Intervalo	Máximo / Mínimo	Variância	N de itens
Médias de item	5,177	4,559	5,734	1,175	1,258	,155	11
Variâncias de item	1,786	,832	2,584	1,752	3,105	,256	11

Taste evaluations

Testes de efeitos dentre-sujeitos

Medida: TasteEval

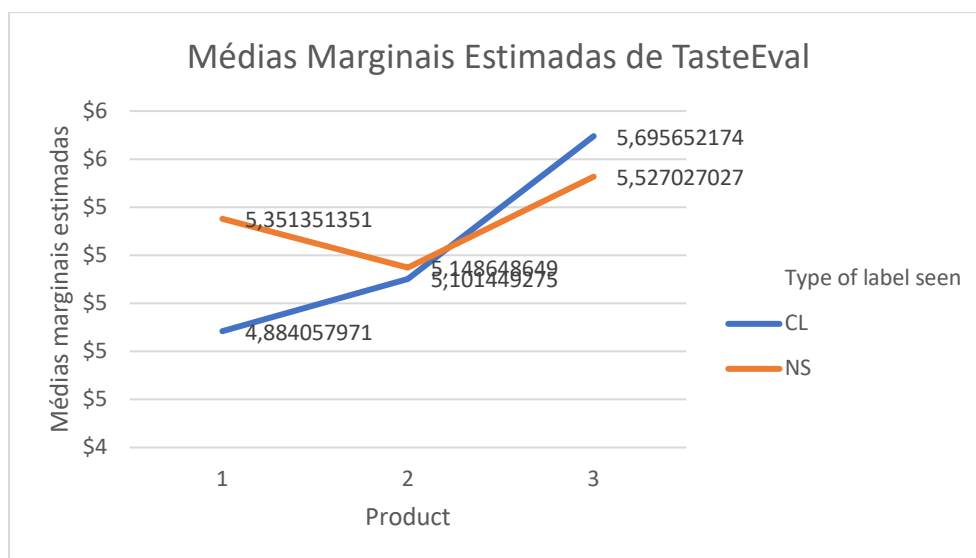
Origem		Tipo III Soma dos Quadrados	df	Quadrado Médio	Z	Sig.	Eta parcial quadrado
Product	Esféricidade considerada	22,862	2	11,431	5,973	,003	,041
	Greenhouse-Geisser	22,862	1,890	12,097	5,973	,003	,041
	Huynh-Feldt	22,862	1,928	11,856	5,973	,003	,041
	Limite inferior	22,862	1,000	22,862	5,973	,016	,041
Product * FOPNL	Esféricidade considerada	7,468	2	3,734	1,951	,144	,014
	Greenhouse-Geisser	7,468	1,890	3,952	1,951	,147	,014
	Huynh-Feldt	7,468	1,928	3,873	1,951	,146	,014
	Limite inferior	7,468	1,000	7,468	1,951	,165	,014
Erro(Product)	Esféricidade considerada	539,670	282	1,914			
	Greenhouse-Geisser	539,670	266,468	2,025			
	Huynh-Feldt	539,670	271,892	1,985			
	Limite inferior	539,670	141,000	3,827			

Testes de efeitos entre sujeitos

Medida: TasteEval

Variável transformada: Média

Origem	Tipo III Soma dos Quadrados	df	Quadrado Médio	Z	Sig.	Eta parcial quadrado
Intercepto	11966,477	1	11966,477	6367,618	,000	,978
FOPNL	1,424	1	1,424	,758	,386	,005
Padrão	264,977	141	1,879			



Healthiness evaluations

Testes de efeitos dentre-sujeitos

Medida: HealthEval

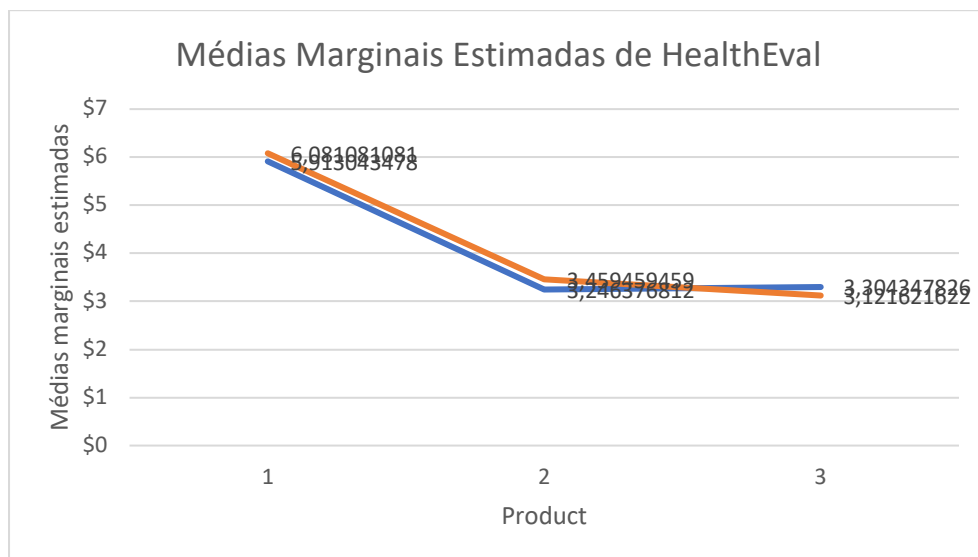
Origem		Tipo III Soma dos Quadrados	df	Quadrado Médio	Z	Sig.	Eta parcial quadrado
Product	Esféricidade considerada	702,803	2	351,402	264,401	,000	,652
	Greenhouse-Geisser	702,803	1,970	356,681	264,401	,000	,652
	Huynh-Feldt	702,803	2,000	351,402	264,401	,000	,652
	Limite inferior	702,803	1,000	702,803	264,401	,000	,652
Product * FOPNL	Esféricidade considerada	3,353	2	1,677	1,261	,285	,009
	Greenhouse-Geisser	3,353	1,970	1,702	1,261	,285	,009
	Huynh-Feldt	3,353	2,000	1,677	1,261	,285	,009
	Limite inferior	3,353	1,000	3,353	1,261	,263	,009
Erro(Product)	Esféricidade considerada	374,791	282	1,329			
	Greenhouse-Geisser	374,791	277,826	1,349			
	Huynh-Feldt	374,791	282,000	1,329			
	Limite inferior	374,791	141,000	2,658			

Testes de efeitos entre sujeitos

Medida: HealthEval

Variável transformada: Média

Origem	Tipo III Soma dos Quadrados	df	Quadrado Médio	Z	Sig.	Eta parcial quadrado
Intercepto	7513,942	1	7513,942	3654,534	,000	,963
FOPNL	,468	1	,468	,228	,634	,002
Padrão	289,904	141	2,056			



Energy content evaluations

Testes de efeitos dentre-sujeitos

Medida: EnergyEval

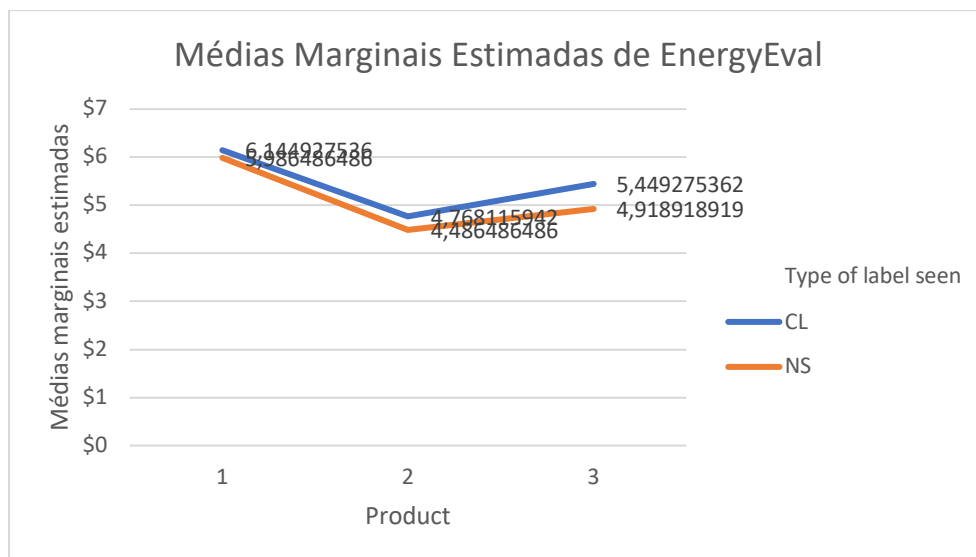
Origem		Tipo III Soma dos Quadrados	df	Quadrado Médio	Z	Sig.	Eta parcial quadrado
Product	Esfericidade considerada	150,265	2	75,132	52,743	,000	,272
	Greenhouse-Geisser	150,265	1,934	77,684	52,743	,000	,272
	Huynh-Feldt	150,265	1,975	76,097	52,743	,000	,272
	Limite inferior	150,265	1,000	150,265	52,743	,000	,272
Product * FOPNL	Esfericidade considerada	2,563	2	1,282	,900	,408	,006
	Greenhouse-Geisser	2,563	1,934	1,325	,900	,405	,006
	Huynh-Feldt	2,563	1,975	1,298	,900	,407	,006
	Limite inferior	2,563	1,000	2,563	,900	,344	,006
Erro(Product)	Esfericidade considerada	401,707	282	1,424			
	Greenhouse-Geisser	401,707	272,737	1,473			
	Huynh-Feldt	401,707	278,425	1,443			
	Limite inferior	401,707	141,000	2,849			

Testes de efeitos entre sujeitos

Medida: EnergyEval

Variável transformada: Média

Origem	Tipo III Soma dos Quadrados	df	Quadrado Médio	Z	Sig.	Eta parcial quadrado
Intercepto	12001,241	1	12001,241	4370,373	,000	,969
FOPNL	11,209	1	11,209	4,082	,045	,028
Padrão	387,192	141	2,746			



ANOVA taste of mixed nuts

ANOVA^a

Modelo		Soma dos Quadrados	df	Quadrado Médio	Z	Sig.
1	Regressão	13,925	3	4,642	3,295	,022 ^b
	Resíduo	195,810	139	1,409		
	Total	209,734	142			

a. Variável Dependente: NUTS_Taste

b. Preditores: (Constante), HealthyEatingConcern, Type of label seen, Food Skills

Coefficientes^a

Modelo		Coefficients não padronizados		Coefficients padronizados		Sig.
		B	Erro Erro	Beta	t	
1	(Constante)	3,613	,755		4,788	,000
	Type of label seen	,458	,199	,189	2,299	,023
	Food Skills	,103	,159	,060	,650	,517
	HealthyEatingConcern	,150	,104	,134	1,444	,151

a. Variável Dependente: NUTS_Taste

ANOVA taste of cheesy flips

ANOVA^a

Modelo		Soma dos Quadrados	df	Quadrado Médio	Z	Sig.
1	Regressão	,798	3	,266	,104	,958 ^b
	Resíduo	354,936	139	2,553		
	Total	355,734	142			

a. Variável Dependente: FLIPS_Taste

b. Preditores: (Constante), HealthyEatingConcern, Type of label seen, Food Skills

Coeficientes^a

Modelo		Coeficientes não padronizados		Coeficientes padronizados	t	Sig.
		B	Erro Erro	Beta		
1	(Constante)	4,933	1,016		4,856	,000
	Type of label seen	,039	,268	,012	,144	,886
	Food Skills	-,036	,214	-,016	-,169	,866
	HealthyEatingConcern	,073	,140	,050	,523	,602

a. Variável Dependente: FLIPS_Taste

ANOVA taste of crunchy peas

ANOVA^a

Modelo		Soma dos Quadrados	df	Quadrado Médio	Z	Sig.
1	Regressão	3,001	3	1,000	,567	,637 ^b
	Resíduo	245,069	139	1,763		
	Total	248,070	142			

a. Variável Dependente: PEAS_Taste

b. Preditores: (Constante), HealthyEatingConcern, Type of label seen, Food Skills

Coeficientes^a

Modelo		Coeficientes não padronizados		Coeficientes padronizados	t	Sig.
		B	Erro Erro	Beta		
1	(Constante)	5,101	,844		6,043	,000
	Type of label seen	-,152	,223	-,058	-,684	,495
	Food Skills	,186	,178	,100	1,044	,298
	HealthyEatingConcern	-,076	,116	-,063	-,658	,512

a. Variável Dependente: PEAS_Taste

ANOVA healthiness of mixed nuts

ANOVA^a

Modelo		Soma dos Quadrados	df	Quadrado Médio	Z	Sig.
1	Regressão	3,627	3	1,209	1,197	,313 ^b
	Resíduo	140,373	139	1,010		
	Total	144,000	142			

a. Variável Dependente: NUTS_Health

b. Preditores: (Constante), HealthyEatingConcern, Type of label seen, Food Skills

Coefficientes^a

Modelo		Coefficients não padronizados		Coefficientes padronizados	t	Sig.
		B	Erro Erro	Beta		
1	(Constante)	5,354	,639		8,380	,000
	Type of label seen	,155	,169	,077	,920	,359
	Food Skills	-,014	,135	-,010	-,101	,920
	HealthyEatingConcern	,129	,088	,139	1,466	,145

a. Variável Dependente: NUTS_Health

ANOVA healthiness of cheesy flips

ANOVA^a

Modelo		Soma dos Quadrados	df	Quadrado Médio	Z	Sig.
1	Regressão	11,133	3	3,711	1,927	,128 ^b
	Resíduo	267,679	139	1,926		
	Total	278,811	142			

a. Variável Dependente: FLIPS_Health

b. Preditores: (Constante), HealthyEatingConcern, Type of label seen, Food Skills

Coefficientes^a

Modelo		Coefficients não padronizados		Coefficientes padronizados	t	Sig.
		B	Erro Erro	Beta		
1	(Constante)	1,331	,882		1,509	,134
	Type of label seen	,229	,233	,082	,981	,328
	Food Skills	,353	,186	,179	1,897	,060
	HealthyEatingConcern	,016	,121	,012	,130	,897

a. Variável Dependente: FLIPS_Health

ANOVA healthiness of crunchy peas

ANOVA^a

Modelo		Soma dos Quadrados	df	Quadrado Médio	Z	Sig.
1	Regressão	9,539	3	3,180	1,871	,137 ^b
	Resíduo	236,167	139	1,699		
	Total	245,706	142			

a. Variável Dependente: PEAS_Health

b. Preditores: (Constante), HealthyEatingConcern, Type of label seen, Food Skills

Coefficientes^a

Modelo		Coeficientes não padronizados		Coeficientes padronizados	t	Sig.
		B	Erro Erro	Beta		
1	(Constante)	1,573	,829		1,898	,060
	Type of label seen	-,162	,219	-,062	-,742	,459
	Food Skills	,362	,175	,195	2,069	,040
	HealthyEatingConcern	-,031	,114	-,026	-,272	,786

a. Variável Dependente: PEAS_Health

ANOVA energy content of mixed nuts

ANOVA^a

Modelo		Soma dos Quadrados	df	Quadrado Médio	Z	Sig.
1	Regressão	2,804	3	,935	,804	,494 ^b
	Resíduo	161,630	139	1,163		
	Total	164,434	142			

a. Variável Dependente: NUTS_Energy

b. Preditores: (Constante), HealthyEatingConcern, Type of label seen, Food Skills

Coefficientes^a

Modelo		Coeficientes não padronizados		Coeficientes padronizados	t	Sig.
		B	Erro Erro	Beta		
1	(Constante)	5,403	,686		7,882	,000
	Type of label seen	-,162	,181	-,076	-,898	,371
	Food Skills	,070	,145	,046	,483	,630
	HealthyEatingConcern	,077	,094	,078	,820	,414

a. Variável Dependente: NUTS_Energy

ANOVA energy content of cheesy flips

ANOVA^a

Modelo		Soma dos Quadrados	df	Quadrado Médio	Z	Sig.
1	Regressão	3,463	3	1,154	,472	,703 ^b
	Resíduo	340,146	139	2,447		
	Total	343,608	142			

a. Variável Dependente: FLIPS_Energy

b. Preditores: (Constante), HealthyEatingConcern, Type of label seen, Food Skills

Coefficientes^a

Modelo		Coeficientes não padronizados		Coeficientes padronizados	t	Sig.
		B	Erro Erro	Beta		
1	(Constante)	4,955	,994		4,982	,000
	Type of label seen	-,292	,263	-,094	-1,111	,268
	Food Skills	-,092	,210	-,042	-,437	,663
	HealthyEatingConcern	,059	,137	,042	,434	,665

a. Variável Dependente: FLIPS_Energy

ANOVA energy content of crunchy peas

ANOVA^a

Modelo		Soma dos Quadrados	df	Quadrado Médio	Z	Sig.
1	Regressão	14,583	3	4,861	2,413	,069 ^b
	Resíduo	280,047	139	2,015		
	Total	294,629	142			

a. Variável Dependente: PEAS_EnergyCont

b. Preditores: (Constante), HealthyEatingConcern, Type of label seen, Food Skills

Coefficientes^a

Modelo		Coeficientes não padronizados		Coeficientes padronizados	t	Sig.
		B	Erro Erro	Beta		
1	(Constante)	4,134	,902		4,582	,000
	Type of label seen	-,526	,238	-,183	-2,209	,029
	Food Skills	,199	,190	,098	1,047	,297
	HealthyEatingConcern	,057	,124	,043	,458	,648

a. Variável Dependente: PEAS_EnergyCont