Effect of front-of-package nutrition labelling: A conjoint analysis of consumer preferences for high-protein yogurts

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Abstract

Title: Effect of front-of-package nutrition labelling: A conjoint analysis of consumer preferences for high-protein yogurts

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This thesis studies the impact of front-of-pack nutrition labelling on young adult consumers' preference for high-protein yogurts. Against the background of increasingly health-oriented consumer choices, it examines the explicit nutrition labelling tactics of food brands in order to understand their effects on product choices in the European market. The relative importance of attributes as protein content, flavor, price, and specific nutrition claims made on the front-of-packaging in determining product preferences was investigated in an online survey administered to a sample of 110 young European adults entailing a conjoint analysis task. Results show that preferences were more affected by front-of-pack factual information on the protein content of yogurts than by “high on protein” or “natural protein” allegations. This indicates that young European adults may attribute more value to nutrition labelling than marketing claims. Findings further emphasized the role of price sensitivity, thereby suggesting that notwithstanding regard for health benefits, budgetary considerations still determine product preferences to a large extent. This study provides useful insights for manufacturing and marketing companies of yogurts by stating the prospects of transparent and informative labelling strategies which are in close association with health awareness amongst young adults. In addition, it contributes to the body of knowledge on consumer evaluation of functional foods and provides insights into the likely success of nutrition information provision tactics in influencing consumer food preferences.

Keywords: high-protein yogurt, consumer preferences, front-of-pack nutrition labelling, conjoint analysis, health consciousness, nutritional labelling, young adults, European market

Resumo

Título: Efeito de alegações nutricionais associadas ao teor de proteína em iogurtes: uma análise das preferências do consumidor

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Tendo por pano de fundo as atuais tendências do consumo alimentar, cada vez mais orientado para a promoção da saúde e bem-estar, esta tese estuda as táticas de provisão de informação nutricional das principais marcas de produtos lácteos no mercado, a fim de compreender os seus efeitos nas escolhas dos consumidores. Nomeadamente, é avaliado o impacto da rotulagem nutricional na frente de embalagem nas preferências dos jovens adultos Europeus por iogurtes ricos em proteína. Para tal, determinou-se a importância relativa do atributos teor proteico, alegações nutricionais associadas, aroma e preço através da aplicação da técnica "conjoint analysis" num inquérito on-line respondido de forma válida por 110 participantes. Os resultados mostram que as preferências por estes produtos são mais influenciadas por informação factual sobre o teor de proteína apresentada na frente de embalagem do que pelas alegações "rico em proteína" ou "proteína natural", sugerindo que os jovens adultos europeus atribuem mais valor à rotulagem nutricional do que às alegações das marcas. Destaca-se contudo que, apesar da procura por benefícios para a saúde, as considerações orçamentais continuam a determinar em larga medida as preferências alimentares neste segmento. Este estudo aponta para a importância de aplicar estratégias de rotulagem transparentes e informativas alinhadas com o crescente interesse dos jovens adultos pela promoção da saúde e bem-estar. Contribui ainda aprofundar o conhecimento sobre a procura por alimentos funcionais em geral, fornecendo sugestões sobre formatos de comunicação de informação nutricional com potencial para influenciar as preferências alimentares dos consumidores.

Palavras-chave: iogurte rico em proteínas, preferências do consumidor, rotulagem na frente de embalagem, conjoint analysis, alimentação saudável, rotulagem nutricional, jovens adultos, mercado europeu

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1 INTRODUCTION

The shift experienced in consumer behavior due to individuals' growing focus on health and wellness is having a massive impact on eating habits. According to Statista (2023b), the global market for protein ingredients, for instance, is expected to reach over 47.4 billion US dollars by 2032. Notably, this upward trend in the projection reflects not a mere fad but a structural and deeply rooted shift in consumer behavior towards healthy eating and healthy living. Leading this trend to health-consciousness are protein foods, which are increasingly being considered not merely as muscle-building nutrients but among essential nutritional elements enabling good overall health, general well-being and even a long life (foodnavigator-usa.com, 2018; nutraingredients.com, 2019). Key growth drivers of this trend include also better-educated consumers, increased demand for plant-based proteins and favorable government policies directed towards supporting the food and beverages industry (Precedence Research, 2022).

However, despite a quite robust market growth and widespread consumer interest, there are still some doubts about the actual benefits and value of high-protein foods. What further complicates the matter is that typically, through product labelling, high protein content is highlighted as a focal point for marketing to consumers. This has known implications on their preferences and willingness to pay for food brands (Li & Dando, 2019). This thesis aims thus to investigate the impact of nutrition labelling on the preferences of young adults, in order to gain a better insight into dietary choices. Namely, it examines the impact Front-of-Pack formats on the rising demand for high-protein products in this demographic. As high-protein foods grow in popularity and market share, so too does it become more important to address the complexities of related consumer behavior, particularly in the area of product labelling tactics.

Research carried out by Banovic and colleagues (2018) uncovered a lack of consumer knowledge about the difference between natural and artificially supplemented protein sources, raising the question of whether certain demographics are actually skeptical of the benefits of high-protein foods. Furthermore, since protein intake patterns differ considerably between developed and developing countries, it is necessary to put this discussion within the confines of some given geographical regions. Consumers in developed countries generally exhibit an average daily protein intake of 1.2-1.3 grams per kilogram of body weight, which exceeds the recommended amount of 0.8 grams (Schönfeldt & Gibson Hall, 2012). Such excessive protein consumption is indicative of a disparity between real and perceived nutritional needs for protein, calling into question the need and overt advertising of protein-enriched products.

The consequences of this gap are especially visible in product labelling as well as consumer buying behavior. Although the intake of additional protein may be beneficial for certain groups

such as older people, or some individuals with an extremely high level of physical activity, the wide promotion of protein-enriched products is frequently unrelated to the actual dietary needs, as uncovered by population studies in several Western countries (Henchion et al., 2017; Lundberg, 2023).

Even though European consumers show a growing interest in obtaining more information on food brands' nutrition and health benefits from their packaging, their actual use of such information varies highly with individual characteristics and purchase contexts (Grunert & Wills, 2007). The discrepancy between perceived relevance, level of understanding and actual use of nutrition labelling suggests that consumers' interactions with labels are moderated by several factors, namely the format of the labels, the complexity of the information they convey and the purchases being considered (Grunert & Wills, 2007). This finding is of especial relevance in the case of high-protein foods and associated Front-Of-Pack Nutritional Labelling (FOPNL). Following European Union legislation (European Union, 2023) food packaging must always contain a nutrition declaration that discloses, among others, the protein content of foods. Often, however, this information is given on the back of the packaging, not the front, so it is likely to be unattended by consumers. It is for this reason that FOPNL and claims specifically informing about the high protein content of certain foods might be beneficial to both consumers and brands (Li & Dando, 2019).

This thesis focused on the use of FOPNL and associated claims in the support of promotional efforts seeking to differentiate food brands based on their nutritional and health benefits. Namely, it sought to investigate how conspicuous nutrition information formats may affect consumer food product preferences vis-à-vis other relevant product and marketing factors. To this end, a full-profile conjoint analysis of consumer preferences for high-protein yogurts was conducted with a sample of young European adult consumers (n=110) through the administration of an online survey. Conjoint analysis is a marketing research method used to determine the impact of different product attributes on individuals' preferences (Cattin & Wittink, 1982). It essentially breaks a product down to its attributes (price, flavor etc.) and customers are asked to evaluate between various combinations of those attributes. By analyzing the resulting data, one can determine the attributes that are most important to customers and how changes to them may come to affect brand preferences (HBS Online, 2020). This analysis of consumer preferences was supported by a preliminary investigation of current high-protein yogurt offers in European food retailers and a detailed review of relevant area literature.

Findings indicate that FOPNL tactics have the power to capture the attention of young adult consumers in Europe and affect their preferences for yogurt products. This is to say that high

protein delivery does influence consumer preferences and points to a strong trend towards health-oriented product attributes. Moreover, results offer some insights into the specificity of consumer price sensitivity. Meanwhile, the rationale behind the observed effects of some product attributes like vanilla flavor or natural ingredient claims on preferences was less clear, confirming that there is a far more complex web of food attributes influencing consumer preferences beyond price and nutritional value. Finally, findings point out to the influence of individuals' characteristics, like age, income group and lifestyle, on food preferences. This knowledge can help better target the brand development and marketing activities of dairy products manufacturers to the needs of different consumer segments.

1.1 Relevance and contributions

Understanding the role of product labelling in influencing consumer behavior is one of the important points of modern marketing and consumer psychology, as product labels play a major role in raising brand awareness and generating loyalty, as well as raising market demand (Packaging Industry, 2020). The need for consumers to understand the significance of protein-enriched foods is vital in such an environment where the consumer focus on health and wellness is growing. Thus, labels can be said to provide the link between product and consumer - holding a critical role in communicating essential product information that may both encourage as well as deter purchase. Limited understanding and doubt in the present times about what constitutes healthy eating and what role may protein intake play in it will lead consumers to rely on effective nutrition labelling strategies to learn about the merits of consuming high-protein foods. Understanding the potential effects of FOPNL is specifically relevant for marketing managers, brand strategists and consumer psychologists alike seeking to better understand consumer demand in the health and wellness sector. Examining the impact of product labelling on consumer preferences, especially among young European adults, sheds light on how to optimize labelling to meet consumer expectations and trends in the markets. Such insights help in developing food packaging and branding strategies that further engage consumers with brands, thereby contributing to increase their market share and profitability. At the same time, knowledge on consumer processing of, and responses to FOPNL may also contribute to develop food policies that improve consumer education on nutrition and healthy eating.

1.2 Thesis outline

The next chapter offers a detailed literature review of the dynamics of consumer behavior and marketing analysis, highlighting the central role of nutritional labelling in food choice. Chapter 3 explains the research approach, the structure of the study and the nature of the conjoint analysis methodology. Chapter 4 presents the results of the study and links them to broader marketing and consumer behavior theories that provide valuable insights. Finally, Chapter 5 summarizes the main conclusions and discusses the scope and limitations of the study.

2 LITERATURE REVIEW

This chapter reviews and summarizes literature on the consumer trend of heightened health awareness, the growing interest in functional, protein-rich foods and the role of nutritional labelling and claims, with a focus on the European dairy market. It provides a contextual background to the foundational research questions posed by the thesis and at the same time informs about the relevant attributes included in the resulting conjoint analysis study with young adult consumers. Sources were drawn from academic databases and featured seminal, highly referenced works, as well as industry reports and market information, in order to provide a broad perspective of the topics being studied.

2.1 The rise of health consciousness

The trend toward health and wellness represents a consumer behavior shift influencing not only dietary practices but also market scenarios. What began as just a trend has come to embody a major change in individuals' lifestyles, reflecting the acceptance of increased health consciousness in society. From this viewpoint, proactive wellness has dimensions not only directed at the physical aspects but also reaching out to the psychological, social as well as environmental aspects of health (Chen, 2011; Rana & Paul, 2020).

Wellness, as the basis for the well-being of individuals, entails more than the absence of disease. Rather, it entails an action-oriented, methodical approach by individuals, in which they fully and actively seek to maintain a healthy lifestyle by practicing regular exercise, a balanced diet and stress management habits, as well as worrying and caring for the environment (Gould, 1988; Kraft & Goodell, 1993). In response to this trend, many consumer brands have reinforced their health and wellness positioning by increasing their product and service offers. Functionals foods, with the promise of promoting a higher degree of healthiness beyond basic nutrition, are a good example of trying to respond to consumers' increased health consciousness in relation to dietary habits (Banovic et al., 2018; Statista, 2023a). The preference for this and other product categories that promote health is stronger as health consciousness increases and price sensitivity decreases. This trend is bound to be further exacerbated by the population's expanding ageing needs and just as intensified by the COVID-19 pandemic, thus firming up consumers' demand for functional and protein-enriched foods (Bleiel, 2010; IFIC, 2002; Jaeger et al., 2021).

It is through health consciousness that customers are segmented in the food market, creating types such as 'tasteful lovers' and 'nutrition fact seekers'. Identified by Mai & Hoffmann (2012), this segmentation reflects how much a degree of health consciousness determines consumers' focus on health-related attributes. Brands associated to health-related attributes will be more

important to consumers with higher health consciousness and nutrition self-efficacy in their food decision-making. In line with this, a study conducted by Cecchini & Warin (2016) found that implementing FOPNL systems increases the availability of healthier food products in the market by 18.0%, being also important to sway consumers towards healthier food choices. The study also uncovered that conventional, back-of-package, food labelling can, through just the provision of accurate nutritional composition data, already impact heavily on public health outcomes. This justifies using food labelling as a policy tool in designing healthier diets and combating unhealthy eating habits, and the associated obesity epidemic, in addition to employing it as marketing tactic (Cecchini & Warin, 2016).

2.2 Functional foods and their appeal

Functional foods attract much attention within the food industry given their claims to deliver nutritional benefits beyond covering the basic needs required by the body. Examples of these foods are yogurts with probiotics or calcium-enriched orange juices, among several others (Healthline, 2020). The global functional food market is predicted to grow from USD 305.4 billion in 2022 to USD 597.1 billion by 2032, according to industry projections, with this growth being attributable to consumers' increasing demand for health-promoting foods and supplements (Butnariu & Sarac, 2019; *Functional Food Market*, 2023). In this context, proteins have become a very prominent functional ingredient since they serve many health purposes. Findings of a study conducted by Kitada and colleagues (2019) emphasize the cognitive and metabolic effects of protein intake. They show that the balance of macronutrients, including protein, is one of the essential determinants of longevity and metabolic health, possibly being more important than total energy intake within the caloric framework. Moreover, a high-protein diet is increasingly being recommended as an effective weight gain control mechanism, in the maintenance of muscle mass during ageing, the management of blood sugar and pressure, and overall in overcoming obesity and ageing-related problems (Kitada et al., 2019). Consequently, consumers' healthier food choices are often being primarily pushed specifically by foods with higher protein content, such as fortified snacks and yogurts. Still, many seem to prefer ingesting natural protein sources rather than artificial fortification with other sources (Banovic et al., 2018). Accordingly, plant proteins are gaining more consumer attention as a result of both health considerations and sustainability concerns.

2.3 Consumer perceptions and beliefs about functional foods

Consumer acceptance of functional foods is key to their market success. This depends on several factors, ranging from health concerns, associated to product´s health claims and promoted health benefits, to familiarity, linked to brands' choice of food carrier and other product design attributes (Ares & Gámbaro, 2007; Bech-Larsen & Grunert, 2003). In particular, good and credible brand communication holds a key role in informing about the health benefits delivered (Verbeke, 2005).

Nutrition knowledge and perception of the associations between diet and health are strongly related to the demand for functional foods (Ares & Gámbaro, 2007). While some consumers embrace innovation in food-based solutions to health problems, others remain sceptic about this strategy, with many seeing functional foods as artificial or unnatural products (Jonas & Beckmann, 1998; Niva, 2000). Trust plays thus an important role in their acceptance, with consumers being more willing to accept novel foods when they believe in the authenticity and credibility of their health claims (Urala & Lähteenmäki, 2004). However, trust lies subject to alteration at any point when conflicting information is received or when claims seem unwarranted. Overall, understanding consumer preferences for functional foods has proven challenging. While a great level of interest is evident from the attitudes and opinions of consumers, they still seem to remain fairly unable or unwilling to grasp the terminologies used when discussing functional foods and their benefits (IFIC, 2002). This stresses the importance of effective communication and education to bridge the gap between industry advances and consumer's nutrition and health literacy.

Proteins have become an important ingredient in the functional foods' industry, not only in light of their basic nutritional value but also due to their potential health benefits. A qualitative study by Banovic and colleagues (2018) investigated European consumers' preferences and perceptions of foods with increased protein content. Findings showed that participants overwhelmingly preferred conventional foods with a naturally high protein level to new functional foods, as they considered them healthier and more beneficial. Despite the recognition of the value of a higher protein content to nutrition and health, there was some concern about the possible health effects of the artificial fortification of products with protein associated to the novel character of functional foods. This further highlights the need for clarity and transparency in communicating about products' protein sources and associated benefits.

2.4 The appeal of high-protein foods to consumers

When discussing the market for high-protein foods, one cannot fail to incorporate the historical evolution of the concept. These products were, first and foremost, the object of a gendered marketing and cultural approach. Originally, protein-enriched foods were mainly geared towards males, probably due to connotations with muscle building and sports' nutrition. This trend is already visible in the marketing of food brands in the early 20th century, with the consumption of protein-rich foods being backed by "scientific" claims and products advertised under the pretext of providing an "elixir" that gave men the power to live healthily (O'Hagan, 2022). The masculinization of diet soda and yogurt marketing, for instance, went on until the early 21st century, with ad campaigns employing "dude" tropes and referring to masculine codes about products' protein content (Contois, 2020).

Over time, however, the interest for protein-rich foods has crossed the gender divide to appeal to a much broader audience. Today, high-protein foods, such as yogurts, are speaking to a wide range of European consumers, from health-minded older adult markets to increasingly gender fluid and worried about wellness and sustainability Gen-Zers. In particular, products offering convenient, ready-to-eat protein content like yogurt are driving preferences within the young adult demographic (16-34 years), in detriment of other, more traditional protein sources, that often require cooking and/or mixing with water prior to consumption (Lakanen, 2016). Such demand for high-protein foods has also been significantly influenced by social media. Platforms like Instagram are a catalyst for the high-protein trend, with health influencers wielding considerable power in shaping dietary habits. Promoting high-protein options as part of a healthy lifestyle works particularly well among younger audiences who are more susceptible to the trends showcased on social media (Folkvord et al., 2020).

As the type of food delivering the protein content becomes increasingly more relevant to consumers, market offers are diversifying from now run-of-the-mill protein bars and shakes to introducing novelties like high protein doughnuts or crisps. Other popular high-protein snacks today include chilled protein bars and plant-based snacks, which, along with yogurts, capitalize on being easy to carry, convenient to eat and "clean label", i.e. containing only few and mostly natural ingredients. This signals a higher concern from consumers regarding the potentially negative health and wellness impact of processed foods, including functional foods (Mintel, 2018). But, the market still faces many challenges, chiefly consumer uncertainty about the types of food protein available and their benefits, as well as concerns regarding the high sugar content of many protein-rich foods. To address such concerns, manufacturers are emphasizing flavor

profile while striving to keep an adequate balance of high protein content and low added sugar in their brands (Glanbia Nutritionals, 2022).

A study by Kaya and colleagues (2013) revealed that consumer preferences and willingness-to-pay for foods with health-promoting nutritional profiles in the Republic of Korea seemed to be heavily determined by individual characteristics, like socio-economic status, health concerns and lifestyle. These factors are likely to play an important role in European consumers' food choices as well. Brand preferences and price sensitivity for high protein foods in Europe are therefore also likely to be affected by consumer characteristics, varying hence a great deal between segments. Local advertising and nutritional labelling schemes will also play a crucial role in these food choices. Findings from a study conducted in Italy (Vecchio et al., 2016), underscore the significant impact of specific health claims on consumers' willingness to pay for functional yogurts, emphasizing the part played by effective communication in shaping decisions surrounding the health benefits of high-protein foods. To this end, manufacturers like Danone, Ehrmann and Nestlé, as well as private labels of food retailers like Lidl, Aldi, Spar or Auchan, strive to balance nutritional value with both taste and the provision of consumer information in their ranges of high-protein foods (Aldi, 2023; Auchan, 2023; Interspar Austria, 2023; Lidl, 2023).

2.4.1 Misconceptions and criticisms of high-protein intake

It is worth mentioning the ongoing debate concerning optimal levels of protein intake. While some parties advocate for high-protein diets to better manage weight and increase muscle strength (Leidy et al., 2015), others predict a probable adverse influence from an increased high-protein dose per portion on health (Phillips, 2012). The consumption of excess protein, especially of animal origin, has been associated with more health risks such as cardiovascular diseases and a few cancers, to some extent negating the commonsense notion that more is always better (Phillips, 2012; Song et al., 2016). Also contrary to common belief, it seems that there comes a point beyond which increasing protein intake can no longer contribute towards muscle synthesis and may instead become a causative factor for weight gain (Morton et al., 2018). In addition, not all proteins are born equal; quality rests on food source and processing, with whole foods being generally better sources than processed ones (Hoffman & Falvo, 2004). This lack of consensus on benefits adds to the complexity of consumer food choices and points to the importance of advocating for balanced diets which do not overly favor one type of food or nutrient. Convenient as it may be, the consumption of high-protein foods should not become detrimental of the ingestion of the appropriate levels of fiber and key micronutrients, like

vitamins or minerals, for instance. Likewise, it should not unduly enhance the intake of simple sugars. A study found that certain brands of protein bars can contain up to 30 grams of sugar per serving, with the intake of a single bar nearly reaching the World Health Organization's recommended daily sugar intake limit (WHO, 2015). This highlights the need for informed consumer food choices, with clear nutritional labelling on product packages being essential to promote balanced and healthy diets (The Grocer, 2019).

2.4.2 High-protein yogurts as prototypical high-protein food

The application of special strains of Lactobacillus bulgaricus and other bacteria, as well as of certain processing methods (e.g., ultrafiltration) in the dairy industry has enabled the increase of the protein content of traditional yogurt from the usual 3-5% range per serving to values between 7-15% (Bruhn & Franke, 1988; Glaves Berhmann et al., 2021; Jørgensen et al., 2019). These developments, along with the growing numbers of health-focused food consumers, have made of high-protein yogurts one of the major upcoming categories in the protein-rich foods' sector. In addition to the improved nutrition profile, the versatility and convenience of use of these fermented dairy products contribute to their rising popularity. Yogurts fit well in almost every kind of dietary pattern, being especially appealing to consumers looking for a healthy snack on the go. Still, according to the results of a study conducted by Ortinau and colleagues (2013), the nutritional benefits of high-protein products are constrained by their overall nutritional profile and well as by the quality of the diets of individuals.

Table 1 depicts a non-exhaustive list of brands of high-protein yogurts and similar dairy products currently found in supermarkets in Portugal, Spain and Austria, along with their flavor variations and price ranges, which have been standardized to a 200g size for comparative purposes. This list was put together by the author through an analysis of assortments available in multiple physical and online stores. Due to their health-promoting image and increasing popularity in the South of Europe (Continente, 2023), high-protein fermented/sour dairy products similar to solid yogurt, like the Icelandic Skyr, the Germanic Quark and the Eastern Kefir, can be included in this list. Similarly, high-protein dairy puddings and mousses can also be considered. All these products are usually located alongside yogurts on retail shelves, reflecting a trend towards comparable, dairy-based functional foods with similar health claims and consumer appeal.

The overview of brands offered by Table *1* underscores the growing weight of retail private labels in dairy food categories. Private labels play here a key strategic role, in that their product offerings and competitive pricing strategies make them highly adaptable to the continuously

changing consumer needs. These brands offer retailers several mechanisms for enhancing bargaining power, strengthening profit margins and promote consumer loyalty through their diversified offer (McKinsey, 2021). The presence of private labels can influence the pricing strategies of national brands and sometimes lead to a price increase for the leading national brands in segments where private labels have achieved a significant market presence (Castellari et al., 2014). To some extent, this phenomenon occurs in the yogurt category.

Table 1 – Market overview of high protein yogurts and comparable dairy products in Portugal, Spain and Austria, with private labels in bold (see Appendix 1 for further details).

Brands	**Flavor(s)**	**Unit price range in € (based on 200g)**
PORTUGAL		
Pur Natur (organic)	Natural	3.66
Danone YoPro	Strawberry, Blueberry, Vanilla, Coconut, Mango, Peanut Butter and Banana	1.51 – 2.21
Ehrmann	Caramel, Coffee, Hazelnut, Chocolate	1.89
Premyer	Hazelnut, Salted Caramel, Vanilla	1.49
Corpos Danone	Pineapple, Passion Fruit and Chia	1.28
Nestlé Lindahls	Raspberry, Stracciatella, Lemon and Cookies	1.24
Continente	Chocolate, Caramel, Strawberry, Banana	0.92 – 0.99
SPAIN		
Danone YoPro	Stracciatella, Coconut, Vanilla, Caramel Macchiato	1.84 – 2.16
Nestlé Lindahls	Lime & Cookies, Chocolate, Vanilla	1.67 – 1.94
Carrefour	Cacao, Vanilla	1.70
Kaiku	Strawberry, Lemon	0.86
AUSTRIA		
Ehrmann	Hazelnut, Blueberry, Peach-Orange	1.49
Dr. Oetker	Salted Caramel, Natural	1.35
Spar High Protein	Natural	0.52

Figure 1 shows some examples of the high-protein solid yogurts and desserts currently sold in Portuguese supermarkets, under both manufacturer and private labels, highlighting the similarities in brand image, packaging design and nutritional value information among them. Together with the market overview presented in Table *1*, these examples reflect closely the

variation in key attributes driving consumer preferences for high-protein yogurts, as identified by earlier studies (Banovic et al., 2018; Cadario & Chandon, 2019; Grunert & Wills, 2007; Ikonen et al., 2020; Kaya et al., 2013; Li & Dando, 2019; Vecchio et al., 2016) – nutritional value as well as related packaging and labelling information, flavor variation and price range. Regarding nutrition information, it can be seen that brands focus on the higher protein content to differentiate clearly from the standard yogurt options. Moreover, protein content values are almost always supported by claims like "high on protein", which along with the characteristic product colors make the packaging, and hence the products, easily recognizable on the shelves.

Figure 1 – Examples of high-protein dairy desserts and yogurts sold by a large Portuguese grocery store chain in the fall of 2023.

2.5 Product labelling and nudging in consumer choices

Existent research and commercial offers alike provide testimony of the complexity and ambiguity that characterize consumers' food choices, particularly when it comes to buying high-protein yogurts. Nutritional labelling has the potential to mitigate much of the uncertainty associated with food purchases. Studies like those conducted by Banovic and colleagues (2018), and Lundberg (2023) demonstrate the importance of clear nutritional labelling in informing the food choices made by consumers. As earlier pointed out, the market for high-protein products is growing but remains riddled with misconceptions and varying levels of consumer understanding and acceptance. In this scenario, nutritional labelling remains a pivotal factor in guiding consumer preferences and choices.

A recent study on the implementation of FOPNL schemes by Oswald and colleagues (2022) revealed their important contribution to individuals' food choices. It concluded that well-designed FOPNL can act as a form of "nudging", softly steering consumers towards choosing healthy products, such as high-protein yogurts, without limiting their freedom to purchase the brands they prefer. Two types of "nudges" related to nutritional labelling – Descriptive and Evaluative – are relevant to this thesis. While Descriptive labelling merely provides consumers with factual, often numeric, information regarding the nutrition content of food products, Evaluative labels provide an overall evaluation of their nutritional value by using terms such as

"healthy", "low-fat" or "high-protein" to guide consumers (Cadario & Chandon, 2019). The latter, also known as Interpretative labelling schemes, may entail both nutrient content and health benefit claims. These formats were found to influence consumers' overall perception of the nutritional and health value of food products (Banovic et al., 2018; Ikonen et al., 2020).

FOPNL has been shown to effectively help consumers identify healthier options. However, these positive outcomes do not directly or necessarily translate into consumers making healthier food choices (Ikonen et al., 2020). Indeed, the different attitudes and levels of literacy of consumers regarding nutrition and health require not only the provision of appropriate levels of information on labels but also a supporting communication strategy that bridges the gap between consumer knowledge and what is known and available in the market. In such circumstances, synthetic interpretative labels are more likely to constitute an effective "nudge" towards healthier or higher protein options than the more detailed and descriptive ones.

As the result of brands responding to the growing demand for health-promoting foods, more and more nutrition information is made available on packaging and at the point-of-sales, all of which compete for the time and attention of shoppers. Understanding the effects of nutritional labelling on consumers' food perceptions and choices becomes thus increasingly more vital. Consequently, this thesis explores the effects of different types of FOPNL on consumer preferences for high-protein yogurts, namely by including both descriptive and evaluative labels in the design of the conjoint analysis task.

2.6 Conclusions and research hypotheses

Extant research signals the ongoing change of dietary patterns supporting the rising consumer demand for health-promoting foods. This reflects a society shifting towards the gravity of living a healthier lifestyle and the consequent strategic response from the food industry placing itself sovereignly to meet such emerging needs. In the European high-protein yogurt segment, in particular, attributes like protein content, price range, flavor profile and brand image appear to be important drivers of consumer preference, particularly among young adults. In this scenario, FOPNL emerges as an important tool to help steer consumer choices, gently nudging them towards protein-rich yogurts and helping to differentiate offers and brands from each other in the highly competitive dairy foods market. Last but not least, variation in demographics and socioeconomic status, health concerns, lifestyle choices and price sensitivity are likely to play an important role in determining product choices.

The literature review and market analysis conducted provided the groundwork for an empirical study of consumer preferences in the market for high-protein yogurts using conjoint analysis,

with an emphasis on the investigation of the effects of FOPNL. This study intended to determine the relative importance of these and other relevant product attributes, as well as explore the variation in preferences attributable to consumer demographics and attitudes. Its main underlying assumption was that FOPNL, either in the form of claims of “high protein” or information on protein content (higher in comparison to standard yogurt), would be a key driver of consumer preferences. In line with the identified drivers of consumer preference, the study also added demographic, health and lifestyle variables to the product-based conjoint framework, in order to account for their influence on preferences for high-protein yogurts. This approach seeks to quantify how these factors, alongside FOPNL, determine the consumer's valuation of protein content and other product attributes, thereby providing a more comprehensive view of the decision-making process in the functional dairy foods segment.

3 METHODOLOGY

This chapter presents the methodology used to design and apply the conjoint study and supporting survey instrument seeking to determine the relative importance of different factors influencing consumer preferences for high-protein yogurts. It describes the search for the extent to which each of the specific product attributes studied, including different labelling claims, influences consumer preferences for high-protein yogurts, and how overall preferences may vary across different consumer profiles.

3.1 Research approach

An explanatory research approach was pursued to determine the relative importance of different product and individual characteristics affecting consumer preferences for high-protein yogurts. This approach, based on deductive reasoning, enables the empirical testing of hypotheses derived from established theoretical frameworks on consumer behavior. The main method of research applied was conjoint analysis, a systematic quantitative approach used in marketing to measure the impact of product attributes, such as flavor, nutritional content, price or labelling, on consumer preferences (Green & Srinivasan, 1978). In such approach, hypothetical product profiles are designed based on realistic combinations of different levels of commercial offer attributes known to play a key role in determining preferences, chiefly among them price. Profiles are then subject to experimental design, with a sample being presented to consumers for evaluation. An orthogonal design is typically chosen to keep the process lean while at the same time having a representative, but yet concise set of profiles (Green & Rao, 1971).

From resulting consumer evaluations, preferences for different attribute levels and ideal product profiles can be statistically determined, as well as associated market shares. Namely, regression models are used to decompose consumer preferences into discrete utility values for each attribute. Utilities reflect the trade-offs a consumer is willing to accept and indicate the relative importance of different attributes, e.g. of different types of FOPNL, on product preferences and ultimately consumer choices (Louviere, 1988). The added value of conjoint analysis applications is that they enable to estimate the relative impact of different product attributes on preferences under a holistic, real-life decision context, rather than breaking overall assessments down into disintegrated, one-by-one attribute evaluations (Wind & Green, 1975).

3.2 Population and sample

The population of interest in this study was defined as adults aged between 18 and 29 years residing in Europe, with internet access, reporting to consume yogurt, and having no dietary or health restrictions related to the consumption of high-protein dairy products. The sampling of respondents was carried out through voluntary participation in an online survey (i.e., convenience sampling), following invitation received by email, social media, personal contact or participation in an online survey recruiting platform (Prolific, 2023).

A total of 160 people accessed the link provided in the invitation and started the survey. Of these, 45 were excluded based on their answers to initial screening questions addressing population requirements. These respondents were thanked and dismissed. Another five were excluded from the final sample due to not having completed the survey. Of the remainder, there were ten surveys where only answers to a couple of items from psychometric measures were missing due a technical software fault. The median of the responses given by the rest of the sample were imputed in these cases to avoid missing values. In this way, a final valid sample of 110 respondents contributed with data to the analysis.

3.3 Study design

Figure 2 offers an overview of the stages of study design, data collection and analysis undertaken in this thesis. These stages and related activities are detailed in the next sections.

3.3.1 Stimuli: high-protein yogurt attributes, levels, selection of conjoint profiles and product image

The selection of attributes and their corresponding levels is a critical step in conjoint analysis, upon which the validity and interpretability of the results largely depend. As detailed in Chapter 2, the present study began with a comprehensive literature review in order to identify the key factors influencing the preferences for high-protein yogurts of young European adults. The relevant product attributes identified from prior studies – nutritional value, price, flavor and FOPNL and associated claims - were subsequently validated against the profiles of actual product offers available in *Continente Online* (Portugal), *Carrefour* (Spain) and *Interspar* (Austria) to ensure representativeness and external validity.

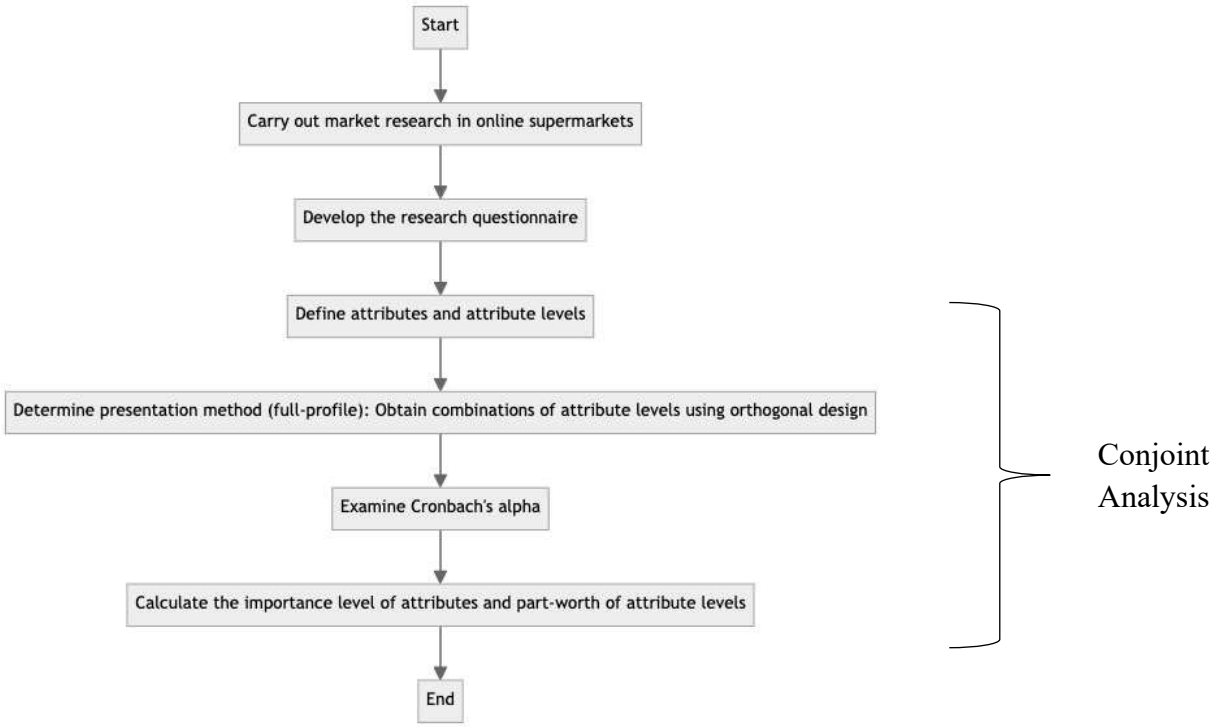

Figure 2 - Flowchart of research methodology.

The main objective of the design was to represent comprehensibly the attributes likely to determine preferences to a large extent. Still, the choice of the number of attributes and levels for the profiles was the object of careful consideration so as not to excessively burden respondents, since cognitive load can impact the quality of answers (Lines & Denstadli, 2004). In view of this, three price tiers were first identified, reflecting relatively low, medium, and high market prices for high-protein yogurts. The choice of only three price levels took into consideration the necessity of cognitive ease for the participants. Subsequently, other three attributes and their levels were established, as shown in Table *2*: nutritional value (3 levels), product claim (3 levels) and flavor (2 levels). The reference level taken for the analysis of the effect of each attribute on preference ratings is indicated.

Table 2 – Attributes and levels of high-protein yogurt profiles tested in the conjoint analysis task.

Attribute	Levels	Supporting evidence
Nutritional Value	20g Protein, 10g Protein, 5g Protein (reference)	(Banovic et al., 2018; Cadario & Chandon, 2019; Carrefour Espana, 2023; Continente, 2023; Grunert & Wills, 2007; Interspar Austria, 2023)
Product Claim	High Protein, Natural, No Claim (reference)	(Banovic et al., 2018; Grunert & Wills, 2007; Ikonen et al., 2020; Li & Dando, 2019; Oswald et al., 2022)
Flavor	Vanilla, Plain (reference)	(Carrefour Espana, 2023; Continente, 2023; Interspar Austria, 2023)
Price	€2.94 (high), €1.55 (medium), €0.81 (low) (reference)	(Carrefour Espana, 2023; Continente, 2023; Interspar Austria, 2023)

The full conjoint analysis design resulted in 54 product profiles to be assessed by respondents. The next phase involved the development of an orthogonal design in SPSS, a statistical method for creating a subset of product profiles that retains the essential properties of the full factorial design, but with fewer runs. This method is particularly advantageous as it allows for efficient estimation of main effects without requiring a prohibitively large number of observations, thereby avoiding burdening respondents with a large number of assessments. Its application in the present study led to the identification of nine product profiles to be evaluated by respondents in random order of presentation, depicted in Table *3*.

Table 3 – High-protein yogurt profiles evaluated by respondents in the conjoint analysis task.

Profile	Price	Flavor	Claim	Protein content
1	High	Vanilla	No Claim	5g Protein
2	High	Plain	High Protein	10g Protein
3	Medium	Plain	No Claim	10g Protein
4	Medium	Plain	Natural	5g Protein
5	Medium	Vanilla	High Protein	20g Protein
6	Low	Plain	No Claim	20g Protein
7	Low	Plain	High Protein	5g Protein
8	High	Plain	Natural	20g Protein
9	Low	Vanilla	Natural	10g Protein

The conjoint task was part of an online survey administered using the Qualtrics platform (Qualtrics, 2023). This format facilitated the exposure of respondents to carefully designed product images as conjoint profile cards. These images, illustrated in Figure 3, were created using Photoshop to ensure visual accuracy of selecting products in a retail environment.

Figure 3 – Examples of product profiles presented as stimuli in the conjoint analysis task.

Upon exposure to each of the nine product profiles tested, respondents were asked to express their preferences by rating the likelihood of buying each of them on a 7-point probability response scale ranging from 1, "extremely unlikely," to 7, "extremely likely". Figure *4* exemplifies the conjoint analysis rating task performed by survey respondents. As earlier stated, the images in cards were inspired by the packaging of protein-rich yogurt brands sold in grocery stores, such as those depicted in Figure 1. A comprehensive overview of the conjoint tasks as well as of the survey that entailed them is provided in Appendix 2.

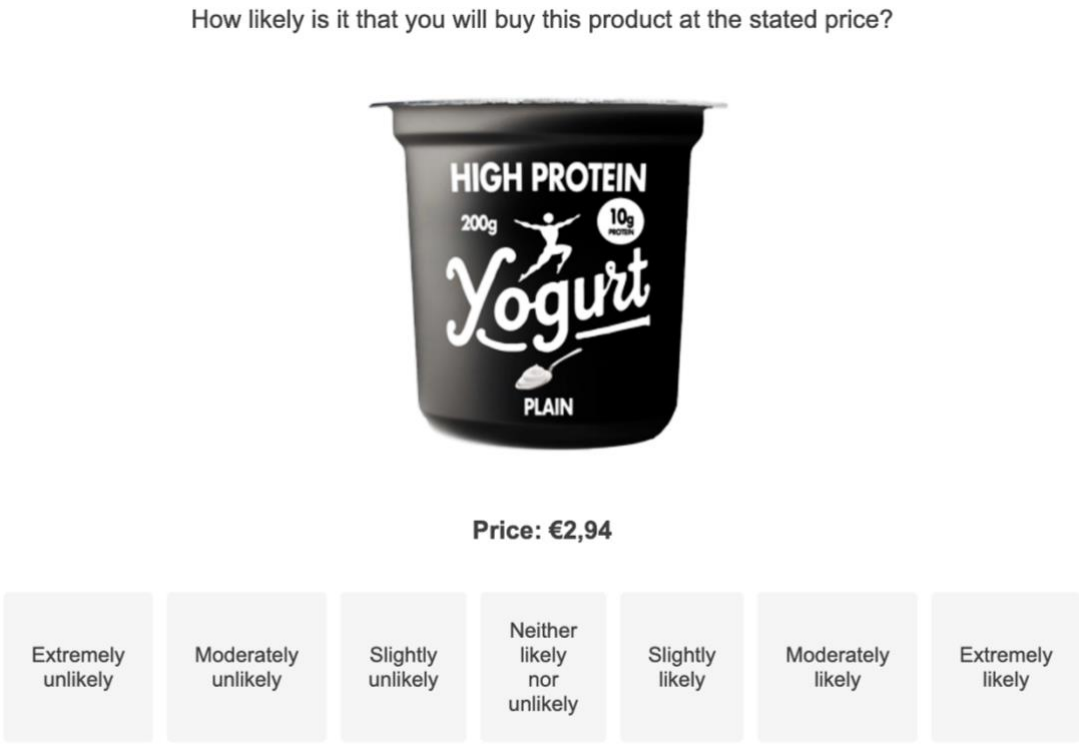

Figure 4 – Example of a rating task for respondents.

3.3.2 Other variables assessed

Prior studies suggest that consumer demographics, health attitudes and lifestyle choices may contribute, in addition to product attributes, to explain individual preferences for high-protein foods, namely yogurts. Studying all these determinants together can therefore provide a more nuanced vision of the determinants of consumer preferences, being also key to better understanding consumer behavior and market segmentation in this particular context. Table *4* describes the other variables inquired in the survey once participants completed the conjoint analysis task.

Table 4 – Characteristics of the respondents assessed in the survey.

Variable	Variable/Class label	Q&A format
Demographics		
Age	Age of respondent in years	*How old are you?* Dropdown menu ranging from 19-29 years & under 19/over 29
Gender	0 for male, 1 for female, 2 for non-binary	*What gender do you identify with?*
Household composition	1 = “Living alone”, 2 = "Living with family", 3 = "Living with friends, roommates, or partners"	*What best describes the composition of your household?*
Country of residence	1 = “Portugal”, 2= “Germany/Austria”, 3= Else	*In what country do you currently live in?* Choice of predefined countries
Yearly individual income	1 for "Under €10,000", 2 for "€10,000 - €25,000", 3 for "Over €25,000"	*Please indicate your annual income class (before taxes)*
Yogurt consumption status	1 for "Occasional consumers", 2 for "Regular consumers", 3 for "Heavy consumers"	*How often do you consume yogurt?* Occasional: Rarely/Monthly, Regular: Weekly, Heavy: Daily
Dietary Preferences	0 for Lactose Intolerant or Vegan, 1 for No Restrictions, 2 for Gluten-Free, 3 for Vegetarian	*Do you have any dietary preferences or restrictions?*
Level of physical activity	0 = ≤ 5h/week, 1 = > 5h/week	*Please indicate how many hours per week you usually exercise?* Continuous slider
Interest in the health and nutrition value of food products		
“I consciously make food choices that are beneficial to my health.”	HNV Item 1	*Please rate to what extent you agree with the following:* 7-point Likert-type response scale ranging from “1= Strongly disagree“ to “7= "Strongly agree"
“I prioritize taste over health benefits when choosing what to eat.”	HNV 2 (reversed)	
“I actively seek out information regarding the health aspects of the foods I consume.”	HNV Item 3	
“I consistently check the nutrition labels on food products before purchasing.”	HNV Item 4	
Mean $HNV_{1,3,4}$:4.95 (Cronbach’s α = 0.747)		
Importance of protein content in yogurt choice		
“The protein content is a primary factor in my decision to purchase a particular yogurt.”	PC Item 1	*Please indicate the extent to which you agree with the following:* 7-point Likert-type response scale ranging from “1= Strongly disagree“ to “7= "Strongly agree"
“I rarely consider the protein content when choosing yogurt.”	PC Item 2 (reversed)	

To ensure consistent data collection and minimize potential response biases, standardized response formats, developed and validated by previous research, were employed. Cronbach's α was computed for the psychometric items assessing interest in the nutrition and health value of food products and the importance of protein content in yogurt choice. Results showed that reliability was greatly improved by discarding items requiring reversal of scores in both cases. Scores of items HVN 1, 3 and 4 were therefore averaged to compute an overall scale means and entered as such in the analysis; item PC 1 scores were entered individually.

3.4 Survey administration

The survey instrument, entailing the conjoint analysis task and other measures, was administered online through the platform Qualtrics (Qualtrics, 2023) between November 10 to November 25, 2023. Qualtrics was chosen for its wide accessibility to young adults and the efficiency of data collection processes. Following informed consent and the initial screening of respondents, to exclude those not meeting the study population requirements, the conjoint task was administered by showing each of the nine profiles to respondents in random order and eliciting their evaluation. Once this task was completed, respondents provided measures of the other variables of interest. Finally, they were thanked for their participation. The full survey is provided in Appendix 2.

3.5 Data preparation and statistical analysis

Data preparation and statistical analysis were conducted using R (see Appendix 3), a programming language and environment widely recognized for its capabilities in statistical computing and graphics (R Core Team, 2023). The first step in the analysis was to apply descriptive statistics to the data collected. This step was crucial to gaining an initial understanding of the distribution of the dependent variables, such as the rating of the individual product profiles. These ratings served as the dependent variable, reflecting the participants' preferences for the product profiles evaluated. Means, standard deviations and distributions were calculated to identify key trends and variability within the data set.

Using multiple regression analysis in R, the respondents' product ratings were analyzed as a function of the various attribute and level combinations of the protein-rich yogurt profiles. The relationship function is central to this understanding and is expressed as follows:

$$Y1 = X1 + X2 + X3 + \cdots + Xn$$

In this conjoint utility function, (Y1) signifies the overall utility score that a consumer assigns to a yogurt product, reflecting their preference or valuation of the product profile. (X1, X2, X3,…,Xn) represent the series of independent variables, each corresponding to the attributes varied in the yogurt profiles, such as price, flavor, claim, and protein content. This utility function shows the additive nature of consumer preferences, suggesting that the total utility a consumer perceives from a yogurt product is the sum of the individual utilities they assign to each of its attributes.

To prepare the categorical data from the yogurt profile cards for statistical modelling, dummy variables were created for each attribute/level, indicating the presence (1) or absence (0) of each attribute level in each profile. These binary indicators allowed to incorporate categorical data into our conjoint analysis and thus draw on 990 observations (i.e., 110 responses times nine product profiles. Price level, for instance, was attributed two dummy variables for 'high' and 'medium', with the low category being omitted as the baseline for comparison in interpreting regression results. By utilizing dummy variables, we can interpret the coefficients of the dummies as the expected change in the utility score from the baseline level when the attribute is present. This approach ensures that the model captures the impact of each attribute on the consumer's decision-making process accurately and comprehensively.

An additional aim of this thesis was to investigate the impact of selected consumer characteristics (see Table 4) on the preferences for high-protein yogurt, since such findings could help to better target the development of brands and marketing activities to different consumer segments and their needs. This implied that the results of corresponding measures applied in the survey should be entered as predictors, along product attributes and their levels, in the estimated regression models with conjoint task ratings as regressors.

Multicollinearity can subject a model to biased interpretation by increasing the variance of coefficient estimates from which it becomes difficult to picture clear relations amidst the independent variables (Yu et al., 2015). In order to avoid introducing severe multicollinearity by entering multiple correlated consumer characteristics, their bivariate correlations were computed. The estimated Spearman’s rho correlation coefficients and their significance are presented in Appendix 4. In an effort to optimize the regression model, variables "HNV1,3,4" and "PC1" were excluded due to their strong intercorrelations with each other and with "Level of physical activity" and "Gender". For the sake of parsimony and the explanatory value of the regression model, "Yogurt consumption status" (a non-significant predictor of preference ratings) and "Age" (a respondent characteristic with limited variation due to study population requirements) were also omitted from the set of predictors.

4 RESULTS AND DISCUSSION

This chapter presents the results of data collection and analysis, with emphasis on those obtained by performing conjoint analysis. It begins with a summary of the descriptive statistics for the different variables of interest, followed by further analysis of a variety of product attributes in terms of their correlation with consumer demographics and characteristics. General trends and patterns identified from the data are analyzed step by step, and then individual attributes such as protein content, taste, price, and claims are examined. This structure ensures a coherent and logical flow and facilitates a clear identification of the most important attributes.

4.1 Sample characteristics

Table *5* describes the main sociodemographic, food behavior and lifestyle characteristics of the respondent sample. As prespecified by the population requirements for the study sample, respondents were, on average, ca. 25 years old, with a predominance of females. The latter suggests a gender-related interest in the yogurt category, confirmed to some extent by the fact that more than half of women reported to regularly consume this type of product. Regarding country of residence, respondents were evenly distributed between Portugal, German/Austria, and other countries. As far as personal income is concerned, there was a slight predominance of respondents reporting to belong to the middle range income bracket. This perhaps resulted in a moderate degree of price sensitivity concerning high-protein yogurts. In terms of living arrangements, nearly half of the respondents reported living with friends, roommates or a romantic partner, a factor that may influence their food shopping and consumption patterns.

On average, survey respondents exhibited a strong interest in the health and nutrition value of food products, with there being also a sizeable share of them who reportedly engage in over five hours of exercise per week. Respondents' average score of the importance of protein content in yogurt choice falls slightly above the mid-point of the response scale, being therefore indicative of a moderate self-rated relevance of this attribute in buying decisions.

Table 5 – Demographics and characteristics of respondents (*n*=110).

Age	
Mean [95% CI]	24.6 [24.2-25.1]
Median [Min, Max]	25.0 [19.0, 29.0]
Gender	
Male	44 (40.0%)
Female	66 (60.0%)
Household composition	
Living alone	20 (18.2%)
Living with family	38 (34.5%)
Living with friends/roommates/partner	52 (47.3%)
Country of residence	
Portugal	38 (34.5%)
Germany	39 (35.5%)
Rest of the World	33 (30.0%)
Yearly individual income	
Under €10000	39 (35.5%)
€10000 - €25000	43 (39.1%)
€25000+	28 (25.5%)
Yogurt consumption status	
Occasional Consumers	27 (24.5%)
Regular Consumers	60 (54.5%)
Heavy Consumers	23 (20.9%)
Interest in the nutrition and health value of food products ($HNV_{1,3,4}$)	
Mean [95% CI]	4.95 [4.7-5,2]
Median [Min, Max]	5.33 [1,7]
Importance of protein content in yogurt choice (PC1)	
Mean [95% CI]	3.58 [3.3-3.9]
Median [Min, Max]	3.0 [1,7]
Level of physical activity	
≤ 5h exercise/week	52 (47.3%)
> 5h exercise/week	58 (52.7%)

4.2 Multivariate regression analysis

Table 6 presents the results of the multivariate regression analysis entering conjoint profile attribute levels as predictors and the preference ratings of respondents as regressor.

Table 6 – Results of the regression analysis with product attributes/levels as predictors and profile ratings as regressor.

	Coefficients			
Term	***β*-estimate**	**SEM**	***t*-statistic**	***p*-value**
INTERCEPT				
Low price (€0.81)+ Natural flavor + no FOPNL claim + FOPNL protein content of 5g	**4.189**	**0.157**	**26.616**	**< 0.001**
PRICE				
Medium (€1.55)	**-0.842**	**0.141**	**-5.984**	**< 0.001**
High (€ 2.94)	**-1.921**	**0.141**	**-13.647**	**< 0.001**
FOPNL				
Claim High protein	-0.070	0.141	-0.495	0.621
Claim Natural protein	-0.021	0.141	-0.151	0.880
Protein content of 10g	0.273	0.141	1.937	0.053
Protein content of 20g	**0.573**	**0.141**	**4.068**	**<0.001**
FLAVOR				
Vanilla	**0.295**	**0.122**	**2.423**	**0.016**

Residual standard error: 1.808 on 982 degrees of freedom for 990 observations of 110 respondents on 9 profiles.
Multiple R-squared: 0.1761, Adjusted R-squared: 0.1702
F-statistic: 29.982 on 7 and 982 DF, *p*-value: < 2.2e-16

In the attributes-only model, price emerges as a very important determinant of preference, with increases in price levels (medium and high compared to a low reference) significantly detracting from profile ratings. This speaks to the consumer sensitivity when it comes to price changes. Regarding FOPNL, only descriptive labelling seems to have a significant impact on preferences, and only when paired to the highest protein content considered. Specifically, the labelling indicating 20 grams of protein content significantly enhanced product ratings compared with no labelling, but not the one indicating 10 grams of protein. On the other hand, "high protein" or "natural" claims on packaging seem not to significantly affect consumer preferences, when compared to profiles where such claims are lacking.

Figures 5a-b provide a useful visualization of the conjoint analysis results. Figure 5a plots the estimated regression correlation coefficients, i.e., the estimated part-worth utilities for each attribute level, allowing for the easy comparison of their valence, magnitude and significance, while Figure 5b provides the quantification of the relative importance of the individual attributes, as derived from the regression analysis coefficient estimates by rescaling the part-

worth utilities to add up to 100%. Notably, the highest price point significantly deters purchase likelihood. This finding may be attributable to the pricing strategy uncovered during market research, where the cost of €2.94 for a 200g serving of non-organic brand yogurt far exceeds the average market price, as reported in Table *1*. An organic yoghurt, for example, cost €3.66, which is a relatively high price for a 200g portion. Thus, the study's medium price point may offer a more accurate reflection of price influence. The second result, and a more relevant finding for the topic of this thesis, is that descriptive nutritional labelling paired with a high protein content positively affects consumer preference, outweighing the effects of other significant drivers like FOPNL claim and flavor.

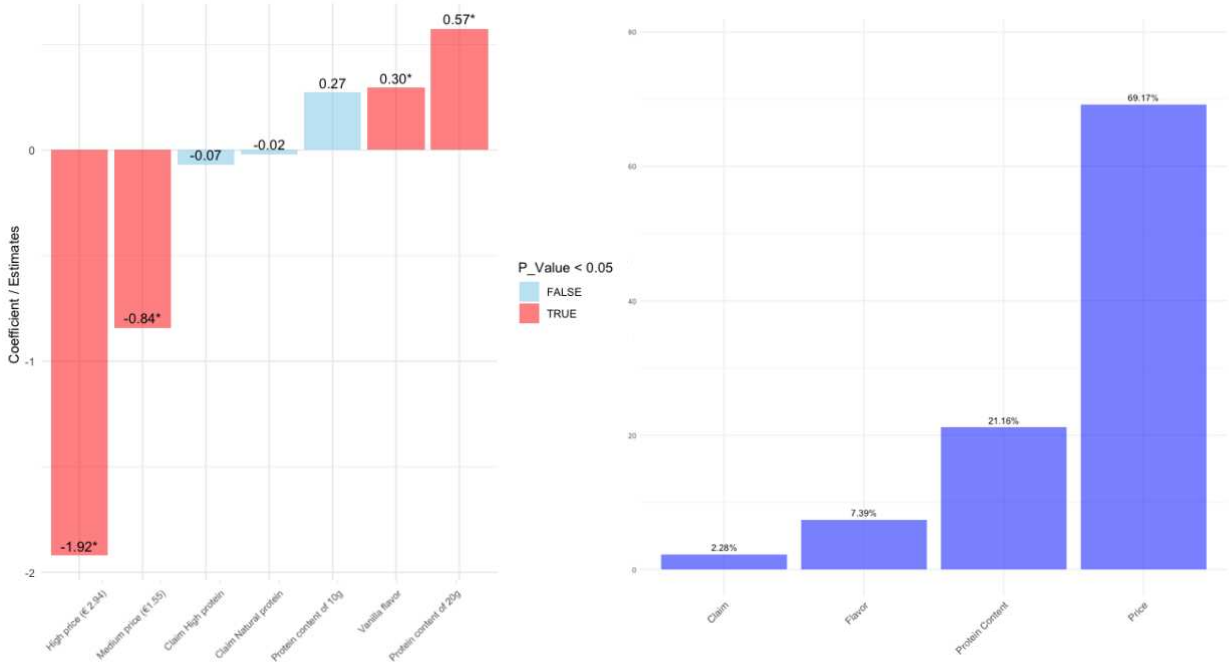

Figure 5a (left) – Plot of part-worth utilities per attribute level tested in the conjoint analysis. Figure 5b (right) – Plot of the relative importance of tested attributes in determining consumer preferences for high-protein yogurt (n=110).

Table 7 presents the results of the multivariate regression analysis entering conjoint profile attribute levels and selected sample characteristics as predictors and the preference ratings of respondents as regressors. These findings offer a more nuanced understanding of high-protein yogurt preferences, firstly by showing that gender differences can play a significant role. Indeed, being female is associated to significantly lower preference ratings for the profiles compared to being male, as indicated by the corresponding negative beta coefficient (p = 0.04). Regarding income, the model reveals a significantly higher preference for the category among the middle-income group (€10,000 - €25,000) compared to the lowest income group, suggesting

a certain degree of price sensitivity within this bracket (p = 0.01). Such significant association does not replicate for the higher income level (above €25,000), indicating that beyond a certain income threshold, the price of high-protein yogurt may not impact preference as much it does for consumers from households in lower income classes. Moreover, living with family or with friends/roommates/partners is significantly negatively associated to profile ratings (p = 0.001 in both cases), suggesting that consumers from multi-person households are likely to have a lower preference for protein-rich yogurts than those living alone. Finally, engaging in more than 5 hours of exercise per week was significantly (p = 0.039) associated with profile ratings compared to the lower activity reference class. This suggests that higher levels of regular physical activity may be linked to a greater preference for high-protein yogurts in general.

Table 7 – Results of the regression analysis with product attributes/levels and consumer characteristics as predictors and profile ratings as regressor.

	Coefficients			
Term	***β*-estimate**	**SEM**	***t*-statistic**	***p*-value**
INTERCEPT				
Low price (€0.81)+ Natural flavor + no FOPNL claim + FOPNL protein content of 5g + Male + Income < 10000€ + Living alone + ≤ 5h/week	**4.657**	**0.237**	**19.652**	**<0.0001**
PRICE				
Medium (€1.55)	**-0.842**	**0.138**	**-6.113**	**<0.0001**
High (€ 2.94)	**-1.921**	**0.138**	**-13.940**	**<0.0001**
FOPNL				
Claim High protein	-0.070	0.138	-0.506	0.613
Claim Natural protein	-0.021	0.138	-0.154	0.878
Protein content of 10g	0.273	0.138	1.979	0.048
Protein content of 20g	**0.573**	**0.138**	**4.156**	**<0.0001**
FLAVOR				
Vanilla	**0.295**	**0.119**	**2.475**	**0.013**
Sample characteristics				
Female	**-0.244**	**0.120**	**-2.038**	**0.042**
Income (€10 000 - €25 000/year)	**0.355**	**0.140**	**2.538**	**0.011**
Income (+ €25 000/year)	-0.240	0.150	-1.600	0.110
Living with family	**-0.717**	**0.167**	**-4.292**	**<0.0001**
Living with friends/roommates/partner	**-0.586**	**0.159**	**-3.691**	**<0.0001**
> 5h/week of exercise	**0.240**	**0.116**	**2.067**	**0.039**

Residual standard error: 1.77 on 976 degrees of freedom for 990 observations of 110 respondents on 9 profiles.
Multiple R-squared: 0.2152, Adjusted R-squared: 0.2048
F-statistic: 20.592 on 13 and 976 DF, *p*-value: < 0.001

4.3 Discussion

This thesis performed conjoint analysis research with a sample of target segment consumers to uncover key drivers of preferences for high-protein yogurts. One crucial contribution of this study was demonstrating that descriptive front-of-pack information on protein content has a significant and substantial effect on consumer preferences. Results showed that yogurt profiles exhibiting higher protein content labels were generally preferred, even after accounting for other product and consumer characteristics. This is consistent with the strengthening of health-conscious eating habits, as outlined in Chapter 2. Indeed, these findings confirm that there is a general trend toward emphasizing nutritional value in diet. The preference for increased protein content, in this case of yogurt, is equally consistent with the burgeoning supply of functional, protein-rich foods being marketed to meet increasingly health-conscious consumer lifestyles (Chen, 2011; Rana & Paul, 2020).

Contrary to the initial hypothesis, the analysis revealed that while protein content itself was a significant factor in shaping consumer preferences, the "high protein" claims did not markedly influence the young adults' evaluations of yogurts. This suggests that while the indication of the product's protein content is valued, specific claims made about it may not be as important to consumers. This result could be due to the demographics of the sample, which included young adults who may be more cautious in their food choices due to their greater skepticism towards marketing strategies. This trend is not extensively addressed in extant research, although these types of claims are discussed in various publications and are shown to have an impact on purchasing behavior (Cecchini & Warin, 2016; Mai & Hoffmann, 2012).

To this respect, results also suggest that factual nutritional information is likely to be favored over evaluative health claims. Considering previous studies highlighting the influence of interpretative labelling on consumer behavior (Ikonen et al., 2020), the findings of this thesis indicate a potential shift towards a more informed and evidence-based approach among young consumers. This preference for Descriptive Nutritional Labelling makes an even stronger case for the existence of a highly nuanced understanding of health-related information, potentially reinforced by the role of digital media in the dissemination of nutritional knowledge. This influence of social media on the shaping of eating habits consumers to descriptive nutritional information would be consistent with the observations of Folkvord and colleagues (2020).

Finally, the observation of strong price sensitivity among young adults suggests a delicate balance between the appeals of health benefits and economic constraints. While the literature suggests that willingness to pay more for health-promoting dietary profiles is influenced by socioeconomic status and health concerns (Kaya et al., 2013), the findings of this thesis portray

a consumer segment that appreciates health benefits but also weighs them against financial considerations. This makes the market dynamics even more complex and requires a reassessment of pricing strategies to meet the different needs of this segment of the population. Including consumer characteristics as predictors provides additional insights on the nature of the relevant predictors of preferences, especially when considering the negative coefficient for female respondents. This hints at a complex relationship between gender and protein-rich food preferences. Historically, high-protein foods were marketed with a clear gender bias, predominantly targeting males with connotations of muscle building and sports' nutrition (O'Hagan, 2022). Present findings suggest that this bias may still prevail to some extent. Income levels further complicate this landscape. The significant positive coefficient for individuals with an income between €10,000 and €25,000 suggests that young adults in this income bracket place value on the health benefits of high-protein yogurt. This preference seems, however, not to be shared by those in the higher income group, indicating that the decision-making process for these consumers may involve a broader range of considerations beyond health, such as those related to sustainability (Banovic et al., 2018).

Household composition or living arrangements also demonstrated to play an important role in determining preferences, with respondents residing with family or friends/roommates/partner exhibiting a significant lower preference for high-protein yogurts than those living alone. This could reflect the collective nature of food preferences and choices in shared living arrangements.

Last but not least, the significant positive relationship found between a highly active lifestyle and a preference for high-protein yogurt suggests that individuals who engage in more frequent physical activity may prioritize dietary choices that support their fitness and wellness goals. This aligns with the study by Kaya and colleagues (2013), which found that lifestyle and socio-economic status significantly influence consumer preferences and willingness-to-pay for health-promoting nutritional profiles. Altogether, these findings emphasize the importance of aligning food product benefits with different aspects of consumers' health-related lifestyles.

In sum, the conjoint analysis findings in conjunction with the trends in consumer behavior discussed in Chapter 2 provide a multi-layered picture of preference determinants.

5 CONCLUSIONS

5.1 Main findings

This thesis studied the role of FOPNL in determining the food preferences of European consumers interested in protein-enriched foods, against the background of increasing health-through-nutrition awareness and an ever-growing functional foods' market. Namely, it focused on the question of how much is FOPNL impacting young adults' preferences for high-protein yogurts compared to other relevant product attributes, to uncover any relative advantage of this promotional strategy. To answer this question, the study began with a literature review, followed by online research of several European grocery stores to ascertain the characteristics of their current offer in the high-protein dairy category. This formed the basis for the development of the attributes and levels for a subsequent conjoint analysis study based on the responses obtained from an online consumer study.

A key finding uncovered by this research is that young adults show a clear preference for explicit labelling of the actual protein content in high-protein yogurts. This preference underscores an important trend towards valuing substantive nutritional information over associated allegations, suggesting that interpretative FOP labelling and related claims may not hold as much importance as actual protein content description. Interestingly, these findings contradict the established theories and findings offered by extant research, mostly not conducted among young demographics. Much emphasis has traditionally been laid on the perceived value of health-related claims in food packaging and a strong influence through claims like 'high-protein' or 'natural' labels on consumer choices is inferred. This thesis uncovered however a different outcome, with results unveiled that the young adults do not seem to hold a particular preference for products that boast such claims, favoring clarity and transparency instead.

Moreover, results highlight the importance of individual characteristics, such as gender and lifestyle, in shaping preferences for high-protein yogurts. This reveals a gender divide and suggests that protein's association with ideals of fitness with masculine connotations could narrow the product's appeal. To reach a broader market, brands need to navigate beyond these niches, possibly through education and inclusive marketing that resonate with varied health motivations and lifestyles.

5.2 Implications

The contributions provided by the work carried out in this thesis are valuable to product marketing and public health activities alike, especially when targeted to young adults. First and foremost, they indicate the need for promotional and health communication strategies to shift towards the provision of more informative content on nutritional value, one that supports a better understanding of the health benefits of high-protein products. Making clear the source and quality of the protein which is present in their products, rather than relying on attractive buzzwords, may serve brands better. In that sense, this transparency could further help to promote greater trust and loyalty within the young adult consumer segment who are likely to possess disparate levels of product awareness and health consciousness.

Secondly, weighing in economic considerations suggests that the yogurt industry should critically rethink its pricing strategies in order to offer a wider portfolio of protein-rich product offers without compromising on nutritional benefits. Strategies in this respect could include value packs or scales-priced packages to cater for budget constraints that usually overhang the younger demographics. Likewise, other relevant consumer characteristic, such as gender, income level and household composition, suggest that a one-size-fits-all approach to marketing high-protein yogurts may be ill-advised and create opportunities for further differentiation.

5.3 Limitations and future research recommendations

This study provides valuable insights into young adults' preferences for high-protein yogurts, but it is subject to several limitations that should be acknowledged for a proper contextual understanding of the findings. One notable limitation is the reliance on self-reported data from an online survey, which introduces potential biases such as the possibility of over-reporting or under-reporting specific behaviors (Bethlehem, 2010). Additionally, this research has a focused scope on high-protein yogurts, limiting the generalizability of the findings to other food products or broader dietary patterns. Finally, limiting the study to young Western adults precludes generalizing results to other segments and population groups. Future research should diversify the demographics of samples to incorporate the all-comprehensive scope of consumer preferences based on their individual characteristics.

The empirical measurement of product knowledge was not included, preventing a comparative analysis against other groups that could yield significant variances in the interpretation of product attributes and claims. The unique product knowledge of young adults, likely influenced by the prolific access to nutritional and health information through digital media and educational institutions, may have impacted their preferences. Sensory attributes, which are

known to significantly influence food preferences, were likewise not considered in this study. Attributes such as taste, texture, and aroma play a critical role in consumer choices and could be key factors driving the acceptance of high-protein yogurts. Future research could include a sensory tasting study, allowing for a comprehensive evaluation of these products, including real consumption experiences.

Furthermore, the inclusion of an organic yogurt variant, which is significantly more expensive than the typical market offering, was a factor that distorted the high price level in our conjoint analysis. This may have influenced respondents' price sensitivity perceptions, potentially limiting the generalizability of our findings to standard pricing scenarios. Future studies should account for such outliers to ensure a more representative analysis of consumer price sensitivity.

In addition, factors such as brand loyalty, shopping habits and past consumption behavior were not controlled for in the study. These elements are known to substantially affect purchasing decisions, alongside the product features focused on in this research. Finally, conjoint analysis, while robust, operates on the assumption that consumers make rational choices based on the evaluation of available information. This method may not fully capture the complexity of real-world decision-making, which can be influenced by emotions, social contexts, or marketing pressures.

Recognizing these limitations is crucial for accurately interpreting the results and understanding the scope of their applicability. Future studies could address these gaps by employing a more holistic approach, including empirical measurement of product knowledge, sensory evaluation, and accounting for brand loyalty and habitual consumption patterns to understand consumer preferences more comprehensively.

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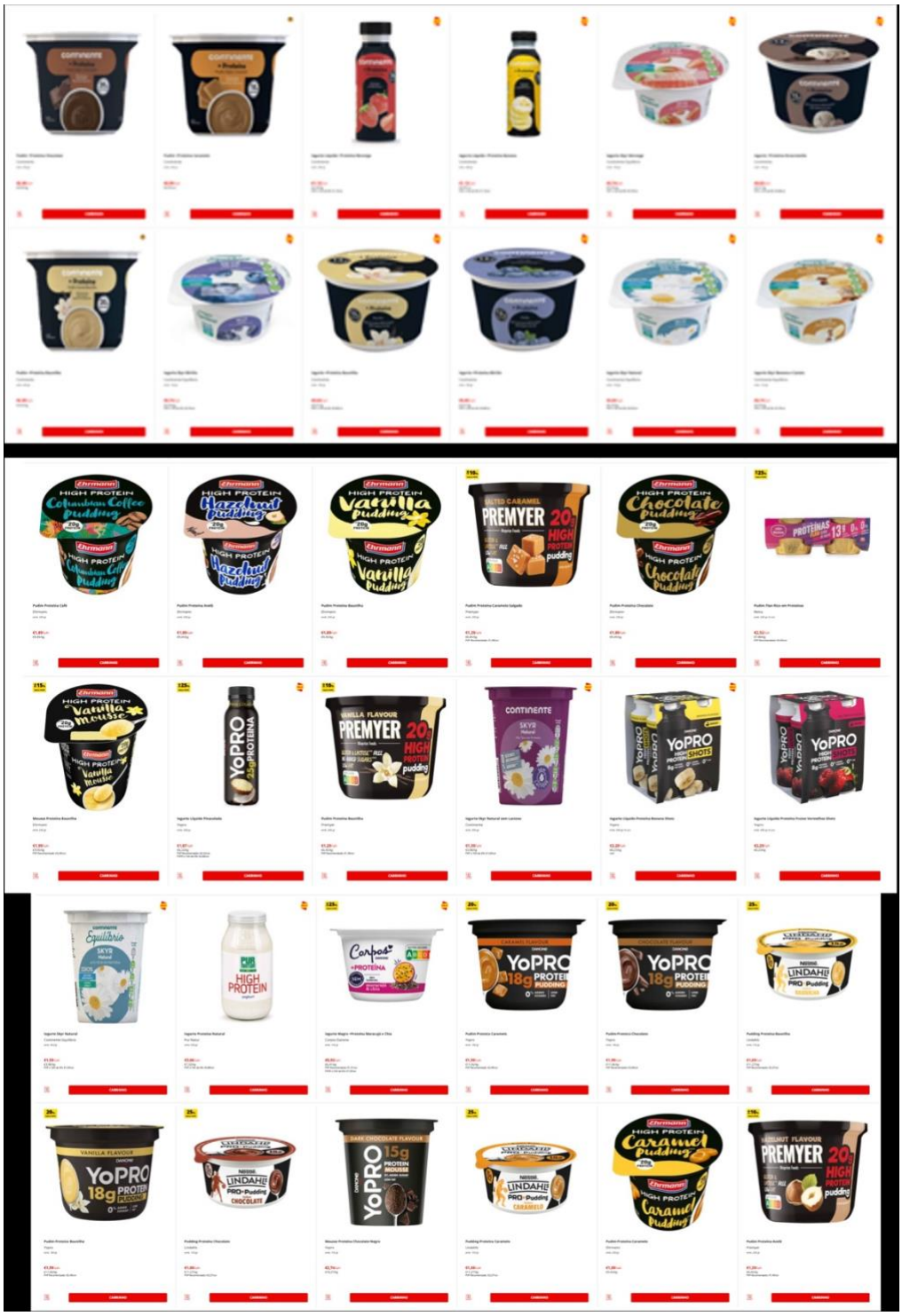
Appendix 1 – High-protein yogurts in Portugal



Appendix 2 – Survey on Qualtrics

intro

Thank you for taking part in my survey.

This research is being conducted as part of a thesis on **consumer choices in the food market** for the Master's degree in Management at the Católica Lisbon School of Business and Economics.

This survey is anonymous and will take about **5 minutes to complete**. Your participation is completely voluntary, and you can stop at any time. All data collected is for academic research purposes only.

If you agree to participate, please click the button below to start the survey for any questions or comments, please feel free to contact me by e-mail: s-mcoman-miko@ucp.pt

Thank you for your time and valuable input.
Mark Coman-Miko

Selection questions

What is your age?

▼ Under 18 (18) ... over 29 (30)

How often do you consume yogurt?

- Daily (4)
- Weekly (3)
- Monthly (2)
- Rarely (1)
- Never (0)

Do you have any dietary preferences or restrictions?

- Vegetarian (3)
- Vegan (0)
- Gluten-Free (2)
- Lactose Intolerant (0)
- No Restrictions (1)

Intro conjoint

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

To this end, we will **show you 9 different types of yogurts** sequentially and ask you to evaluate each one of them independently according to your personal preference.
Its important that you imagine yourself in a **realistic shopping situation** where you would actually consider buying this type of product for the stated price, and provide your preference accordingly.
These nine yoghurts may **differ in flavour, composition or source of ingredients**, as you will be able to see by the information provided in the packaging. Please view now each one of them carefully, consider all its characteristics, and give us your honest opinion about it.

Profile2

How likely is it that you will buy this product at the stated price?

Price: €2,94

Extremely unlikely (1)
Moderately unlikely (2)
Slightly unlikely (3)
Neither likely nor unlikely (4)
Slightly likely (5)
Moderately likely (6)
Extremely likely (7)

Profile7

How likely is it that you will buy this product at the stated price?

Price: €0,81

Extremely unlikely (1)
Moderately unlikely (2)
Slightly unlikely (3)
Neither likely nor unlikely (4)
Slightly likely (5)
Moderately likely (6)
Extremely likely (7)

Profile5

How likely is it that you will buy this product at the stated price?

Price: 1.55€

Extremely unlikely (1)
Moderately unlikely (2)
Slightly unlikely (3)
Neither likely nor unlikely (4)
Slightly likely (5)
Moderately likely (6)
Extremely likely (7)

Profile4

How likely is it that you will buy this product at the stated price?

Price: €1,55

Extremely unlikely (1)
Moderately unlikely (2)
Slightly unlikely (3)
Neither likely nor unlikely (4)
Slightly likely (5)
Moderately likely (6)
Extremely likely (7)

Profile3

How likely is it that you will buy this product at the stated price?

Price: €1,55

Extremely unlikely (1)
Moderately unlikely (2)
Slightly unlikely (3)
Neither likely nor unlikely (4)
Slightly likely (5)
Moderately likely (6)
Extremely likely (7)

Profile6

How likely is it that you will buy this product at the stated price?

Price: €0,81

Extremely unlikely (1)
Moderately unlikely (2)
Slightly unlikely (3)
Neither likely nor unlikely (4)
Slightly likely (5)
Moderately likely (6)
Extremely likely (7)

Profile1

How likely is it that you will buy this product at the stated price?

Price: €2,94

Extremely unlikely (1)
Moderately unlikely (2)
Slightly unlikely (3)
Neither likely nor unlikely (4)
Slightly likely (5)
Moderately likely (6)
Extremely likely (7)

•

Profile8

How likely is it that you will buy this product at the stated price?

Price: €2,94

Extremely unlikely (1)
Moderately unlikely (2)
Slightly unlikely (3)
Neither likely nor unlikely (4)
Slightly likely (5)
Moderately likely (6)
Extremely likely (7)

Profile9

How likely is it that you will buy this product at the stated price?

Price: 0.81€

Extremely unlikely (1)
Moderately unlikely (2)
Slightly unlikely (3)
Neither likely nor unlikely (4)
Slightly likely (5)
Moderately likely (6)
Extremely likely (7)

Carousel questions

Please rate to what extent you agree with the following statements.

	Strongly agree (7)	Agree (6)	Somewhat agree (5)	Neither agree nor disagree (4)	Somewhat disagree (3)	Disagree (2)	Strongly disagree (1)
I consciously make food choices that are beneficial to my health. (8)	○	○	○	○	○	○	○
I prioritize taste over health benefits when choosing what to eat. (9)	○	○	○	○	○	○	○
I actively seek out information regarding the health aspects of the foods I consume. (10)	○	○	○	○	○	○	○
I consistently check the nutrition labels on food products before purchasing. (11)	○	○	○	○	○	○	○
The protein content is a primary factor in my decision to purchase a particular yogurt. (13)	○	○	○	○	○	○	○
I rarely consider the protein content when choosing yogurt. (14)	○	○	○	○	○	○	○

Which country do you currently live in?

- Portugal (1)
- Germany (2)
- Austria (3)
- USA (4)
- Denmark (5)
- France (6)
- Other (0) _____

What gender do you identify with?

- Male (1)
- Female (2)
- Non-Binary (3)

Please indicate how many **hours per week** you usually **exercise**.
eg. training, running, practising sports etc

hours a week

0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30

()	

Please indicate your annual income class (before taxes).

- Under €10,000 (1)
- €10,000 - €25,000 (2)
- €25,000 - €35,000 (3)
- €35,000 - €50,000 (4)
- Over €50,000 (5)
- Prefer not to say (0)

Which best describes your household composition?

- Living alone (1)
- Living with family (2)
- Living with friends/roommates/partner (3)
- Other (please specify) (0)

_____

Appendix 3 – R code

```
….loading packages

# Read the dataset + manipulation of the missing values to the median of th
e column
yogurt  <- read_sav("yogurt_data_AC011223.sav") %>%
  mutate(across(where(is.numeric), ~replace_na(., median(., na.rm = TRUE)))
)

# Select only the columns relevant for conjoint analysis
# Adjust the column names according to your dataset

yogurt_selected <- yogurt %>%
  pivot_longer(cols = starts_with("profile"),
               names_to = "profile",
               values_to = "rating") %>%
  mutate(profile = factor(profile))

#Extract numeric profile IDs from the profile column
yogurt_selected <- yogurt_selected %>%
  mutate(profile_number = as.numeric(str_extract(profile, "\\d+")))

# Load the "AUSGABE" dataset
ausgabe_data <- read_excel("AUSGABE.xlsx")

# Convert string levels to numeric dummy variables
ausgabe_data <- ausgabe_data %>%
  mutate(
    price_medium_1.55 = as.numeric(price == "medium"),
    price_high_2.94 = as.numeric(price == "high"),
    flavour_vanilla = as.numeric(flavor == "vanilla"),
    claim_high_protein = as.numeric(claim == "high protein"),
    claim_natural = as.numeric(claim == "natural source"),
    protein_10g = as.numeric(nutrition == "10g"),
    protein_20g = as.numeric(nutrition == "20g")
  )

# Ensure that the profile_number in yogurt_long is numeric
yogurt_selected <- yogurt_selected %>%
  mutate(profile_number = as.numeric(profile_number))

# Merge the datasets
yogurt_merged <- yogurt_selected %>%
  left_join(ausgabe_data, by = "profile_number")

# Assuming 'yogurt_merged' is your dataset
correlation_matrix <- round(cor(yogurt_merged[, c("rating", "Age", "Yoghurt
Class", "Gender", "Mean_HealthNutrition_3i", "carousel_5_inv", "income_clas
s", "householdcomposition", "country_class", "exercise_1_dummy")], use = "c
omplete.obs",method="spearman"),2)
correlation_matrix
```

	rating	Age	YoghurtClass	Gender	
rating	1.00	-0.08	-0.01	-0.06	
Age	-0.08	1.00	0.10	-0.05	
YoghurtClass	-0.01	0.10	1.00	-0.02	
Gender	-0.06	-0.05	-0.02	1.00	
Mean_HealthNutrition_3i	-0.04	0.06	0.25	-0.04	
carousel_5_inv	0.11	-0.14	0.05	-0.24	
income_class	-0.05	0.08	0.00	-0.13	
householdcomposition	-0.11	0.12	-0.06	0.11	
country_class	-0.01	0.00	0.08	0.02	
exercise_1_dummy	0.09	-0.02	0.05	-0.18	

	Mean_HealthNutrition_3i	carousel_5_inv	income_class
rating	-0.04	0.11	-0.05
Age	0.06	-0.14	0.08
YoghurtClass	0.25	0.05	0.00
Gender	-0.04	-0.24	-0.13
Mean_HealthNutrition_3i	1.00	0.43	0.14
carousel_5_inv	0.43	1.00	-0.12
income_class	0.14	-0.12	1.00
householdcomposition	0.07	-0.13	0.04
country_class	0.04	0.00	0.18
exercise_1_dummy	0.25	0.32	-0.12

	householdcomposition	country_class	exercise_1_dummy
rating	-0.11	-0.01	0.09
Age	0.12	0.00	-0.02
YoghurtClass	-0.06	0.08	0.05
Gender	0.11	0.02	-0.18
Mean_HealthNutrition_3i	0.07	0.04	0.25
carousel_5_inv	-0.13	0.00	0.32
income_class	0.04	0.18	-0.12
householdcomposition	1.00	-0.02	-0.09
country_class	-0.02	1.00	0.13
exercise_1_dummy	-0.09	0.13	1.00

```
#summary with stargazer
stargazer(data.frame(yogurt), type = "text", no.space = TRUE, header = FALS
E,
          title = "Summary Statistics")


Summary Statistics
=========================================================
Statistic                 N   Mean  St. Dev.  Min   Max
---------------------------------------------------------
Age                     110 24.645  2.352    19    29
YoghurtClass            110 1.964   0.676     1     3
profile1                110 2.564   1.673     1     7
profile2                110 2.482   1.717     1     6
profile3                110 3.609   1.698     1     7
profile4                110 3.336   1.747     1     7
profile5                110 4.145   1.953     1     7
profile6                110 4.773   1.890     1     7
profile7                110 4.109   1.965     1     7
profile8                110 2.809   1.850     1     7
profile9                110 4.736   1.764     1     7
Mean_Profiles           110 3.618   1.217   1.000 6.444
Mean_HealthNutrition_3i 110 4.955   1.186   1.000 7.000
carousel_5_inv          110 3.582   1.752     1     7
country_class           110 1.955   0.806     1     3
Gender                  110 1.600   0.492     1     2
exercise_1              110 5.664   3.982     0    24
exercise_1_dummy        110 0.527   0.502     0     1
income_class            110 1.900   0.778     1     3
householdcomposition    110 2.291   0.758     1     3
YogurtConsumption       110 2.136   0.862     1     4
YogurtConsumption_inv   110 3.864   0.862     2     5
DietaryPreferences      110 3.382   1.157     1     4
country                 110 3.136   2.340     1     7
income                  110 2.136   1.215     1     5
TSC_4775                110 1.573   0.497     1     2
carousel_1_inv          110 5.464   1.246     1     7
carousel_2_inv          110 4.436   1.456     1     7
carousel_3_inv          110 4.945   1.387     1     7
carousel_4_inv          110 4.455   1.695     1     7
carousel_6_inv          110 4.373   1.842     1     7
---------------------------------------------------------
```

-
```
    #labelling
yogurt_merged$YoghurtClass <- factor(yogurt_merged$YoghurtClass,
                                     levels = c(1,2,3),
                                    labels = c("Occasional Consumers", "Regular
Consumers", "Heavy Consumers"))

yogurt_merged$income_class <- factor(yogurt_merged$income_class, levels = c
(1,2,3), labels = c("Under €10000", "€10000 - €25000", "€25000+"))

yogurt_merged$householdcomposition <- factor(yogurt_merged$householdcomposi
tion, levels = c(1, 2, 3), labels = c("Living alone", "Living with family",
"Living with friends/roommates/partner"))
```

```
yogurt_merged$Gender <- factor(yogurt_merged$Gender, levels = c(1, 2), labe
ls = c("Male", "Female"))

yogurt_merged$country_class <- factor(yogurt_merged$country_class, levels =
c(1, 2, 3), labels = c("Portugal", "Germany", "Rest of the World"))

#checking Cronbach alpha

alpha(subset(yogurt, select = c(carousel_1_inv, carousel_3_inv, carousel_4_
inv)))


Reliability analysis
Call: alpha(x = subset(yogurt, select = c(carousel_1_inv, carousel_3_inv,
    carousel_4_inv)))

  raw_alpha std.alpha G6(smc) average_r S/N   ase mean  sd median_r
      0.75      0.76     0.7      0.52 3.3 0.042    5 1.2     0.45

    95% confidence boundaries
         lower alpha upper
Feldt     0.65  0.75  0.82
Duhachek  0.66  0.75  0.83

 Reliability if an item is dropped:
               raw_alpha std.alpha G6(smc) average_r S/N alpha se var.r med
.r
carousel_1_inv      0.61      0.62    0.45      0.45 1.6    0.072    NA  0.
45
carousel_3_inv      0.60      0.62    0.45      0.45 1.6    0.072    NA  0.
45
carousel_4_inv      0.79      0.80    0.66      0.66 3.9    0.039    NA  0.
66

 Item statistics
                 n raw.r std.r r.cor r.drop mean  sd
carousel_1_inv 110  0.82  0.85  0.76   0.64  5.5 1.2
carousel_3_inv 110  0.84  0.85  0.76   0.63  4.9 1.4
carousel_4_inv 110  0.81  0.77  0.55   0.49  4.5 1.7

Non missing response frequency for each item
                   1    2    3    4    5    6    7 miss
carousel_1_inv 0.01 0.03 0.06 0.04 0.28 0.42 0.16    0
carousel_3_inv 0.02 0.05 0.11 0.03 0.48 0.19 0.12    0
carousel_4_inv 0.06 0.09 0.15 0.09 0.33 0.16 0.11    0

# Create the first part of the table with some variables
table1 <- table1::table1(~ Age + Gender + YoghurtClass + income_class + cou
ntry_class + householdcomposition + exercise_1_dummy + carousel_1_inv + car
ousel_2_inv + carousel_3_inv + carousel_4_inv + carousel_5_inv +carousel_6_
inv + Mean_HealthNutrition_3i,
                               data = yogurt, na.rm = TRUE, digits = 3, for
mat.number = TRUE)

table1
```

	Overall (N= 110)
How old are you?	
Mean (SD)	24.6 (2.35)
Median [Min, Max]	25.0 [19.0, 29.0]
What gender do you identify with?	
Mean (SD)	1.60 (0.492)
Median [Min, Max]	2.00 [1.00, 2.00]
YoghurtClass	
Mean (SD)	1.96 (0.676)
Median [Min, Max]	2.00 [1.00, 3.00]
income_class	
Mean (SD)	1.90 (0.778)
Median [Min, Max]	2.00 [1.00, 3.00]
country_class	
Mean (SD)	1.95 (0.806)
Median [Min, Max]	2.00 [1.00, 3.00]
Which best describes your household composition? - Selected Choice	
Mean (SD)	2.29 (0.758)
Median [Min, Max]	2.00 [1.00, 3.00]
exercise_1_class	

Mean (SD)	0.527 (0.502)
Median [Min, Max]	1.00 [0, 1.00]
I consciously make food choices that are beneficial to my health.	
Mean (SD)	5.46 (1.25)
Median [Min, Max]	6.00 [1.00, 7.00]
I prioritize taste over health benefits when choosing what to eat.	
Mean (SD)	4.44 (1.46)
Median [Min, Max]	5.00 [1.00, 7.00]
I actively seek out information regarding the health aspects of the foods I consume.	
Mean (SD)	4.95 (1.39)
Median [Min, Max]	5.00 [1.00, 7.00]
I consistently check the nutrition labels on food products before purchasing.	
Mean (SD)	4.45 (1.70)
Median [Min, Max]	5.00 [1.00, 7.00]
The protein content is a primary factor in my decision to purchase a particular yogurt.	
Mean (SD)	3.58 (1.75)
Median [Min, Max]	3.00 [1.00, 7.00]
I rarely consider the protein content when choosing yogurt.	
Mean (SD)	4.37 (1.84)
Median [Min, Max]	5.00 [1.00, 7.00]

COMPUTE Mean_HealthNutrition_3i=MEAN(carousel_1_inv,carousel_3_inv,carousel_4_inv)	
Mean (SD)	4.95 (1.19)
Median [Min, Max]	5.33 [1.00, 7.00]

```
#Regression model with carousel and exercise variables
options(scipen=999)
model1 <- lm( rating ~ (price_medium_1.55) + (price_high_2.94) + (flavour_v
anilla) + (claim_high_protein) + (claim_natural) + (protein_10g) + (protein
_20g), data = yogurt_merged)


# View the summary of the model to see part-worth utilities
summ(model1,digits = 3)
```

MODEL INFO:
Observations: 990
Dependent Variable: (rating)
Type: OLS linear regression

MODEL FIT:
$F(7,982) = 29.981$, $p = 0.000$
$R^2 = 0.176$
Adj. $R^2 = 0.170$

Standard errors: OLS

	Est.	S.E.	t val.	p
(Intercept)	4.189	0.157	26.616	0.000
price_medium_1.55	-0.842	0.141	-5.984	0.000
price_high_2.94	-1.921	0.141	-13.647	0.000
flavour_vanilla	0.295	0.122	2.423	0.016
claim_high_protein	-0.070	0.141	-0.495	0.621
claim_natural	-0.021	0.141	-0.151	0.880
protein_10g	0.273	0.141	1.937	0.053
protein_20g	0.573	0.141	4.068	0.000

```
# Run the regression model
model2 <- lm( rating ~ price_medium_1.55 + price_high_2.94 + flavour_vanill
a + claim_high_protein + (claim_natural)+ (protein_10g)+ (protein_20g) + (G
ender)+ income_class+householdcomposition+ (exercise_1_dummy), data = yogur
t_merged)
summ(model2, digits = 3)
```

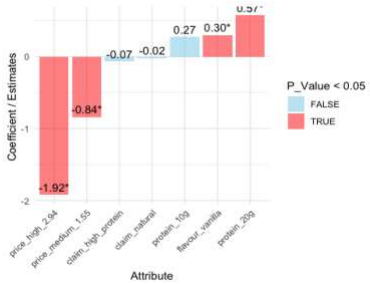
MODEL INFO:
Observations: 990
Dependent Variable: rating
Type: OLS linear regression

MODEL FIT:
$F(13,976) = 20.592$, $p = 0.000$
$R^2 = 0.215$
Adj. $R^2 = 0.205$

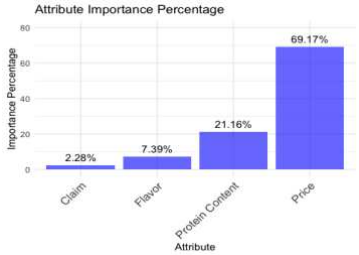
Standard errors: OLS

	Est.	S.E.	t val.	p
(Intercept)	4.901	0.303	16.178	0.000
price_medium_1.55	-0.842	0.138	-6.113	0.000
price_high_2.94	-1.921	0.138	-13.940	0.000
flavour_vanilla	0.295	0.119	2.475	0.013
claim_high_protein	-0.070	0.138	-0.506	0.613
claim_natural	-0.021	0.138	-0.154	0.878
protein_10g	0.273	0.138	1.979	0.048
protein_20g	0.573	0.138	4.156	0.000
Gender	-0.244	0.120	-2.038	0.042
householdcomposition2	-0.717	0.167	-4.292	0.000
householdcomposition3	-0.586	0.159	-3.691	0.000
income_class10000-25000	0.355	0.140	2.538	0.011
income_class+25000	-0.240	0.150	-1.600	0.110
exercise_1_dummy	0.240	0.116	2.067	0.039

```
coefficients <- coef(model1)
p_values <- summary(model1)$coefficients[, "Pr(>|t|)"]

# Exclude the intercept (if it's the first coefficient)
if (length(coefficients) > 1) {
  coefficients <- coefficients[-1]
  p_values <- p_values[-1]
}

# Calculate the importance percentages based on coefficients
importance_percentages <- (abs(coefficients) / sum(abs(coefficients))) * 10
0

# Create a data frame for plotting
importance_data <- data.frame(Attribute = names(coefficients),
                              Coefficients = coefficients,
                              Importance = importance_percentages,
                              P_Value = p_values)

# Sort the data frame by absolute coefficients in descending order
importance_data <- importance_data[order(-abs(importance_data$Coefficients)
), ]

# Create a plot with both coefficients and importance percentages, highligh
ting significant attributes
ggplot(importance_data, aes(x = reorder(Attribute, Coefficients), y = Coeff
icients, fill = P_Value < 0.05)) +
  geom_bar(stat = "identity", alpha = 0.5) +
  geom_text(aes(label = ifelse(P_Value < 0.05, sprintf("%.2f*", Coefficient
s), sprintf("%.2f", Coefficients)), vjust = -0.5)) +
  scale_fill_manual(values = c("FALSE" = "skyblue", "TRUE" = "red")) +  # C
olor for significance
  theme_minimal() +
  labs(x = "Attribute", y = "Coefficient / Estimates ") +
  theme(axis.text.x = element_text(angle = 45, hjust = 1))
```



```r
# Extract the coefficients and p-values from model2
coefficients <- coef(model2)
p_values <- summary(model2)$coefficients[, "Pr(>|t|)"]

# Define the dummies for each attribute
dummies_price <- c("price_medium_1.55", "price_high_2.94")
dummies_flavor <- c("flavour_vanilla")
dummies_claim <- c("claim_high_protein", "claim_natural")
dummies_protein <- c("protein_10g", "protein_20g")

# Create a data frame for the attributes and their levels
attributes_data <- data.frame(
  Attribute = c("Price", "Flavor", "Claim", "Protein Content"),
  Coefficients = c(sum(coefficients[dummies_price]),
                   sum(coefficients[dummies_flavor]),
                   sum(coefficients[dummies_claim]),
                   sum(coefficients[dummies_protein])),
  P_Value = c(max(p_values[dummies_price]),
              max(p_values[dummies_flavor]),
              max(p_values[dummies_claim]),
              max(p_values[dummies_protein]))
)

# Calculate the importance percentages based on coefficients
importance_percentages <- (abs(attributes_data$Coefficients) / sum(abs(attr
ibutes_data$Coefficients))) * 100

# Create a data frame for plotting
importance_data <- data.frame(
  Attribute = attributes_data$Attribute,
  Importance = importance_percentages,
  P_Value = attributes_data$P_Value
)

# Sort the data frame by importance percentages in descending order
importance_data <- importance_data[order(-importance_data$Importance), ]

# Create a plot with importance percentages, highlighting significant attri
butes
ggplot(importance_data, aes(x = reorder(Attribute, Importance), y = Importa
nce)) + geom_bar(stat = "identity", alpha = 0.6, fill = "blue") + geom_text
(aes(label = paste0(sprintf("%.2f", Importance), "%")), vjust = -0.6) +them
e_minimal() + scale_y_continuous(limits = c(0, 80)) + labs(x = "Attribute",
y = "Importance Percentage", title = "Attribute Importance Percentage") + t
heme(axis.text.x = element_text(angle = 45, hjust = 1, size = 12))
```



Appendix 4 – Spearman correlation matrix

Variable	rating	Age	Yoghurt consumption status	Gender	Mean $HNV_{1,3,4}$	PC 1	Yearly personal income	Household composition	Country of residence
Age	-0.08								
Yoghurt consumption status	-0.01	0.10							
Gender	-0.06	-0.05	-0.02						
Mean $HNV_{1,3,4}$	-0.04	0.06	0.25	-0.04					
PC 1	0.11	-0.14	0.05	-0.24	0.43				
Yearly personal income	-0.05	0.08	0.00	-0.13	0.14	-0.12			
Household-composition	-0.11	0.12	-0.06	0.11	0.07	-0.13	0.04		
Country of residence	-0.01	0.00	0.08	0.02	0.04	0.00	0.18	-0.02	
Level of physical activity	0.09	-0.02	0.05	-0.18	0.25	0.32	-0.12	-0.09	0.13