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**Analysing the impact of the Nutri-score nutrition labelling system on
consumer perceptions and purchase intention**

**A Nutri-score tápértékjelölési rendszer fogyasztói megítélésre és vásárlási
szándékra gyakorolt hatásának vizsgálata**

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ABSTRACT

This quantitative study aims to investigate the effect of Nutri-score nutrition labelling system on consumers' perception of product healthiness and buying intention utilizing explicit (self-report) and implicit methods in an online shopping context. The study addresses also, whether personal factors such as nutrition knowledge, general health interest, body weight discrepancy and demographic variables affect their perception and behaviour. In the self-report questionnaire, participants evaluated product healthiness with validated scales and indicated their purchase intention. The implicit association test revealed that consumers rather associate Nutri-score with healthy concepts, moreover, t-test confirmed that participants had significantly higher explicit healthiness perception and purchase intention in the Nutri-score label intervention condition. The research has several implications to businesses, most importantly, that by presenting Nutri-score label in online shopping environments, demand and sales for specific products can be increased and so yield management can be optimized.

I. INTRODUCTION

1.1 Topic choice

Understanding consumers' behaviour is a complex process, where many influencing factors are present (Köster, 2009). In many cases, their decision is influenced by their unconscious mind (Martin & Morich, 2011), and so traditional methods, like questionnaires and interviews are not suiting anymore for a comprehensive understanding of their decision journey (Varga, 2016).

Online and offline shopping behaviour is very different, and offline companies are able to trigger the buying impulse to a greater extent than online retailers (Aragoncillo & Orus, 2018). Online and offline channels both have unique advantages and disadvantages and understanding shoppers' motivations and behaviours in both cases is crucial for better serving their needs and preferences (Kim & Han, 2023). According to Köster (2009) food-related choices are influenced by many interacting factors among other extrinsic and intrinsic product characteristics. Out of these factors, one of the most relevant for my research is product packaging.

Multiple studies examine strategies whereby consumers' choices can be influenced towards a more health-conscious product with product packaging: with the help of package colour (Garber et al., 2000; Huang & Lu, 2016; Mai et al., 2016; Sugrue & Dando, 2018), shape (Fenko et al., 2016; Sousa et al., 2020; Velasco et al., 2014), size (Ahani et al., 2013; Scott et al., 2008; Silayoi & Speece, 2004), material (Binninger, 2015; Hussain et al., 2023; Marckhgott & Kamleitner, 2019; Underwood et al., 2001; Ye et al., 2019) and font (Asri et al., 2020; Deliya & Parmar, 2012; Mutsikiwa, 2013) consumers' perception of quality, taste, brand image and healthiness can be formed and changed. The last one is particularly relevant nowadays, as overweight, obesity, hypertension, type 2 diabetes, stroke and other very common diseases are partly due to the growth of unhealthy food choices (Vecchio & Cavallo, 2019), and so guiding consumers towards healthier choices is crucial.

For this aim, besides the above-mentioned elements – so-called sub-elements (Hussain et al., 2023) – product labels, including nutrition labels, are important to examine. Studies indicate that nutrition labels can indeed contribute to precisely assessing the healthiness of a product, but this is not valid in every case. Nutrition labels come in many forms and ways (Kelly & Jewell, 2018), which makes it complicated for consumers to get familiar with them and correctly interpret them.

The Nutri-score label system was introduced to create an easily understandable concept based on colours to guide consumers towards healthier choices at the point of purchase (Julia & Hercberg, 2017) and since then, multiple studies have examined its effect on consumer choices (De Temmerman et al., 2021; Egnell et al., 2020; Jürkenbeck et al., 2022; Vandevijvere & Berger, 2021). Egnell et al. (2020) investigated the understanding and effectiveness of different front-of-package labels (FoPLs) in 12 countries. Among all five labels tested, Nutri-Score emerged as the most efficient FoPL to assess the nutritional quality of foods and help consumers discriminate between products. Their results suggest that Nutri-Score is clearly understood in diverse sociocultural contexts, moreover, it showed greater effectiveness compared with the other four FoPLs even in countries where another official FoPL was already implemented, for example in the UK, where the Multiple Traffic Lights label was introduced in 2004, or in Australia, where the Health Star Rating system has been applied since 2014.

Local qualitative research on FoLPs and Nutri-Score (Tóth & Szakály, 2023) implies that health-conscious consumers tend to look more at food labels before purchasing and find nutritional labels familiar and a reliable source of information. However, nonconscious consumers spend less time examining the labels and are not familiar with nutrition labels, but they still evaluate the labels positively. In both groups, the overall opinion was the most positive in the case of the Nutri-score label. Based on the focus group interviews, Tóth and Szakály (2023) suggest that the introduction of FoPLs must be accompanied by a broad consumer education campaign to ensure that the public understands and uses the labels correctly, as labels did seem to be actually affecting intention to purchase, but the marking would not encourage them to change the quantity of consumption. This is an issue as overconsumption of a relatively good-scored product can cause exceeding the recommended daily intake of an ingredient, product, and so recommended total calories. Hungarian Ministry of Agriculture examined, on the example of 800 products within 8 product categories, what possible effect of introduction of FOP systems used in EU member states might have on typical domestic products (Felkai & Kuti, 2022). They conclude that the introduction of Nutri-Score represents a significant risk, given the negative discrimination caused by colours and categories. It classifies many traditional Hungarian products into categories E, D, and C, including those whose single dose does not reach the 100 g defined as the evaluation basis. Based on the research of the TÉT Platform Association (Szegedyné Fritz, 2017) regarding the understanding of FoPLs, online survey data suggests that 60 % of the respondents did not understand or were uncertain about what the terms mean.

The Nutri-Score system is getting more popular in countries of the EU (implemented by countries such as France, Belgium, Spain, the Netherlands, Luxembourg and Switzerland), but the implementation of Nutri-Score has been only voluntary, therefore consumer organisations, health organisations and food companies and retailers (such as Danone, Nestlé, Ahold Delhaize, Albert Heijn, Carrefour, Lidl and Rewe) jointly requested the European Commission to adopt Nutri-Score as the basis for the harmonization of nutrition FoPLs in the EU (*Joint Letter to the European Commission Regarding Mandatory Nutri-Score*, 2020).

Online grocery shopping is getting more and more popular, the Hungarian grocery delivery market is expected to have a CAGR of 12,44% until 2028 (Statista Search Department, 2023a), while the European market is estimated to grow 10,89% annually reaching a market volume of 142,40 billion US dollars by 2028 (Statista Search Department, 2023b). Therefore, in this emerging sector new approach should be applied to guide consumers towards healthier choices. At online retailer stores, such as Kifli.hu, or in the online webshops of grocery stores which already support Nutri-Score offline (such as Aldi, Lidl or Auchan), it's not common to showcase nutritional labels right next to the product. By browsing between products in most cases only such „labels” are present which indicate good price („Good deal”) or product origin („Local product”). To obtain nutritional information, you need to click on the product and see the ingredient list and nutritional table. However, some foreign supermarkets, such as Delhaize started to show Nutri-Score directly at the browsing stage of purchase, so consumers can be informed right at the beginning about the nutritional values of the products without having to click on the product. In my research, I examine the effect of Nutri-Score in this context, when shown next to a product in an online store-like environment.

Previous studies on this topic utilize qualitative, experimental, self-report or eye-tracking methods to examine FoPLs – including the Nutri-Score system - however, the implicit association test was not used yet to examine healthiness perceptions, only related to associations to specific product attributes, such as package shape (Parise & Spence, 2012). Therefore, as a secondary research method, I include IAT to examine the underlying associations of consumers with the Nutri-Score system.

1.2 Research question

Based on the above-mentioned research gap, in my paper I aim to investigate the effect of Nutri-score on consumer behaviour in an online context and accordingly, my research question is: How does Nutri-Score labelling affect explicit and implicit healthiness perceptions and

purchase intention, considering personal factors such as nutrition knowledge, general health interest and body weight discrepancy.

Based on previous research findings my hypotheses are the following:

- *H1: The presence of the Nutri-score label with a score A on food products positively influences consumers' perceived healthiness of the products.*
- *H2: The presence of the Nutri-score label with a score A on food products positively influences consumers' purchase intentions.*
- *H3: Consumers' perceived healthiness of the products positively influences consumers' purchase intentions.*
- *H4: The influencing effect of perceived healthiness of products on purchase intention is greater when the Nutri-score is present compared to when it is absent.*
- *H5: Interest in a healthy lifestyle positively influences perceived healthiness of products.*
- *H6: Interest in a healthy lifestyle positively influences purchase intention.*
- *H7: Nutrition knowledge positively influences perceived healthiness of product.*
- *H8: Nutrition knowledge positively influences purchase intention.*
- *H9: Body weight discrepancy negatively influences perceived healthiness of product.*
- *H10: Body weight discrepancy negatively influences purchase intention.*
- *H11: Consumers implicitly associate Nutri-score labelled product with healthiness and unlabelled products with unhealthiness.*

1.3 Structure of the paper

In the literature review, I cover the most relevant concepts and previous research findings in neuroscience, and consumer decision-making process, including food-related choices with an emphasis on online behaviour. Next, I introduce the influencing power of product packaging with a structured overview of package sub-elements, most importantly, nutrition labels. I present my research models based on previous research findings. For my quantitative research, I used a questionnaire with validated scales and an implicit association test to reveal not only explicit perception but unconscious associations as well. Next, I presented my results using various statistical methods, such as t-test, z-test, crosstabulation, analysis of variance, correlation, and linear regression. In the Discussion, I provide a short comparison with previous research findings and some practical implications for online marketing professionals as well.

II. LITERATURE REVIEW

2.1 Consumer neuroscience and neuromarketing

In the fast-paced, digital world businesses are seeking new approaches to engage with their customers and influence their behaviour (Millagala, 2023). Because of this, with the advancements in technology, companies are shifting to a data-driven, customer-centric strategy (Camilleri, 2020). Consumer neuroscience allows researchers and companies to better understand customers' behaviour, their attention and its effects on branding-related actions (Plassmann et al., 2012).

Consumer neuroscience examines aspects of consumption and marketing through methods and findings from neuroscience (Lee & Chamberlain, 2007) to better understand decision-making and related processes (Ariely & Berns, 2010). Neuroscience – the study of the brain and nervous system (Loewenstein et al., 2005) – has shown some of the most growth and development throughout the past decades (Plassmann et al., 2012), as it allows direct measurement of thoughts and feelings, challenging our understanding of the relation between mind and action (Loewenstein et al., 2005).

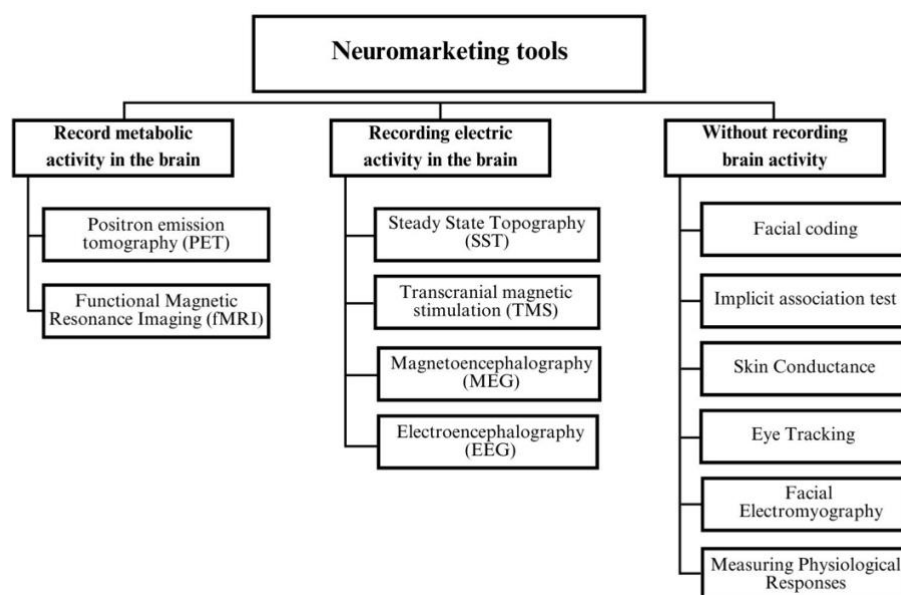
Plassmann et al. (2012) group previous related research into four categories: which investigate the favourability of brand associations, the different types of brand associations, brand recall and memories, and brand loyalty. Thanks to the neuroscience approach, Deppe et al. (2005) found a connection between individuals' differences in prefrontal cortex activity during a given task related to magazines, and so concluded that the way people perceive and judge news statements may be influenced by the magazine's brand. Another study (McClure et al., 2004) in the early stages of consumer neuroscience research investigated brand associations also in connection with specific brain activities. They took Coke and Pepsi in behavioural taste tests and carried out passive experiments during functional magnetic resonance imaging (fMRI) in two conditions: anonymously and branded. They observed a consistent neural response in the ventromedial prefrontal cortex which correlated with subjects' behavioural preferences for these beverages. They found that for Coca-Cola, brand information significantly influenced subjects' expressed preferences.

Not only brand preference can be determined through the fMRI method, but brand recall, influences on memory and therefore, brand awareness. Study of Klucharev et al. (2008) revealed that brain regions such as the medial prefrontal cortex and the anterior cingulate cortex were more active when participants were exposed to high-expertise messages. Accordingly,

high-expertise sources are more persuasive for consumers and can result in increased memory recall and more favourable attitudes.

Plassmann et al. (2007), when examining the neuropsychological background of loyalty, found that for loyal customers of a store, the presence of a brand acts as a rewarding signal, while those, who have fewer purchases – are less loyal – do not show such patterns. They concluded that loyal customers had established affective bonds to the store, which might be the psychological driver of their repurchases.

Bercea (2012) classified the available neuromarketing tools, which can be seen in Figure 1. Some methods record metabolic, some electric activity in the brain, while methods of the third group don't record any brain activity. In Chapter 3.1 I will give a detailed overview about the implicit association test method, as I use it in my primer research.



1. Figure: Classification of neuromarketing tools (Bercea, 2012)

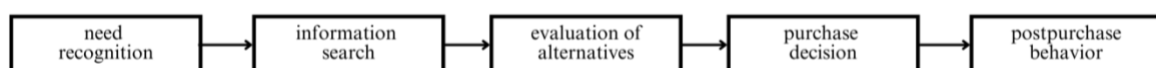
The terms consumer neuroscience and neuromarketing are often used interchangeably according to Agarwal and Dutta (2015). They supported the differences defined by Plassmann et al. (2012), according to which neuromarketing refers to practitioner and commercial interest in neuro-physiological tools to conduct company-specific market research, while consumer neuroscience refers rather to the research area at the intersection of neuroscience, psychology and marketing. Falk et al. (2012) – by comparing brain activations and self-reports of participants – found that neuromarketing research reveal better the reality than traditional methods like questionnaires and interviews. Such marketing analyses of the subconscious are based on three theorems (Varga, 2016):

1. our decisions are influenced by our subconscious, so we cannot provide satisfactory explanations for the reasons behind each decision,
2. our emotions significantly influence our judgements and choices,
3. we do not make most decisions based full information, rather based on partial information, most of the times immediately.

The decision making process is crucial to have effective marketing strategies, as it helps the deeper understanding the underlying attitudes and thoughts and so contributes for example to successful product development, product design and advertisement (Mansor et al., 2021). In the next chapter therefore, I will cover the most important theoretical aspects of the consumer decision making process.

2.2 Consumer decision-making

In the era of information and communication technology, customers shopping opportunities have evolved and therefore, decision-making processes also changed (Helal et al., 2022). The influencing factors of our buying decisions are the basis of a well-thought marketing campaign, and so recognizing them is vital to target consumers effectively, improve products and services and to create competitive advantage (Stankevich, 2017). Consumers' choices depend on cultural, social, personal and psychological factors (Kotler, 2006). Engel et al. (1978) established a 5-stage model to examine the way that buyers pass through to reach a buying decision, which can be seen on Figure 2.



2. Figure: Buyer decision process (Engel et al., 1978)

- *Need recognition* can be caused by internal or external stimuli. The internal stimuli can be hunger, thirst – in most of the cases some upper level of Maslow's hierarchy of needs, while an advertisement, a discussion with a friend can be considered as external stimuli (Munthiu, 2009).
- Similar to Munthiu (2009), Rossanty and Nasution (2018) highlight two primary aspects of *information search* activities. Firstly, internal information search, when consumers use their long-term memory to recall experiences and knowledge, or secondly, external

which comes from mass media and other sources of information. Consumers may also involve family and friends as a source of reference.

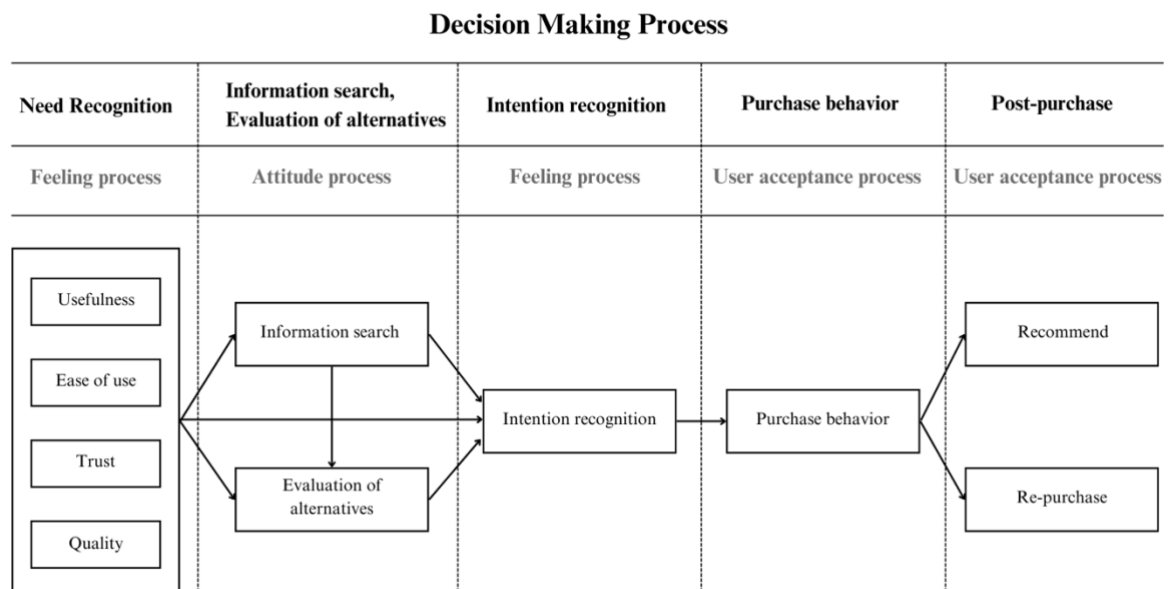
- The complexity of the *evaluation process* depends on factors such as the consumer's prior experiences, the importance of the service/product, the cost of making a bad decision and the urgency of the decision (Munthiu, 2009). Consumers look at product attributes, the importance attached to each of them and they will pay attention to those attributes, which deliver the benefits and which absence was identified in the need recognition phase (Sumi & Kabir, 2010).
- In early stages of buyer behaviour process research, Engel et al. (1978) included the *purchase decision* only as the fourth stage of the model, however figure of Munthiu (2009) includes non-purchase decision and purchase intention as well. They highlight many possible reasons, which can cause nonpurchase, such as deciding to postpone the purchase, replacing the product or service with another alternative.
- At the *post purchase stage*, consumers assess the product's performance. If the product's performance reaches the level of expectation, satisfaction was created, if it's under, they are dissatisfied (Mishra, 2018).

However, consumers not necessarily go through every stage each time they buy a product. Karimi et al. (2015) highlight the importance of customer involvement: according to them, the level of involvement reflects how personally important or interested the customer is and how much information they need to decide. The involvement usually does not depend on product, but on the consumer, however they highlight that some products, such as purchasing a house, typically require high-involvement for all consumers. Karimi et al. (2015) examined four archetypes of online consumers and concluded that decision-making style and product knowledge have an impact on the consumer during the purchasing decision-making process. The intensity of the process in terms of number of cycles, duration, number of alternatives and criteria all depended on the mentioned two variables.

Thanks to the emergence of technology, online shopping is getting more and more popular and has become part of consumers' lifestyle (Fernandes et al., 2021). Fernandes et al. (2021) highlights that online shopping offers a convenient way for consumers to access information and product recommendations and makes search and evaluation of information easier.

Regarding the online decision making process, according to Petcharat and Leelasantitham (2021), the buyer process mentioned on Figure 2. is lacking a process of intention recognition

between the evaluation process and the purchase process, which in online terms technically means the function of the shopping cart. They claim that the online decision-making process is strongly related to the technology acceptance model, and therefore created a conceptual model (Figure 3.) to showcase the connection between the two concepts. They found that perceived usefulness, perceived ease of use, perceived trust, and perceived quality have a positive effect on the information search process and intention recognition. Out of the four variables, trust and ease of use were found the most important perceptions, therefore they highlight that keeping online platforms trustworthy and secure and improving user experience is crucial for consumers to convert and potentially revisit the website. Moreover, the quality of the online platform and the accuracy of product details seemed to be important as well.



3. Figure: Research model for online purchase decision making process (Petcharat & Leelasantitham, 2021)

As for security, Kumar and Dange (2012) claim that internet shopping has much higher risks during the purchasing process than in-store shopping. Aligned with Petcharat and Leelasantitham (2021) they also claim that addressing security, privacy, and trust issues is essential for improving the effectiveness of online shopping environments. To ensure trust, many B2C E-commerce platforms provide third-party privacy and security protection, such as encryption and password protections, and so psychological risk - such as disappointment and frustration of shopping online, which is mainly caused by the privacy information lost – can be decreased (Kumar & Dange, 2012).

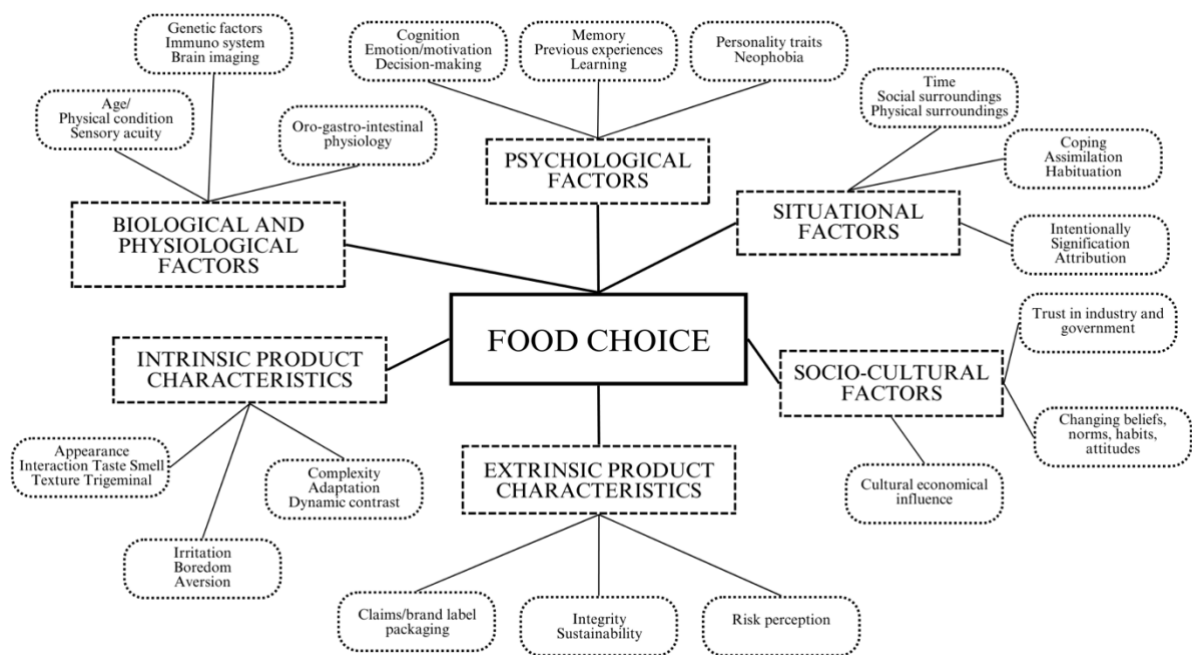
Consumer's decision – whether online or in-store - does not depend only on measurable factors, such as their knowledge and the time available for making the solution. Unconsciously, other factors affect the decision making, and so, neuroscience comes into play. Martin and Morich (2011) claim that most human behaviour either begins as an unconscious process or occurs completely outside of conscious awareness. These automatic processes impact consumers' attitudes, beliefs, and goals without consumers' conscious minds. They highlight the significance of context, cues, and feedback as shaping factors of consumer behaviour, and emphasize the role of emotions throughout the process.

To sum up, the buyer decision journey depends on multiple factors: personal, environmental, cultural attributes, prior knowledge, and subconscious aspects. Therefore, when examining buyer decisions and making business decisions, firms must investigate not only external factors, but – with the appropriate neuroscience research methods – the underlying aspects of behaviours as well. In online environments technological factors – such as platform quality, perception of trust and ease of use come into play, which effect consumers choices and may change the length of depth of the buyer decision process stages described by Engel et al. (1978).

2.3 Making food choices

Making food-related choices is very complicated behaviour that is influenced by many interacting factors, which can be grouped into six main categories: psychological, situational, socio-cultural, biological and physiological factors, extrinsic and intrinsic product characteristics (Köster, 2009). Blake et al. (2021) highlights that food choice is not equivalent to dietary intake, as the assessment of dietary intake itself does not provide insights on why and how the product was consumed. Blake therefore claims that this research area should examine three interconnected questions simultaneously to have an overview about the whole behaviour and process: research should cover firstly what people eat, secondly how people interact within food environments and thirdly why people decide to consume foods as they do.

Similarly, as shown on Figure 4., Köster (2009) also claims that in order to fully understand and predict food choice behaviour, more interdisciplinary research is needed instead of studies where they isolate partial behaviours and keep all other influences constant – the so called mono-disciplinary research. He highlights the importance of fundamental insights from psychology, and so, with an integrated approach, consumption patterns can be revealed.



4. Figure: Essential factors and sub-factors that influence eating and drinking behaviour and food choice. Own editing, adapted by Asioli et al. (2017) based on Köster (2009)

Depending on the research field (nutrition, psychology, social science, marketing, etc.) and context, many other categorizations appear in studies (Chen & Antonelli, 2020). Chen and Antonelli (2020) proposed another framework, by grouping the factors mentioned by Köster (2009) as summarized below:

1. Food-related features: intrinsic features such as colour and aroma, and extrinsic features such as information and packaging
2. Individual differences: biological (e.g., hunger, appetite, and taste), physical (e.g., access, skills of cooking, and time), psychological (e.g., mood and stress), cognitive (e.g., attitudes or preference, beliefs, and knowledge), and social (e.g., family and peers) factors
3. Society-related features: culture, economic variables such as price, income, and policy

Counihan and Van Esterik (2013) claim that individual food choices are embedded in the patterns of food consumption, and changed over the decades with the natural environment, biological basis, physical needs, lifestyle, and technology, which itself has seen enormous development in the past couple of years. Therefore, when examining food choices and food-related behaviour, a holistic approach should be applied, where many mediating factors come into play. Swinburn et al. (2013; p. 2.) refer to this as 'food environment' and define it as the

„collective physical, economic, policy and socio-cultural surroundings, opportunities and conditions that influence people's food and beverage choices and nutritional status”.

Malota et al. (2018) aimed to map food purchasing and consumption preferences of the Hungarian population with the help of seven main dimensions: involvement, community dining, health consciousness, local product orientation, price consciousness, image consciousness and quality consciousness. With cluster analysis, they grouped respondents into six homogeneous segments, as:

- *active maximalists*: active participants in food preparation, paying attention to price, quality, image, local origin and health consciousness, typically metropolitan, economically stable, women;
- *value-for-money seekers*: quality and price are important to them, but image and product origin are not a priority, mostly older individuals in financial difficulty;
- *local speciality seekers*: local origin of products is important to them, typically young graduates;
- *everyday active*: they don't have high importance factors in their product choices, price and quality of products are the least important compared to all groups;
- *price-sensitive*: exclusively price is an influencing factor, mostly people with financial difficulties, low education, and minimal health awareness;
- *comfortable perfectionists*: not active in food shopping and preparation, metropolitan with high health-consciousness.

They highlight, that depending on the cluster, food choice and consumption patterns, preferences, the factors that influence their decisions vary, and therefore these customers require segmented, targeted communications. This is aligned with Köster (2009) and the factors shown on Figure 4. Price-sensitive consumers may be influenced more by economic factors, local specialty seekers by their habits and culture and active maximalists by many factors such as previous experiences and memory (brand recall), intrinsic product characteristics (quality) and cultural aspects. Depending on their lifestyle they might have more or less time for shopping, may have different beliefs about sustainability. Therefore, from the firm's point of view, different approaches are needed to effectively reach them and make them convert (buy, consume a product), and achieve that they repurchase. Of course, as discussed in chapter 2.1, and shown in Figure 4., cognition and other psychological factors influence the subconscious

mind when making food choices, and those patterns cannot be determined by self-reported questionnaires and traditional data collection methods.

2.3.1 Online food choices

As explained earlier, thanks to the emerging technologies, consumers' buying behaviour has changed, which is valid for online grocery shopping habits as well: purchasing food products online has become an integral part of consumers' life (Bauerová, 2019).

Multiple studies examine online grocery shopping behaviour, which mainly consider two aspects: examining differences between online and offline grocery shopping behaviour and drivers or barriers of purchasing food online. Hand et al. (2009) in the earlier stages of online purchasing behaviour research aimed to identify triggers for the adoption and discontinuation of online grocery shopping, specifically investigating the role of situational factors. They claim that situational factors tend to be the key triggers for starting online grocery shopping: participants described lifestyle changes – such as moving, having mobility issues, having a baby, working late – as the main drivers. Brand loyalty seemed to have an effect as well, as moving house to an area where participants preferred supermarket did not have a store, made consumers rather shop in its virtual store. According to Hanus (2016), consumers need to make several decisions online before purchasing: select the shopping network and place, consider financial matters, compiling shopping lists or choosing product brand. This is similar to the buying process described on Figure 2. (information search and evaluation of alternatives), however, also due to technology (such as filtering, searching possibilities), the complexity of the evaluation process varies (Munthiu, 2009), thus this can be accomplished in shorter period of time (Anesbury et al., 2016).

However, the combination of online and offline buying is present, which is referred to as webrooming (Aw et al., 2021). Research of Aw et al. (2021) revealed that need for touch, need for interaction (with in-store elements and salesperson) and price-comparison orientation significantly influenced webrooming intention. Certain consumers demonstrate a greater preference to touch products than others: consumers with higher need to touch products, tend to be more confident – perceive lower risk - when they can physically experience product features and therefore, they are more likely to switch from online to offline at the purchase stage. Similarly results of Mortimer et al. (2016) show the mediating effect of perceived risk between trust and online grocery shopping intention, but only for occasional online grocery shoppers.

For those, who purchase food online more frequently, due to regular online transactions and previous experiences, no such mediating effect was found.

To conclude, just as at offline food shopping and purchasing goods in general, psychological, situational, socio-cultural, biological and physiological factors, extrinsic and intrinsic product characteristics (Köster, 2009) play a role, but the involvement of technological aspects into the decision making process is crucial. Depending on prior knowledge and experiences regarding online shopping, perceived risk may vary among customers of different segments.

In my research I examine nutrition labelling appearing in the front products packaging or in online settings mostly next to the product, which as being an extrinsic product feature, can affect food choices – whether made offline or online. Therefore, I cover relevant research findings regarding product packaging more in details in the next chapter.

2.4 Product packaging

Clement (2007) claims that ninety percent of consumers make a purchase decision after only examining the front of the packaging, based on that first visual cue, without physically picking up the product. Therefore, packaging is not just a layer to protect, contain the product and offer convenience for consumption (Smith & Zook, 2011): it's an essential element of brand communication (Smith & Zook, 2011) and a tool for projecting a firm's brand's image and price-positioning (Lifu, 2012) to make it appealing for target customers.

According to Lifu (2012), product packaging serves as an advertising medium, thereby helping the firm to cut down on advertisement costs, which makes it crucial both from branding and business perspective that the companies use the opportunities of product packaging. On the other hand, Lifu (2012) also highlights that besides having an attractive packaging which may lead to impulse buying, firms need to keep up product quality to encourage repurchase and so gain sustainable, long-lasting competitive advantage, as packaging carries distinguishing value to products (Hussain et al., 2023). Smith and Zook (2011, p. 426.) even refer to packaging as the „*silent salesperson*“, while Mutsikiwa (2013) also claims that excellence in product quality guarantees repeat purchases, but package design determines the trial purchases.

Mutsikiwa (2013), when examining purchase behaviour of dairy products, revealed that not all aesthetic package design elements trigger consumer purchase behaviour. Mutsikiwa highlights that the elements that have an influence should be blended to ensure that they appeal to consumers and so guiding their intention to purchase products. These other elements, so called

sub-elements (Hussain et al., 2023), which influence buying intention besides packaging design are: package colour, shape, size, material, font style and labels.

In the following sections I would like to highlight some key research findings regarding the sub-elements of product packaging, specifically highlighting their effect on consumer behaviour and purchase intention.

2.4.1 Package colour

Colours in marketing assist in the recognition and recall of advertisements and brands (Percy & Rossiter, 1983), moreover as being important visual cues, according to Kauppinen-Räsänen (2014) they tend to be the first physical element consumers notice. However, as mentioned before in chapter 2.3, personal factors such as culture, age and gender effect the perception of colours, moreover, other brand-related characteristics can have significant effect as well.

Garber et al. (2000) found that for a particular brand, in the case of not loyal customers a change in package colour could lead to an enhancement in brand consideration. In stable product-categories, this revised-packaged product was more likely to be picked up and purchased if the colours were similar to the original packaging, as people associate that colour with the category and they got used to it. Garber et al. (2000) also found that a change in product packaging colour can increase the length of search for a specific product category. Study of Sugrue and Dando (2018) demonstrated that both product and label colour can have a significant effect on consumer preference and flavour perception of ciders. They found that cider tinted green was perceived as colder than the control cider, red-tinted was perceived as having more body, and cider with a red label was perceived as sweeter and fruitier than cider with a green label.

Research of Mai et al. (2016) investigated the effect of light-coloured and dark-coloured packaging on consumer's perceptions. They found that light-coloured packaging has a dual impact on consumer behaviour: firstly, it induces positive perceptions related to health, and secondly, it triggers negative taste associations. This negative effects of light-coloured packaging on taste were more salient among people who did not actually taste the product or were less health-conscious, so the effects change under specific circumstances. Similarly Huang and Lu (2016) also found a connection between package colour and perceived healthiness: food products in blue-coloured packages were perceived healthier than the ones in red-coloured packages, moreover it influenced purchase intentions. Food in a blue package with health claims (e.g. "light" label) was perceived healthier than food in red package with regular labels.

2.4.2 Package shape

People tend to associate slim and angular body with a healthy person, whereas fat and round body with an unhealthy person (Katz et al., 2004), and this shape-healthfulness association tends to be true for packaging as well. According to Fenko et al. (2016) package shape significantly influences perceived product healthfulness and taste expectations. Based on their results, cookies in angular packages were perceived as healthier than cookies in round packages. Sousa et al. (2020) when examining how shape and colour of packaging could influence sensory and hedonic judgements of specialty coffee consumers found that the angular shape (angular illustration on the label) increased the expectation of acidity compared to the round shape. Previously, Velasco et al. (2014) also found significant relationship between taste perception and shapes: rounded shapes were associated with sweet taste, while angular shapes with sour tastes in their research.

Parise and Spence (2012) investigated the association between packaging and specific brand attributes with two experiments using implicit association test: it was used to measure implicit associations between mouthwash packages (Scope and Listerine) and the attributes 'gentle' and 'powerful' and found significant association between the bottle of Listerine mouthwash and the attribute 'powerful'. However, they highlight that this result may be driven by the brand names, by the shape of the bottles or the combination of these two factors. Therefore – to measure the association between bottle design and attributes - in their second experiment they only provided the bottle silhouettes and found the same association.

2.4.3 Package size

Depending on the market segment and the brand's target group, firms release different sizes of products and packages (Smith & Zook, 2011), for example family packs. According to Smith and Zook's example, Coca Cola withdraw their 2-liter bottle from the Spanish market, as only very few Spanish people had large-enough fridges to fit in the products. This demonstrates that sometimes, there is a need for the product, but because of the circumstances, a certain size of product can cause failures and so revenue-loss for the company. This is also aligned with Silayoi and Speece (2004), who claim that package size affects consumer judgment and decisions often in not easily uncovered ways.

Study of Scott et al. (2008) confirmed that participants perceived the small packages to be more like diet food than the large packages, so size can effect healthiness perceptions as well, which can affect buying intention. Ahani et al. (2013) when examining the relation between size of

packaging and consumer behaviour also found that if the products are offered in smaller packages, the tendency to buy them increases. They also highlight that because food products have expiration date on them, customers may not like large packages, which is in line with findings of Silayoi and Speece (2004), indicating that consumers from smaller households may not be interested in larger packages, as it's seems like a waste for them.

2.4.4 Package material

Material of the packaging is another leading factor of a product that derives in straight interaction with the consumer, and it also imitates the image of the brand and quality of a product (Hussain et al., 2023). Underwood et al. (2001) claim that when consumers realize that the material quality of packaging is lower, they undertake that the quality of the product will be low as well. However, most customers are not capable to decide the quality of the packaging material and therefore assess product quality based on the design of packaging (Hussain et al., 2023). Findings of Binninger (2015) indicate that natural packaging enhanced perceptions of food product quality, credibility, attractiveness, and purchase intentions, while several other studies examined the effect of matte and glossy packaging on consumer behaviour: Ye et al. (2019) using both implicit and explicit methods showed that matte packaging signals healthier products, while glossy tastier products. Marckhgott and Kamleitner (2019) found that consumers may perceive food in matte packaging as more natural, and in these cases, consumers also expected the product to be tastier and increased their purchase intention.

2.4.5 Package font

Font style has been examined by many researchers along with the other sub-elements (Asri et al., 2020; Deliya & Parmar, 2012; Mutsikiwa, 2013). Mutsikiwa (2013) highlights the importance of readability of text displayed on packaging: by ensuring that customers identify and notice their brands on shelves, firms can reduce time spent looking for their brand. Asri et al. (2020) claim that if font style as a graphic design element is used consistently, it can contribute to creating powerful marketing communications, which also supports claim of Lifu (2012), that packaging can have communication power and serve as a medium to advertising. Therefore, as stated by Deliya and Parmar (2012), just like other sub-elements, style of font also has strategic importance when designing product packages.

To sum up, many elements can influence customers perceptions, buying intention and actual buying behaviour, whereby not only product packaging attributes, but individual characteristics

and behaviour patterns must be considered. However, not every aspect is easily detectable and measurable (Silayoi & Speece, 2004), moreover, as highlighted by Chitturi et al. (2019), the combined effect of variables – in their research specifically the combination of the preferred colour and shape – should be taken into consideration. Therefore, when examining product attributes, and their effect on consumer behaviour, an in-depth analysis is recommended to reveal these combined effects.

The last element of product packaging which may effect buying intention and perceptions mentioned by Hussain et al. (2023) is printed information, including product labels. As this is in the focus of my research - more specifically the Nutri-score label system - I will cover the most important research findings in a separate chapter.

2.5 Product labels

Shah et al. (2013, p. 38.) define printed information as „*all the data related to the product such as price, quality, and product description, which can help consumers to identify a product*”. Package labels may help consumers to make healthier food choices (Temple, 2020). Van der Colff et al. (2015) measured satisfaction related to food labels and defined two main information categories, as following:

- primary information: expiry date, allergens, nutrition/health, ingredient list, quality guarantees
- secondary information: usage instructions, manufacturer name, symbols, serving numbers, country of origin

According to their research, primary food label information tended to be more important, and more likely to influence their product choice. In general they conclude that credibility, legibility, comprehensibility and adequacy of primary label information should be addressed to create more satisfying labelling (Van der Colff et al., 2015). Temple (2020) mention that there are nutrient-specific and summary labels. Nutrient-specific include for example Multiple Traffic Lights (MTL) and Guideline Daily Amounts (GDA), warning labels (e.g., for food high in added sugar). Summary labels, such as Nutri-Score and labels with stars, give an overall cue for the customer about how healthy the product is.

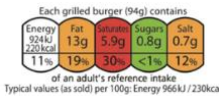
According to another categorization, there are front-of-package (FOP) labels and back-of-package (BOP) labels (Temple & Fraser, 2014). Front-of-package labels inform the buyer of the brand name and the type of food and may also have a statement about the composition of

the food (such as “good source of fibre”) or a health claim. On the other hand, back-of-package labels include a Nutrition Facts panel that provides details of the nutritional composition of the food, an ingredients list, and amounts of nutrition also written as percent of recommended daily intake-format (Temple & Fraser, 2014).

In the WHO European Region most FoPL (front of pack label) systems in operation were established by national governments and NGOs (Kelly & Jewell, 2018). This resulted in various different kinds of labels across Europe, which make it harder for consumers to effectively compare products based on FOP labels and may lead to confusion (Department of Health, 2013).

A detailed overview about the types of FOP labels can be seen in Table 1., which is based on the comprehensive analysis about FOPLs across WHO European Region done by Kelly and Jewell (2018).

1. Table: Four major types of FoPL (front-of-pack labelling) system

endorsement logos	summary indicator systems	nutrient-specific warning labels	nutrient-specific interpretive label
nutrient levels combined to give an overall assessment of absolute healthfulness	nutrient levels combined to give an overall assessment of relative healthfulness	information on individual nutrients kept separate	information on individual nutrients kept separate
positive evaluative judgement only (on better-for-you foods)	both positive and negative evaluative judgements (graded directive assessment of food overall)	products that exceed a nutrition standard identified (negative judgements of worse-for-you foods)	both positive and negative evaluative judgements (graded directive assessment of nutrients)
products are eligible to carry the endorsement symbol only if a nutrition standard is met	can appear on all eligible products	if a product exceeds the threshold, it must carry the label	can appear on all eligible products
nutrient cut-off points binary (i.e. if a product meets the standard, it can carry the label)	nutrient cut-off points graded (e.g. high, medium, low)	nutrient cut-off points binary	nutrient cut-off points graded (e.g. high, medium, and low)
Choices logo	Nutri-Score	Red warning label	Colour-coded %RI
			

own editing based on Kelly and Jewell (2018, p. 3-4.,10.)

Several studies examine the effectiveness and understanding of front-of-package nutrition labelling (Arrúa et al., 2017; Egnell et al., 2020; Findling et al., 2018; Grunert, Celemin, et al., 2010; Schuldt, 2013). Savov et al. (2022) groups previous research related to the effectiveness of front-of-pack label systems worldwide into three main areas, as follows:

- examining the ability of consumers to identify a healthier product using different FoPL systems,
- determining the impact of consumers' intentions to buy a healthier product, or
- whether FoPLs help consumers to reduce junk food consumption.

Egnell et al. (2020) examined and compared the customer understanding of five FoPLs - Health Star Rating system (HSR), Multiple Traffic Lights (MTL), Nutri-Score, Reference Intakes (RIs), and Warning symbol - in 12 different countries. They found that all five FoPLs significantly improved consumers' ability to rank products according to their nutritional quality, but there were differences among FoPL types: the Reference Intake (RI) was the least effective, while the Nutri Score produced the highest improvement in ranking ability. They conclude that this can be explained by the differences between interpretive (such as Nutri Score) and noninterpretive (such as RI) labels, as the former entails some level of interpretation of nutritional content using colours, graphics, and therefore it's better understood by consumers. Moreover, as discussed in chapter 2.4.1, the colours should be taken into consideration, regarding effectiveness of FoPLs, as explained by Schuldt (2013), the colour red may carries generic negative associations, and indicates the „stop” symbol, therefore seen as unhealthy, while green labels on the other hand may promote healthfulness, and this mental model can play significant role in understanding labels.

2.5.1 Nutri-score labelling system

The 5-colour FOP label, referred to as „Nutri-score nutrition label”, was firstly introduced in France with the aim to drive consumers towards healthier food choices at the point of purchase (Julia & Hercberg, 2017). The label-system – as seen on Figure 5. - utilises colours (from dark green to dark orange) and letters (A-E), and so does not categorize products as “healthy” or “unhealthy”, rather it provides information of the relative overall nutritional composition of a food product compared to other similar products - whether it's more or less favourable to health (Hercberg et al., 2022).



5. Figure: Graphical format of Nutri-score (Hercberg et al., 2022)

The Nutri-Score label is based on a previously used nutrient profiling system (Food Standards Agency nutrient profiling system – FSA-NPS) and was derived from the Five-Colour Nutrition Label (5-CNL). It is computed by using the nutrient contents per 100 grams of products. It allocates points to specific types and quantities of contents, summarizes them and results in a continuous scale from -15 to +40, where -15 being the healthiest and 40 being the least healthy, moreover it uses two separate scales for foods and beverages to categorize products into the five-label scheme as seen in Table 2. (Chantal & Hercberg, 2017).

2. Table: Attribution of colours for the Nutri-score system

Foods (points)	Beverages (points)	Colour
Min to -1	water	Dark green
0 to 2	Min to 1	Light green
3 to 10	2 to 5	Yellow
11 to 18	6 to 9	Light orange
19 to max	10 to max	Dark orange

own editing based on Chantal and Hercberg (2017)

Jürkenbeck et al. (2022) explains the importance of labels in relation with health-halo effect – whereby one claim on the package impacts customers’ judgement on other product attributes (Roe et al., 1999) – and found that the Nutri-Score can help to prevent health-halo effects caused by nutrition claims on sugar and so reduce problematic health effects caused by misleading claims.

As I examine Nutri-score in an online context, I will give a short overview about studies in this topic specifically narrowed down to online shopping environments in the next chapter.

2.5.2 Effect of nutrition information online

In this chapter I would like to cover previous research about the effect of various types of nutrition information placed on packages in relation of online grocery shopping. Most of the studies made are experimental, usually showcasing an online shopping environment, where hypothetical purchases are made by participants and their choices are evaluated.

Fuchs et al. (2022) developed a Chrome web browser extension for an online supermarket and aimed to assess the effect of digital food label intervention (Nutri-Score was displayed next products) on the nutritional quality of individuals' weekly grocery shopping. Compared to the control group – where no Nutri-score was shown –, individuals exposed to the intervention chose products with a higher nutritional quality, for example products with less sugar or saturated fat. Finkelstein et al. (2019) compared two front-of-pack nutrition labels (Multiple Traffic Lights and Nutri-Score) relative to a control condition where no labels were displayed. Their results show that both labels significantly improved the healthy eating scores relative to control. Nutri-score performed than Multiple Traffic Lights, but the latter did not statistically reduce calories or sugar from beverages. They conclude that Nutri-score may be better if the goal is to improve overall diet quality, but Multiple Traffic Lights may perform better if the goal is to reduce total energy intake, because calories are clearly displayed on the label. Robertson et al. (2023) simulated different online food markets and tested the effects of Nutri-score on consumer decisions. Their results show that consumers who were exposed to Nutri-scores applied to snack products made healthier purchases, than consumers who were not. They also tested an adapted market, where in general more healthy options were provided: consumers who were exposed to Nutri-Scores on products when shopping in the this adapted market made the healthiest choices.

To sum up, Nutri-score and other nutrition labels can not only affect consumer behaviour in a traditional context, where they are placed on packages, but in an online context, where the label is seen next to products. In the next chapter I will present my hypotheses and research model with the help of related previous studies and findings.

2.6 Conceptual model

The FOPL systems shown in Table 1. all have their own design and use, therefore affect consumer behaviour in different ways (Savov et al., 2022). The effectiveness of product labels can contribute to improvements in the general health status of the population, but it's effectiveness depends on whether the labelling is noticed, understood and applied during food selection by consumers (Kelly & Jewell, 2018).

The Nutri-score label system is a quite new, and therefore an evolving research area. De Temmerman et al. (2021) investigated the impact of the presence of the Nutri-score and its five scores on consumers' perceived healthiness and purchase intentions. They conducted two online experiments, in which respondents were asked to rate products from different categories, with or without Nutri-scores, in terms of their perceived healthiness and purchase intentions.

Products marked with Nutri-score A and B were perceived healthier and respondents were more willing to purchase them than products with a less good Nutri-score. When Nutri-score was present, respondents indicated significantly higher purchase intentions for products in categories A and B than if no Nutri-score were present. Moreover, they found that perceived healthiness mediates the relationship between Nutri-Score categories and purchase intentions and concluded that Nutri-score can help to steer consumers toward healthier purchases.

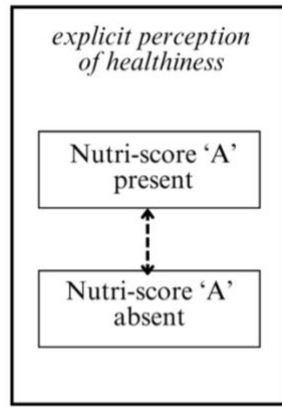
Jürkenbeck et al. (2022) also examined effects of Nutri-score labels on perceived healthiness and found that it can have significant influence. Vandevijvere and Berger (2021) investigated impact of Nutri-score in another context, specifically in relation of electronic shelf labels (ESL). The impact of ESL on consumer purchases (measured by the proportion of weekly sales for Nutri-Score A, B, C, D, E products) was mixed: positive impacts were found for example in the case of fruits, dairy products and confectionery, while they reported negative impact for bread and bakery products. They concluded that shelf labelling on its own won't influence consumer behaviour but note that the ESL was indicated in black and white (in contrast with front-of-pack label, where it is marked with colours) and so this could affect the understanding of labels as discussed in chapter 2.4.1. more in details.

Findling et al. (2018) examined food label perceptions of customers. They concluded that any front-of-package label can improve adults' ability to understand and compare the nutritional quality of foods and beverages relative to no label. According to their results, when consumers compared products on certain levels of nutrients (e.g. which product has lower sugar-content), the single traffic light performed best, while the multiple traffic light and no-label versions performed worst. They conclude that these labels can indeed help individuals assess product healthiness, but also highlight the degree of effectiveness depends on customer knowledge.

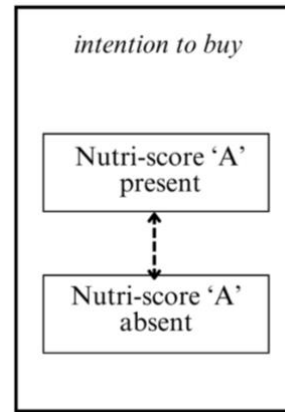
Based on the above-mentioned previous studies and findings, I make the following hypothesis for my research and visualize these relationships on separate models.

H1: The presence of the Nutri-score label with a score A on food products positively influences consumers' perceived healthiness of the products.

H2: The presence of the Nutri-score label with a score A on food products positively influences consumers' purchase intentions.



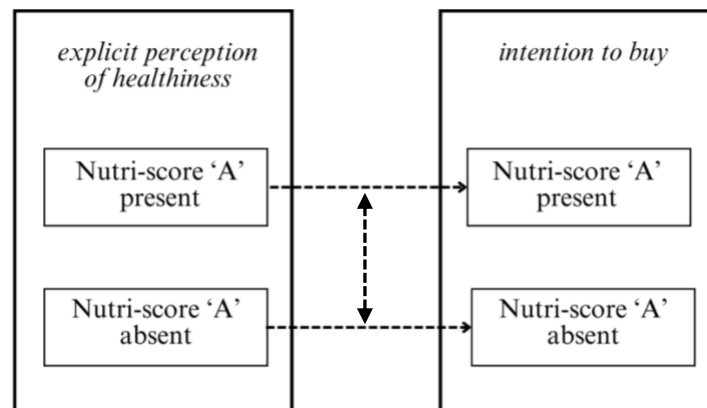
6. Figure: Model 1.



7. Figure: Model 2.

H3: Consumers' perceived healthiness of the products positively influences consumers' purchase intentions.

H4: The influencing effect of perceived healthiness of products on purchase intention is greater when the Nutri-score is present compared to when it is absent.



8. Figure: Model 3.

Vyth et al. (2010) investigated the use of the 'Choices' nutrition logo in Dutch supermarkets. The choice logo is showcasing a tick (seen in the first column of Table 1.), which indicates a good choice for a health-conscious lifestyle and is assigned to products that contain lower levels of sodium, added sugar, trans-fatty acids and energy and increased levels of fibre compared to similar products in the same product category. Vyth et al. (2010) found that those participants who reported paying attention to their weight and also those who reported often looking at nutrition information on packages, stated that they purchase more products with the Choices logo. Al-Barqi et al. (2020) researched participants perceived importance of health value and its relationship with the frequency of food label use. They found that the importance of health value – rated on a 5-degree scale from not important to very important - significantly correlated

with the frequency of food label use during purchasing. Moreira et al. (2019) aimed to research consumer characteristics which may affect the choice of food and found that respondents who follow a healthy lifestyle - practise sports or reported some sort of health condition, such as food allergies - pay more attention to nutritional values of products. Moreover, consumers with more schooling and healthy habits had greater perception of healthy products as well. Hartmann et al. (2018) also found significant, positive, weak correlation between healthiness perception and general health interest. Based on these studies my hypothesis is:

H5: Interest in a healthy lifestyle positively influences perceived healthiness of products.

H6: Interest in a healthy lifestyle positively influences purchase intention.

Al-Barqi et al. (2020) when aiming to investigate aspects of nutrition labels among college students reported that the majority of study participants had moderate knowledge about general nutrition facts, and this was significantly and positively associated with the frequency of food label use. In their research they assessed nutrition knowledge of participants by adapting 30 questions from the General Nutrition Knowledge Questionnaire of Kliemann et al. (2016) and based on their number of correct responses participant were grouped into low, moderate and high nutrition knowledge levels. Following this methodology, in my research I aim to assess also objective nutrition knowledge, instead of subjective knowledge where participant directly indicate how much knowledge they have in a certain topic. However, Al-Barqi et al. (2020) only investigated food label use, not the perceptions regarding healthiness. Grunert et al. (2010) found that label usage is mainly related to interest in healthy eating, but the understanding of nutrition information on food labels is mainly related to nutrition knowledge. According to Hartmann et al. (2018) nutrition knowledge is significant predictor of healthiness evaluation. Based on the previous research related to food labels and nutrition knowledge I assume that:

H7: Nutrition knowledge positively influences perceived healthiness of product.

H8: Nutrition knowledge positively influences purchase intention.

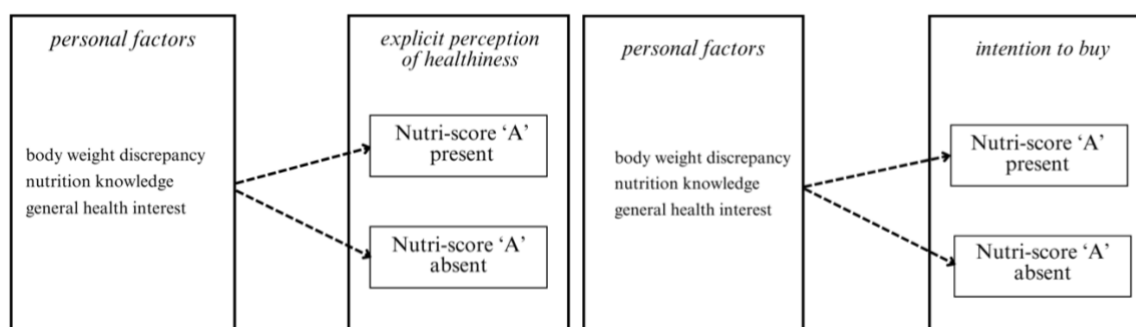
Regarding self-perceived weight status research of Chen et al. (2012) found that those who perceived their weight about right were 51 % less likely to use food labels than those perceiving themselves as overweight. As for Body Mass Index (BMI) Bhawra et al. (2022) states that respondents with BMIs over 30 (obese) understood less front-of-package labels compared to

those with BMIs between 18.5 and 24.9 (in normal range). Borgmeier and Westenhoefer (2009) when showing food pairs of healthier and less healthy options to participants concluded that overweight respondents had a slightly lower number of correct (healthier) decisions compared to normal weight subjects. I combine this two concepts, as described by e.g. Maruf et al. (2012) and Shabu et al. (2024), and examine body weight discrepancy, which is indicating the difference between actual and perceived weight status.

I assume that body weight discrepancy – the fact that a person thinks differently about their weight-status, than it actually is - has an impact on nutritional label related behaviour, so my hypotheses are:

H9: Body weight discrepancy negatively influences perceived healthiness of product.

H10: Body weight discrepancy negatively influences purchase intention.



9. Figure: Model 4.

10. Figure: Model 5.

Previous study findings about the possible moderating effects of demographic variables vary across studies. Finkelstein et al. (2019) tested the moderating effects of education and income when examining food label use using an experimental online grocery store, where food is purchased and delivered to participants' homes. They found no significant moderating effects on average Nutri-score values of their shopping basket. Robertson et al. (2023) also controlled their model for socio-demographic variables, such as age, gender, education, employment, social class and having a child in the house in their research and found no significant effects of them. Vyth et al. (2010) examined only the familiarity with nutrition labels, and concluded that women and highly educated participants were more familiar with the logo observed. Hartmann et al. (2018) on the other hand investigated healthiness perceptions and found that younger age significantly predicted that labelled products were considered healthier. Research of Moreira et al. (2019) revealed factors which influence food labelling usefulness and perceptions of

mislabelling, and concluded that consumers with more schooling and healthy habits had greater perception of healthy products. Hess et al. (2012) found no significant association between food label use and age or education.

Based on the various studies mentioned above, in my research I examine the possible effects of demographic variables, however I do not hypothesize specific relations because of the variety of previous study findings.

As for implicit researches in this field, Hollands and Prestwich (2011) investigate the effect of pictures of energy-dense snack foods along with aversive images of the potential health consequences of unhealthy eating on implicit attitudes. They showed a slideshow that featured 100 snack images for one second, followed by either a blank screen (for the control group) or one of five aversive body images (intervention group) for another one second. According to their results, this intervention made implicit attitudes toward energy-dense snacks more negative, and they were more likely to choose fruit rather than snacks in a behavioural choice task.

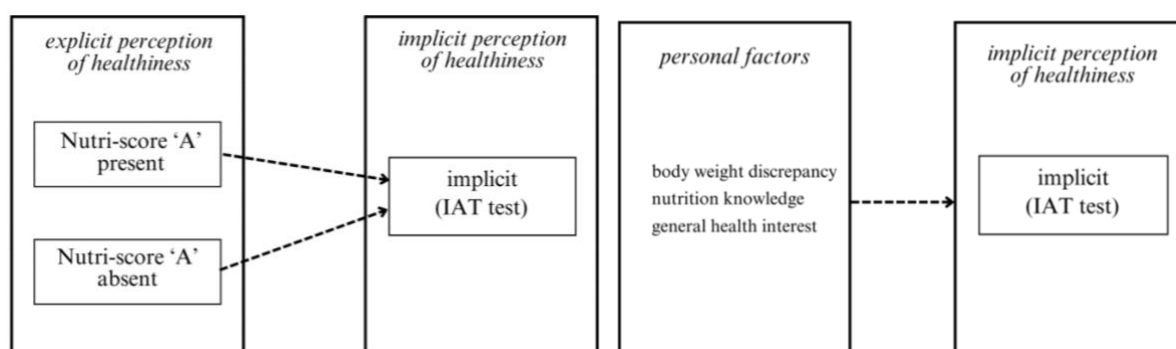
Coricelli et al. (2019) investigated whether normal-weight individuals assigned different values to natural and transformed foods with the Implicit association test and whether participants' hunger level or dietary habits mediated the responses at explicit and implicit level. They found that while for natural foods implicit and explicit measures (healthiness evaluation) seemed to converge, and dietary habits or hunger level did not have an effect. For transformed foods, they found dissociation between implicit and explicit measures, moreover, there appeared a strong moderation of dietary habits and hunger level on the evaluations of such foods. The most relevant research for my thesis which using the Implicit association test was conducted by Ye et al. (2019). They assessed the relative strength of associations between healthfulness concepts and package type, where they found a positive D-score, meaning that respondents associated matte packaging rather with healthy foods and glossy packaging with unhealthy foods. As mentioned earlier in chapter 2.4.2, Parise & Spence (2012) investigated packaging shape and brand attributes with IAT, and found association between the bottle of Listerine mouthwash and the attribute 'powerful'. Based on their research, I assume that package element – in my research, package label – will affect implicit associations regarding the healthiness of the product, so my hypothesis is:

H11: Consumers implicitly associate Nutri-score labelled product with healthiness and unlabelled products with unhealthiness.

Research articles also examine the relationship between implicit and explicit attitudes. Koenig-Lewis et al. (2022) investigated compostable and traditional plastic food packaging related implicit and explicit attitudes, where they found no significant correlation. Songa and Russo (2018) did find significant correlation between explicit self-report questionnaire results and IAT D-score, but the relationship was weak. As for the reasoning of their results, they support claims of Perugini (2005). According to him, explicit and implicit are related, but different constructs, and highlights three possible patterns:

- additive pattern: implicit and explicit attitudes provide unique predictive information and are independent,
- double dissociation pattern: implicit attitudes predict spontaneous behaviour, and explicit attitudes predict deliberative behaviour, and
- interactive pattern: implicit and explicit attitudes interact synergistically to predict behaviour.

In my research I test the relationship between implicit and explicit perception of healthiness to see that in the case of Nutri-score label which pattern seems to be valid.



11. Figure: Model 6.

12. Figure: Model 7.

We can see that implicit attitudes and food related behaviour can be examined with various methods, such as experimental interventions and the Implicit Association Test (IAT). As noted by IAT score has additional validity over self-report measures to predict buying intention, moreover, these implicit associations influence how consumers perceive product packaging, therefore find it insightful and value-adding to include it in my research.

In the next chapter, I will give a detailed overview about the methodology, including a description for the Implicit association test, present my sampling method and sample characteristics.

III. METHODOLOGY

I presented various studies and findings from a wide range of fields – starting from neuroscience to food choice behaviour and nutrition labels in the literature review. After the introduction of the research models, I would like to cover the main aspects for the selection of my research methods and provide an overview of the methodology in this chapter.

The aim of the research is to examine the effect of Nutri-score label on healthiness perceptions and buying intention, while investigating the effect of health-related aspects as well. I used an online questionnaire consisting self-report questions, validated scales, and an Implicit association test. Respondents were selected by convenience sampling. The questionnaire was distributed on social media channels (Facebook, Instagram, and LinkedIn) amongst acquaintances, in Facebook groups related to questionnaires, food and healthy lifestyle topics, moreover I left some QR codes in some university classrooms as well. According to Malhotra (2017), convenience sampling is the cheapest and least time-consuming of all sampling techniques, however, samples are not representative so drawing conclusions about a population is inappropriate, which is a limitation to the research. When distributing the survey, I did not aim to collect responses from specific groups of people due to various factors that I have covered with survey questions, which allow to analyse the sample in depth. The questionnaire allowed me to collect consumers' opinion and attitude time-efficiently using validated scales and methods. The questionnaire was set up in Hungarian, the translated version can be found in Appendix 1.

Respondents were informed about the anonymity and confidentiality of the survey. They had to indicate whether they knew the Nutri-score label or not (or are not sure) and had to complete a task, where they had to rank 5 products, based on the Nutri-score label from a 1-5 scale, where 5 was the best (Nutri-score A) and 1 was the worst (Nutri-score E). The task may have caused some confusion between respondents, as only 64,2 % of respondents ranked the products correctly. 21,2%% paired the scores to the numbers the opposite way (1 to Nutri-score A and 5 to Nutri-score E) which can be due to not paying enough attention to the task and completing it by visual cues (A score started at the left side and numbering started with 1 also on the left side). After this, an IAT test assessed the associations of the respondents, which was followed by the validated scales and demographic questions.

3.1 Implicit association test

The implicit association test was created by Greenwald et al. (1998), and aimed to assess implicit attitudes with the measure of strengths of automatic associations (Greenwald et al., 2003). It uses two target concepts and a pair of attributes (e.g., flower- insect names and pleasant- unpleasant words) to examine the performance of respondents in seven blocks. Out of the seven blocks, five is considered as trial blocks, and two (4th and 7th) as the actual test blocks. The test is based reaction time, on the principle that if an association between two concepts (e.g. flower and pleasant) is readily accepted by the respondent, then decision making is done very rapidly, therefore making reaction time quick (Greenwald & Banaji, 1995). Carpenter et al. (2019) introduced a method that made IAT in Qualtrics software available, however it was only compatible with computers with keyboards, therefore making completion on mobile impossible.

Cui et al. (2021) created a mobile compatible method, so to make the recruitment of participants easier and faster, I used that for my questionnaire. After setting up the IAT test with Hungarian instructions on the [online site](#), I downloaded the .qsv file which could be integrated into Qualtrics, where I set up the questionnaire. For the target concepts (healthy-unhealthy) I used words as stimuli, while for the attribute concept images, for which an example can be seen in Table 3.

3. Table: IAT target and attribute stimuli

Target/Attribute	Stimuli
Healthy	Vegetables, Fruit, Apples, Blueberries, Salad, Porridge
Unhealthy	Fast food, Sugar, Fried cheese, Sweets, Hamburger, Chocolate
Nutri-Score labelled	 
Not labelled	

own editing

The full set of images for the Nutri-score labelled and not labelled stimuli can be found in Appendix 2. I showcased the original product picture as well, as brand label and other front-of-package label („Hungarian product”) and health claims („whole grain”) were removed with Photoshop. The reason for this is – as presented by Chitturi et al. (2019)- ,that these can influence perceptions and can create combined effects, and so modify response time. Products were selected from the category of side dishes (e.g. rice, pasta) and basic ingredients (e.g. oat flakes). The structure of the seven blocks can be found in Table 4. The Nutri-score labelling was not indicated on the product, but below in the left corner it. The reason for this is that in real-life online shopping environments, where the Nutri-score is showcased (e.g. www.delhaize.be), the label is shown below the product, usually bigger than it would be in real size on the product.

4. Table: Blocks of the IAT test

Block	Category	Instructions
1 (20)	Target	Healthy / Unhealthy
2 (20)	Attribute	Nutri-Score labelled / not labelled
3 (20)	Target & Attribute	Healthy or Nutri-Score labelled / Unhealthy or not labelled
4 (40)	Target & Attribute	Healthy or Nutri-Score labelled / Unhealthy or not labelled
5 (20)	Attribute	Nutri-Score labelled / not labelled
6 (20)	Target & Attribute	Healthy or not labelled / Unhealthy or Nutri-Score labelled
7 (40)	Target & Attribute	Healthy or not labelled / Unhealthy or Nutri-Score labelled

own editing, based on Cui et al. (2021, p.6.)

The result of the test is shown by the D-score, which is “*the difference between the average response latencies between contrasted conditions divided by the standard deviation of response latencies across the conditions*” (Nosek et al., 2013; p. 6.). A positive D-score indicates stronger implicit associations in the congruent case (like block 3 or 4), a negative D-score in the incongruent block, therefore indicates opposite bias, while values around 0 indicate no implicit associations (Greenwald et al., 2003). The score varies from -2 to 2.

3.2 Self-report survey

After the implicit association test, a 7 point scale was used to assess the explicit healthfulness perception of respondents, based on Hartmann et al. (2018). Participant had to indicate which product they find healthier: 4 meant equally healthy, 1 meant the product shown on the left side and 7 meant the product on the right side. This task had 3 different, but pairwise same product (the only difference was the Nutri-score ‘A’ sign).

The questionnaire included validated scales of perceived product healthiness (Fenko et al., 2016), purchase intention (Fenko et al., 2016), general health interest (Roininen et al., 1999),

nutrition knowledge (Dickson-Spillmann et al., 2011), and self-reported weight status (Chen et al., 2012). Statements for the validated scale of Fenko et al. (2016), Roininen et al. (1999) and Dickson-Spillmann et al. (2011) were randomized. The seven items of the perceived product healthiness scale and the 3 items of the purchase intention scale was evaluated both in case of a Nutri-score labelled and a not labelled product as well. The nutrition knowledge scale was shortened due to the focus of the research and to reduce survey completion time, and so only 11 statements needed to be answered with yes or no. The basis of the evaluation for eliminating statements were:

- statements, which included food types that are not known in Hungary,
- statements, regarding which the position may have changed since 2011,
- statement, which were not specific enough for selected people for pre-test of the scale (5 people)
- statement, which selected people for pre-test considered too easy.

Self-reported weight status scale of Chen et al. (2012) considered only 3 categories (underweight, about the right weight, overweight), but because WHO classification involves at least four categories (World Health Organization, 2010), I added one more (obese) for being able to compare it with the BMI of respondents better.

The questionnaire had a pilot between the 1st and 3rd of March 2024, where 8 people completed it and based on the feedback minor changes were made: e.g. incorporating in the description, that the IAT test specifically examines response time and that in the case of bipolar scales evaluation must be done based on the packaging only. 151 completed it fully between the 4th of March and 18th of March.

3.3 Sample overview

Out of the 151 completed answers, 149 respondents had successfully finished the implicit association test, as two people had such high error rates (38,89% and 40,56%) that their responses were excluded. Females are overrepresented in the sample with 69,5%, and only 30,5% of respondents were men.

As for educational background, more than 60% of total participants (92 people) have BA/BSc or MA/MSc degree, 21,2% have completed secondary school, 11,9% technical secondary school and the remaining 6% had lower qualification. 32,5 % of respondents live in Budapest, another major part live in a county town (30,5%). The rest of the participant are living in towns (17,9%), villages (13,9%) or in urban areas of Budapest (5,3%). About half of the respondents

are in a relationship (50,3%), about quarter of them are married (25,2%), 20,5% are single and the remaining six people is either widowed, divorced, or did not answer.

5. Table: Demographic overview of the sample

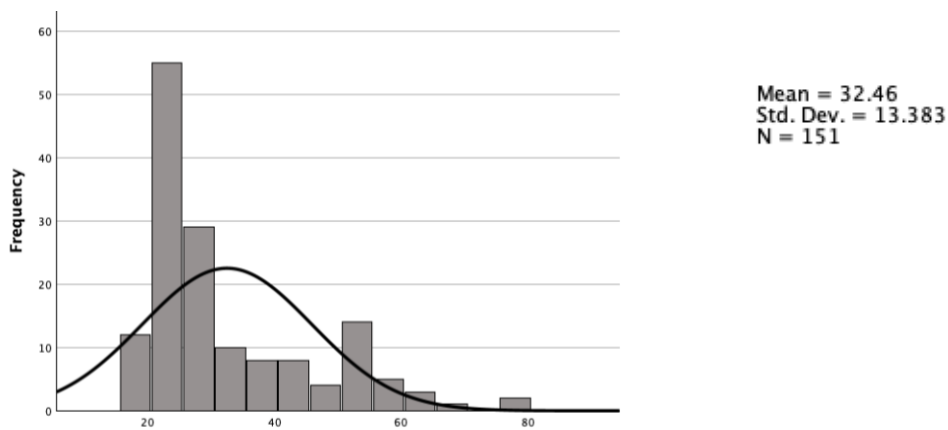
	Frequency	Percent		Frequency	Percent
Gender			Occupation		
<i>Male</i>	46	30,5	<i>Employee</i>	83	55
<i>Female</i>	105	69,5	<i>Entrepreneur</i>	13	8,6
Education			<i>Unemployed</i>	1	,7
<i>No completed primary education</i>	1	,7	<i>Student</i>	46	30,5
<i>Completed primary school</i>	3	2,0	<i>Retired</i>	4	2,6
<i>Technical college, technical school</i>	5	3,3	<i>Household person</i>	4	2,6
<i>Technical secondary school</i>	18	11,9	Income		
<i>Secondary school</i>	32	21,2	<i>0- 100 000 Ft</i>	22	14,6
<i>College (BA/BSc equivalent)</i>	48	31,8	<i>100 000 - 200 000 Ft</i>	15	9,9
<i>University (MA/MSc equivalent)</i>	44	29,1	<i>200 000 - 300 000 Ft</i>	26	17,2
Place of living			<i>300 000 - 400 000 Ft</i>	15	9,9
<i>Budapest</i>	49	32,5	<i>400 000 - 500 000 Ft</i>	26	17,2
<i>Budapest agglomeration</i>	8	5,3	<i>500 000 - 600 000 Ft</i>	11	7,3
<i>county town</i>	46	30,5	<i>600 000 - 700 000 Ft</i>	11	7,3
<i>town</i>	27	17,9	<i>700 000 - 800 000 Ft</i>	8	5,3
<i>village</i>	21	13,9	<i>800 000 - 900 000 Ft</i>	3	2,0
Marital status			<i>900 000 - 1 million</i>	1	,7
<i>Single</i>	31	20,5	<i>Above 1 million</i>	4	2,6
<i>In a relationship</i>	76	50,3	<i>I do not wish to answer</i>	9	6,0
<i>Married</i>	38	25,2			
<i>Divorced</i>	2	1,3			
<i>Widowed</i>	3	2,0			
<i>I do not wish to answer</i>	1	,7			

Source: own editing

Majority of participants are employees (55%) or students (30,5%), but there were some entrepreneurs (13 people), some retired (4 people), and household person (4 people) as well as one unemployed respondent. In terms of net income, bit more than 50% (51,6%) have 400 000 HUF or less monthly net monthly salary. A more detailed distribution of the sample can be found in Table 5.

As for age, as shown in Table 6., 25% of respondents are 23 years old or below, median age is 27 – meaning that half of the participants are below 27 -, moreover, mean age is 32,46. As presented in Figure 13., the sample is not equally distributed as for age: descriptive statistics of

13. Figure: Histogram of age



Source: own editing

Table 6. shows that value for skewness is 1,303 meaning that data points rather concentrate on the left, while value for kurtosis is 0,944, which positive value is indicating that the distribution is bit more peaky than normal distribution.

6. Table: Descriptive statistics for age

Age		
N	Valid	151
	Missing	0
Mean		32.46
Median		27.00
Mode		23
Std. Deviation		13.383
Variance		179.104
Minimum		18
Maximum		80
Percentiles	25	23.00
	50	27.00
	75	40.00
Skewness		1.303
Std. Error of Skewness		.197
Kurtosis		.944
Std. Error of Kurtosis		.392

Source: own editing

After presenting the methodology of the research and the demographical overview of the sample, in the next chapter I continue with the analysis and interpretation of the data.

IV. RESULTS

In this chapter I would like to introduce my results, starting with descriptive analysis of the explicit scales and implicit association test results. After that, I am doing paired samples t-test, correlation, and ANOVA to reveal relationship between model variables. That is followed by a regression model where I aim to test my hypotheses. For data analysis, SPSS program is used.

4.1 Nutri-score familiarity

As for the familiarity with the Nutri-score, 88 people (58,3%) indicated to be familiar with the system, 41 people (27,2%) reported not knowing it and 22 people (14,6%) were unsure about it.

7. Table: Nutri-score familiarity

Have you ever heard of the Nutri-score labelling system?				
	Frequency	Percent	Valid Percent	Cumulative Percent
Yes	88	58,3	58,3	58,3
No	41	27,2	27,2	85,4
I am not sure	22	14,6	14,6	100,0
Total	151	100,0	100,0	

Source: own editing

The task where respondents had to rate products with the help of the Nutri-score labels, were of mixed results. At coding, every participant was assigned a score, which indicated how many correct responses they had out of 5. Nutri-score 'A' had to be paired with number 5 (best), Nutri-score 'B' with the number 4, etc., and as one product with each Nutri-score was presented, only one correct answer of row was possible. Consequently, a ranking score of 4 was not possible, because if participants switched up to possibilities had 3 correct answers. Out of those who were familiar with the Nutri-score, 78,4% answered correctly, 48,78% of those reporting not knowing the Nutri-score rated products completely correctly and those who were not sure what a correct response rate of 36,36%.

8. Table: Crosstab for Nutri-score familiarity and Nutri-score rating task answers

		Number of correct answers in the ranking task					Total	Correct rate*
		0 correct answer	1 correct answer	2 correct answers	3 correct answers	all correct answers		
Have you ever heard of the	Yes	0	13	1	5	69	88	78,4%
	No	1	15	3	2	20	41	48,78%

Nutri-score	I am not	0	10	2	2	8	22	36,36%
labelling system?	sure							
Total		1	38	6	9	97	151	64,23%

*Percentage of people with all correct answers within each group of initial familiarity

Source: own editing

To check whether the proportions significantly differ within the subgroups, I merged 'No' and 'I am not sure' responses and created a new variable where only two labels were present and conducted an Independent-Samples Proportion Z-test, shown in Table 9.

9. Table: Independent-Samples Proportions Group Statistics

					Asymptotic
					Standard
					Error
Number of correct answers in the ranking task = all correct answers	Nutri-score familiarity	Successes	Trials	Proportion	
	= yes	69	88	0,784	0,044
	= no/not sure	28	63	0,444	0,063
					Asymptotic
					Standard
					Error
Test Type	Wald H0	Difference in Proportions		Z	Significance
Number of correct answers in the ranking task = all correct answers					One-Sided p
					Two-Sided p
		0,340	0,076	4,294	<0,001

Source: own editing

The results show that difference in proportions of fully correct responses in the ranking task differ by 0,340 between the two groups (Nutri-score familiar versus not familiar), in the Nutri-score familiar group being higher, and the difference is significant at 95% level of confidence, as shown by Z-test p-value in Table 9., which is leading to the rejection of H_0 of the test, which would indicate that proportions in the two subgroups are equal.

4.2 Analysis of validated scales

In this chapter I'd like to discuss details related to the validated scales I've used in my research. Firstly, with the help of a bipolar scale and 3 pairs of product images, I assessed if labelled or unlabelled products are perceived as healthier. Means and image stimuli is displayed on Figure 14. Respondents had to evaluate product healthiness on a 7-point scale, where 1 was indicated that product 'B' is much healthier than 'A', 4 indicated that they were equally healthy, and 7 indicated that product 'A' was much healthier than 'B'. Mean for the first bipolar scale was

3,20 (standard deviation=1,588), for the second – reversed - 4,64 (standard deviation=1,634) and for the third 3,11 (standard deviation=1,690). Mode value is 4 for all scales. I conclude that mean value for healthiness leans towards the Nutri-score labelled product.



14. Figure: Mean values for bipolar scales; source: own editing

To examine whether mean values significantly differ from 4 – the condition where participants perceive the two products equally healthy – I use One-Sample T-test, with 95% level of confidence.

10. Table: One-Sample t-test for bipolar scale means

One-Sample Test							
Test Value = 4							
	t	df	Significance		Mean Difference	95% Confidence Interval of the Difference	
			One-Sided p	Two-Sided p		Lower	Upper
HP_bipolar_1	-6,203	150	<0,001	<0,001	-0,801	-1,06	-0,55
HP_bipolar_2	4,830	150	<0,001	<0,001	0,642	0,38	0,91
HP_bipolar_3	-6,502	150	<0,001	<0,001	-0,894	-1,17	-0,62

Source: own editing

Results in Table 10. show that two-sided p is less than 0,001 in all three cases, indicating that the mean significantly differs from 4 (it is either more or less). Confidence interval shows that e.g. in the case of the first scale, at 95% of confidence, the value of healthiness will be between 2,94 and 3,45.

The three validated, explicit scales in my questionnaire as explained earlier are: perceived product healthiness (Fenko et al., 2016), purchase intention (Fenko et al., 2016) and general health interest (Roininen et al., 1999). Perceived product healthiness and purchase intention were asked participant two times, once with Nutri-score and once without. Reliability of the scales is high, as explained by Nunnally (1978) Cronbach Alpha values should be over 0,7, which assumption is met: all are over 0,8, as presented in Table 11. All item statistics can be found in Appendix 3. As shown there, with the elimination of some items, scale reliability could have been improved, but as Cronbach's Alpha values were high without elimination as well, I did not delete any. After the reliability test, computed variables were created for each, using arithmetic mean calculated from the responses.

11. Table: Cronbach's Alpha values

Scale	Number of items	Cronbach's Alpha
Healthiness perception with Nutri-score (HPNS)	7	0,861
Healthiness perception without Nutri-score (HPUL)	7	0,899
Purchase intention with Nutri-score (PINS)	3	0,858
Purchase intention without Nutri-score (PIUL)	3	0,882
General health interest (GHI)	8	0,889

Source: own editing

Nutrition knowledge (Dickson-Spillmann et al., 2011) scale was measured on an 11-point scale, where scores indicated the number of correct responses. Lowest number for nutrition knowledge was 4, the highest 11 and the most frequent number of correct answers was 9. 25% of respondent responded correctly for at least 10 statements. Crosstabulation of self-reported weight status (respondents indicating their opinion about their weight) and calculated weight status (based on BMI, which was calculated with height and weight, using the following formula: $\text{weight (kg)} / (\text{height (m)})^2$) can be seen in Table 12.

12. Table: Self-reported weight status and calculated weight status crosstabulation

		Calculated weight status				Total
		underweight (BMI below 18.5)	about the right weight (BMI 18.5-24.9)	somewhat overweight (BMI 25-29.9)	obese (BMI over 30)	
Self-reported weight status	Below average weight	3	8	1	0	12
	About the right weight	5	71	3	0	79

	Somewhat overweight	0	10	32	6	48
	Obese	0	0	1	11	12
Total		8	89	37	17	151

Source: own editing

Pearson Chi-square test was significant between the two variables (value=174,408; sig. <0,001), however, more than 20% of cells have expected count less than 5, therefore, the results of association are not reliable. Still, the table can demonstrate that there were some respondents, who perceive their weight differently, compared to what it actually is: for example five people reported to be about the right weight but in fact are underweight according to their BMIs, and oppositely, six respondents indicated to be somewhat overweight while actually having BMI over 30, which belongs to obese category according to the World Health Organization.

I computed this two concept with the help of the concept of body weight discrepancy, which as mentioned before, is defined by the difference between actual and perceived weight status and used by several research (e.g. Maruf et al., 2012; Shabu et al., 2024). If perceived and calculated status are the same, it indicates correct weight perception, if they differ, incorrect/abnormal weight perception. This variable was coded as a dummy variable, 0 indicating correct perception (117 respondents) and 1 indicating incorrect perception (34 respondents).

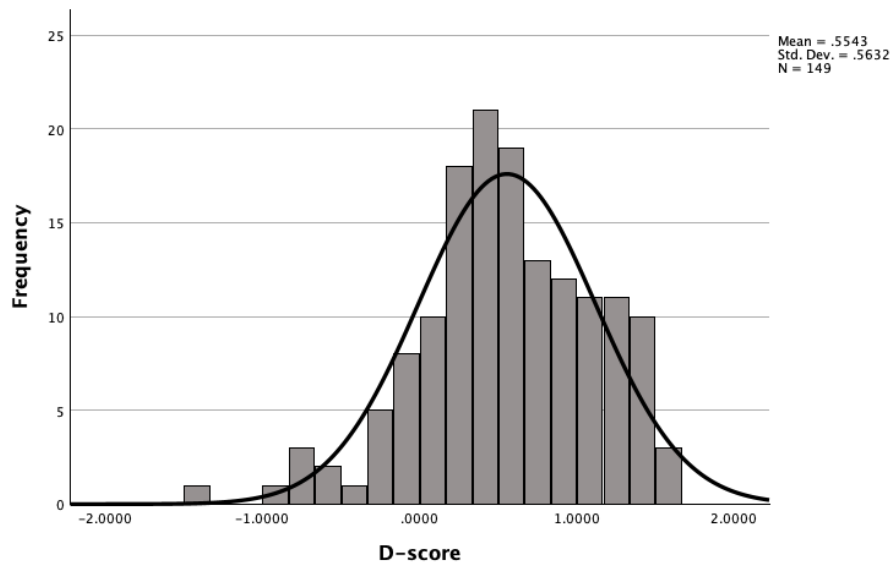
4.3 Result of the implicit association test

In this sub chapter I analyse the results of the Implicit Association Test. 151 respondents completed the task, but two answers were excluded because of the high overall error rates (38,89% and 40,56%), as mentioned earlier. Total error rate was 8,11%, which is within range, as described by Rudman (2011), who identifies typical error rate between 5-10%. Standard deviation was 0,0649.

Looking at the results of the test, D-score has been calculated for each 149 valid respondents, and resulted a mean value of ,55, with a standard deviation of ,5632. Lowest D-value calculated was -1,4599 and the highest 1,6264. A positive D-score value indicated that the respondent gave faster answers in the compatible block (healthy-Nutri-score labelled). The result suggest therefore that participants associate Nutri-score labelled product rather with healthiness and unlabelled products with unhealthiness, therefore I accept H11.

In the congruent case (healthy-Nutri-score labelled) average reaction time was 1162,69 milliseconds with a standard deviation of 381,80 milliseconds. The minimum reaction time was 634,2 milliseconds and the maximum was 2622,39 milliseconds. In the incongruent case

average reaction time was 1491,37 milliseconds with a standard deviation of 441,05. Minimum reaction time was 760,64 milliseconds, while the maximum 3322,68 milliseconds. Skewness value is -0,443 meaning that the distribution of values is skewed to the right, while value for Kurtosis is 0,472 indicating a peak distribution compared to normal distributions. Histogram for the distribution of D-scores can be seen on Figure 15.



15. Figure: D-scores histogram; source: own editing

4.4 Results of correlation analysis

To gain further insights and check the multicollinearity assumption for the linear regression analysis, I conducted a regression analysis with the metric, or dummy variables, which can be seen in Table 13.

13. Table: Correlation analysis

		D-score	HPNS	HPUL	NK	PINS	PIUL	GHI	BWD
D-score	Pearson	--							
	Correlation								
	N	149							
HPNS	Pearson	0,010	--						
	Correlation								
	Sig. (2-tailed)	0,902							
HPUL	N	149	151						
	Pearson	0,026	0,440**	--					
	Correlation								
NK	Sig. (2-tailed)	0,751	<0,001						
	N	149	151	151					
PINS	Pearson	0,057	-0,015	-0,017	--				
	Correlation								
	Sig. (2-tailed)	0,489	0,858	0,837					
PIUL	N	149	151	151	151				
	Pearson	-0,096	0,524**	0,217**	0,045	--			
	Correlation								
GHI	Sig. (2-tailed)	0,245	<0,001	0,007	0,583				
	N	149	151	151	151	151			
BWD	Pearson								
	Correlation								
	Sig. (2-tailed)								
	N								

PIUL	Pearson Correlation	-0,104	0,220**	0,445**	0,103	0,658**	--	
	Sig. (2-tailed)	0,205	.007	<0,001	0,208	<0,001		
	N	149	151	151	151	151	151	
GHI	Pearson Correlation	0,179*	0,048	-0,074	0,313**	0,041	-0,045	--
	Sig. (2-tailed)	0,029	0,556	0,370	<0,001	0,621	0,581	
	N	149	151	151	151	151	151	151
BWD	Pearson Correlation	-0,004	0,038	0,018	0,027	-0,023	0,039	0,044 --
	Sig. (2-tailed)	0,965	0,639	0,827	0,747	0,780	0,639	0,596
	N	149	151	151	151	151	151	151

* Correlation is significant at the 0,05 level (2-tailed).

** Correlation is significant at the 0,01 level (2-tailed).

Source: own editing

Results show highly significant, positive, moderate relationship between Healthiness perception with Nutri-score and Purchase intention with Nutri-score ($r=0,524$; $p < 0,001$), Healthiness perception with Nutri-score and Healthiness perception without Nutri-score ($r=0,440$; $p < 0,001$) and Healthiness perception without Nutri-score and Purchase intention without Nutri-score ($r=0,445$; $p < 0,001$).

Moreover, there is a significant, positive, weak relationship between Nutrition knowledge and General health interest ($r=0,313$; $p < 0,001$), Healthiness perception with Nutri-score and Purchase intention without Nutri-score ($r=0,220$; $p < 0,001$), Healthiness perception without Nutri-score and Purchase intention with Nutri-score ($r=0,217$; $p < 0,001$).

The strongest, highly significant positive association is between Purchase intention with Nutri-score and Purchase intention without Nutri-score ($r=0,658$; $p < 0,001$). Results show significant, weak, positive association between D-score and general health interest ($r=0,179$, $p < 0,005$).

Accordingly, consumers who perceive the products healthier, have a higher intention to buy, both in case of when Nutri-score is present and when it is absent, however, this relationship tends to be stronger, when it is present. Correlations pairwise for healthiness perception and intention to buy are probably high, as they measure the same concepts with little intervention. Consumers who are more interested in a healthy lifestyle tend to have more knowledge related to nutritional facts and associate implicitly stronger Nutri-score labelled products with healthy concepts (have higher D-scores).

However, as correlation between explicit and implicit measures are not significant ($r=0,010$; $p=0,902$; $r=0,026$; $p=0,751$) I conclude that in the case of Nutri-score explicit and implicit

associations are independent, both have unique predictive information, as explained by (Perugini, 2005).

4.5 Comparing means with paired samples T-test

To examine what effect the Nutri-score has on healthiness perceptions and purchase intentions I compare the means pairwise for each concept with a T-test in Table 14.

Mean value for healthiness perception with Nutri-score is 3,4257 (Std. deviation=0,74896), while without Nutri-score mean value is 2,7398 (Std. deviation=0,75034), meaning that in average in the Nutri-score condition respondent rather think the product is healthy, while without Nutri-score they rather don't think this way. This 0,6859 difference in means is statistically significant ($p < 0,001$; $t(150) = 10,622$), as shown in Table 14. The same applies for the difference between the means of purchase intention with and without Nutri-score. Mean value for purchase intention with Nutri-score is 3,8411 (Std. deviation=0,87757), while mean for purchase intention without Nutri-score is 3,4680 (Std. deviation=0,86254). The difference of means (0,37307) is highly significant ($p < 0,001$; $t(150) = 6,367$). Cohen's d values reveal large effect for healthiness perception (0,864) and medium effects for purchase intention (0,518) (Cohen, 1977).

14. Table: Paired samples T-test

	Paired Differences						Significance		
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	One-Sided p	Two-Sided p
				Lower	Upper				
HPNS-HPUL ^a	0,68590	0,79351	0,06458	0,55831	0,81350	10,622	150	<0,001	<0,001
PINS-PIUL ^b	0,37307	0,72001	0,05859	0,25729	0,48884	6,367	150	<0,001	<0,001

^a Cohen's d=0,864
^b Cohen's d=0,518

Source: own editing

Based on these results, I accept H1 and H2, and conclude that the Nutri-score intervention significantly increased consumers perception of healthiness and intentions to buy.

4.6 ANOVA analysis

With the help of one-way ANOVA analysis, I aim to test whether certain demographic groups differ in their average values for explicit and implicit healthiness perception and purchase intentions. For being able to conduct ANOVA with age, continuous variable was recoded into categories (0-19 years old – 1; 20-29 years old – 2; 30-39 years old – 3, etc.). Results of ANOVA is shown in Table 15. Before the F-test, Levene's test was conducted, where I failed to reject H_0 , therefore F-test is reliable. The results show that means for D-score differ across the 2 groups of gender and as per marital status, moreover average value for purchase intention when Nutri-score was displayed differs across men and women.

In case of the D-score, there is small effect ($\eta^2=0,027$ for gender and $\eta^2=0,029$ for marital status), while for purchase intention there is medium effect ($\eta^2=0,083$). Average mean of D-score for men is 0,39, while for women it is 0,62, meaning that women had stronger implicit Nutri-score-healthy associations. As for marital status in larger groups ($N_{\text{single}}=31$; $N_{\text{married}}=38$; $N_{\text{in relationship}}=74$) the mean values are showing a difference for single people, those living in a relationship or are married: mean for single people is 0,29, mean of D-score for people in relationship is 0,56 and for married people it is 0,71. As for purchase intention with Nutri-score average value for females is 3,96, for males 3,55 on a 5-level scale. Eta-squared values show medium effect, ($\eta^2=0,048$). This indicates that males had significantly lower purchase intentions, and females were more effected by the Nutri-score label.

15. Table: ANOVA p-values summary

	D-score	HPNS	HPUL	PINS	PIUL
education	0,660	0,341	0,070	0,269	0,458
gender	0,027^a	0,147	0,271	0,007^b	0,107
place of living	0,878	0,436	0,358	0,959	0,458
occupation	0,126	0,251	0,510	0,240	0,427
income	0,686	0,979	0,660	0,860	0,662
marital status	0,029^c	0,082	0,215	0,773	0,594
age (categorized)	0,311	0,334	0,210	0,511	0,658
^a Eta-squared=0,033					
^b Eta-squared=0,048					
^c Eta-squared=0,083					

ANOVA analysis did not reveal difference in means for age, however, I conducted a correlation analysis to see whether there is an association between age and D-score. At 0,05 significant level there is low association between age and D-score ($r=0,172$), indicating that with categorizing age, the relationship disappeared, but with the original continuous variables there

is an association. This indicates that the older respondents were, the stronger implicit associations they had for Nutri-score-healthy.

4.7 Overview of linear regression models

To test whether there is a cause-effect relationship between healthiness perception and purchase intention, I use linear regression.

16. Table: ANOVA (HPNS → PINS)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	31,759	1	31,759	56,496	<0,001 ^b
	Residual	83,760	149	0,562		
	Total	115,519	150			

a. Dependent Variable: Purchase intention with Nutri-score

b. Predictors: (Constant), Healthiness perception with Nutri-score

Source: own editing

As Table 16. shows the single regression model is statistically significant ($F=56,496$; $p<0,001$), and there is no multicollinearity as shown by VIF value, as there is only one independent variable. Homoscedasticity, linearity, and normal distribution assumptions are also met, as shown by P-P plot, scatterplot, and histogram in Appendix 4.

17. Table: Coefficients (HPNS → PINS)

Model		Unstandardized Coefficients		Standardized Coefficients		Sig.	Collinearity Statistics	
		B	Std. Error	Beta	t		Tolerance	VIF
1	(Constant)	1,736	0,287		6,059	<0,001		
	Healthiness perception with Nutri-score	0,614	0,082	0,524	7,516	<0,001	1,000	1,000

Dependent Variable: Purchase intention with Nutri-score

$R^2=0,275$ $R^2_{Adj}=0,270$ $F(1,149)=56,496$ $p<0,001$

Source: own editing

R^2 value of 0,275 shows that there is weak explanatory power of the model, indicating that 27,5% of the variation in purchase intention with Nutri-score is explained by healthiness perception with Nutri-score. Unstandardized beta value of 0,614 ($p<0,001$) shows that 1 unit change in perception of healthiness will increase purchase intentions by 0,614 unit.

I aim to check the same relationship in the unlabelled condition, where the assumptions were met as well (see Appendix 4.) The model is significant ($F=36,779$; $p<0,001$), however the

explanatory power is weak, 19,8%. I conclude that both explanatory power and unstandardized beta value (beta=0,511) decreased in this model, compared to the Nutri-score labelled condition.

18. Table: Coefficients (HPUL → PIUL)

		Unstandardized Coefficients		Standardized Coefficients		Collinearity Statistics	
Model		B	Std. Error	Beta	t	Sig.	Tolerance VIF
1	(Constant)	2,067	0,240		8,628	<0,001	
	Healthiness perception without Nutri-score (unlabelled)	0,511	0,084	0,445	6,065	<0,001	1,000 1,000

a. Dependent Variable: Purchase intention without Nutri-score (unlabelled)
 $R^2=0,198$ $R^2_{Adj}=0,193$ $F(1,149)=36,779$ $p < 0,001$

Source: own editing

As in both cases there was a weak, but significant effect of healthiness perception on purchase intention, at the Nutri-score labelled model being stronger, I accept H3 and H4.

When examining personal factors (such as nutrition knowledge, general health interest and body weight discrepancy) I use multiple linear regression analysis. The results showed no significant models for their effect on explicit healthiness perception or on purchase intention, as shown in Appendix 5. Accordingly, I reject H5, H6, H7, H8, H9 and H10.

As for their effect on the D-score, with backward elimination method, only General health interest had significant effect on the D-score (beta=0,122; $p=0,029$), however the model has almost no explanatory power ($R^2=0,032$), but it's statistically significant ($p=0,029$). Body weight discrepancy and nutrition knowledge do not significantly affect implicit associations.

19. Table: Coefficients (NK, GHI, BWD → D-score)

		Unstandardized Coefficients		Standardized Coefficients		Collinearity Statistics	
Model		B	Std. Error	Beta	t	Sig.	Tolerance VIF
1	(Constant)	0,159	0,282		0,562	0,575	
	Body weight discrepancy	-0,016	0,111	-0,012	-0,145	0,885	0,997 1,003
	General health interest	0,122	0,059	0,179	2,084	0,039	0,902 1,109
	Nutrition knowledge	0,001	0,031	0,002	0,021	0,984	0,903 1,108
2	(Constant)	0,163	0,185		0,879	0,381	

	Body weight discrepancy	-0,016	0,110	-0,012	-0,145	0,885	0,998	1,002
	General health interest	0,123	0,056	0,180	2,206	0,029	0,998	1,002
3	(Constant)	0,161	0,184		0,873	0,384		
	General health interest	0,122	0,055	0,179	2,209	0,029	1,000	1,000

a. Dependent Variable: D-score

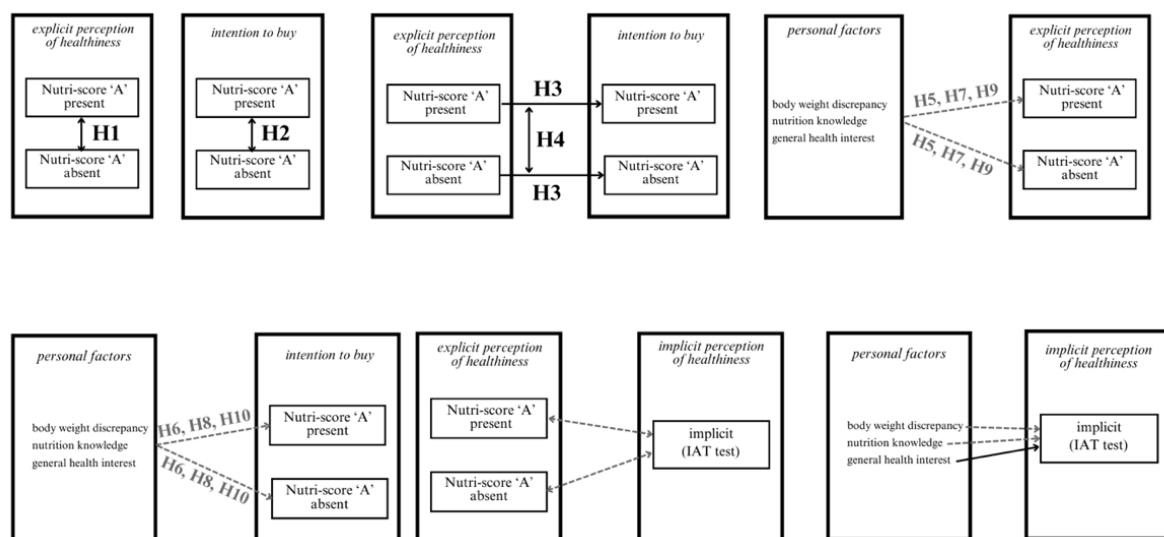
Model 1: $R^2=0,032$ $R^2_{Adj}=0,012$ $F(3,145)=1,612$ $p=0,189$

Model 2: $R^2=0,032$ $R^2_{Adj}=0,019$ $F(2,146)=2,435$ $p=0,091$

Model 3: $R^2=0,032$ $R^2_{Adj}=0,026$ $F(1,147)=4,881$ $p=0,029$

Source: own editing

The summary Figure 16. below shows the results and marks significant associations and relationships with black continuous lines, while not significant ones with grey broken lines.



16. Figure: Models summary

To sum up, results show that the presence of Nutri-score can increase healthiness perception and purchase intentions. If Nutri-score A was displayed on products, respondents rather perceived it healthier and had higher intention to buy it. However, it is important to note, that average purchase intention was above 3,00 in the no-label case as well, indicating that participants would rather buy the product regardless of the presence of the label, but the significant increase in mean value is a proof that the Nutri-score increased their buying intention. The healthiness perception has an influence on purchase intention, indicating that if a product is perceived healthier, it can cause that consumer's rather buy the product. This was true in both cases: with or without Nutri-score. Personal factors had no significant effect on

explicit healthiness perceptions nor purchase intentions. This indicates that if a person is more interested in health-related facts, has more knowledge in these aspects, and potentially has different beliefs about their weight-status than what it is, it does not have an effect neither on their explicit perceptions, nor on their purchase intentions. Lastly, an important result of the research is that according to average D-score of 0,55 for the implicit association test, respondents associate Nutri-score labelled products rather with healthy and unlabelled products rather with unhealthy concepts.

V. DISCUSSION

In the previous chapter I presented the key findings of the research. Now I'd like to highlight its similarities and differences compared to previous research, which were presented in detail in the literature review, moreover I conclude some practical implications of the research.

Aligned with De Temmerman et al. (2021) and Jürkenbeck et al. (2022), I found that Nutri-score can positively influence consumers' perceptions of healthiness and purchase intentions. This research investigated products the category of side dishes (e.g. rice, pasta) and basic ingredients (e.g. oat flakes), and found significant effects, but as concluded by Vandevijvere and Berger (2021) the impact of Nutri-score can vary across different product categories. Therefore, it could be possible that in case of other selected products, I would have not found significant differences in means for explicit healthiness perceptions and purchase intentions, nor influencing power of healthiness perception on purchase intention.

Nutrition knowledge, general health interest and body weight discrepancy did not significantly influence neither explicit healthiness perception, nor purchase intention. As for implicit perception, general health interest had significant effect, but the overall model was too weak to conclude anything relevant from it. Also, correlation analysis did not reveal significant correlations between healthiness perception (explicit and implicit), purchase intention and the three personal factors, except for General health interest and D-score ($r=0,179$; $p=0,029$).

There are many possible reasons, why based on my sample I did not find any strong, significant relationship also in the case of correlation and linear regression between personal factors and perception/purchase intention. Hartmann et al. (2018) did their research in four European countries, specifically the United Kingdom, France, Poland, and Sweden, and compared four different food labels (free of gluten, free of lactose, GMO free and palm oil free). They measured nutrition knowledge with the 20 questions, which I reduced in my research to 11, due to the length of the questionnaire. This can be a possible reason why I did not find significant

relationships, but also Hartmann et al. (2018) concluded that country of residence predicted healthiness perceptions. This aligns with the factors influencing food-related behaviour explained on Figure 4. as well.

Depending on the type of label observed, Hartmann et al. (2018) found significant, weak correlations ($r=0,10-0,14$) between general health interest and healthiness perceptions. However, the labels they observed are different types of labels: as showcased in Table 1., “free of” labels rather belong to the nutrient-specific warning labels, as they are showcasing information related one or more specific ingredient instead of a general indication of nutrient levels of a product. Hartmann et al. (2018) even highlight the fact that consumers with higher nutritional knowledge might be more likely to indicate that unlabelled products are healthier or as healthy as labelled products in the case of e.g. gluten-free labels, as they know that gluten-free products do not have scientifically proven nutritional benefit for an average person, who does not have any intolerances.

Regarding to body-weight discrepancy, the concept in this context in a food-label environment was not yet studied in details. Nianogo et al. (2016) examined this in a slightly different context, related to menu-labelling regulation. They included body weight discrepancy in their model as the difference between the desired weight and the current weight of respondents. This discrepancy was associated with the intention to select foods of lower-calorie when the calorie labels were showcased at the point-of-purchase. However, I defined body-weight discrepancy differently and observed different type of labels in different context.

This research is particularly relevant for webshops and online retailers, as the Nutri-score was presented in online environmental context, either next to the product or on the product in bigger size, than in offline situations. By demonstrating the impact of Nutri-Score on consumer purchase intentions and healthiness perceptions, I believe that Nutri-score can facilitate healthier food choices in online settings. Similarly, Fuchs et al. (2022) and Robertson et al. (2023) explored the effects of nutrition labels in online grocery shopping context and conclude that digital interventions can indeed help improve nutritional quality of purchases.

Related to food environments, many other factors play a role in online and offline food-related behaviour according to Swinburn et al. (2013), which as mentioned in the literature review indicates that food-related behaviour has to be examined with a holistic approach, because of which I applied not only explicit but implicit measures.

The research moreover found that there is a difference in males' and females' implicit associations for Nutri-score-healthy, meaning that men were less influenced by the presence of Nutri-score, had significantly lower D-scores. This has important considerations for marketers when defining targeting strategies and online campaigns: if they are targeting women and want to drive demand for certain healthy products, it's worth to showcase the Nutri-score, as it can significantly affect their behaviour, while for men, this might not be that effective tactical decision.

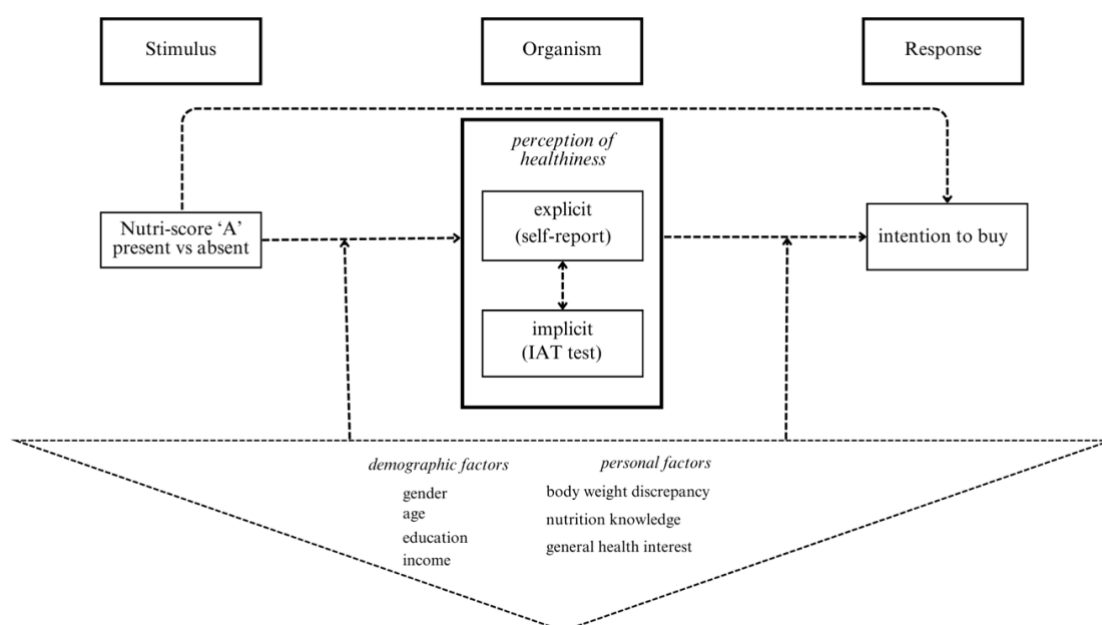
For UX professionals and businesses, current research holds important takeaways as well. By showcasing the Nutri-score in online shopping environments, products can be perceived healthier and purchase intentions could be increased. This could help businesses with yield management, as with showcasing Nutri-score, demand for specific products can be increased and so products with high margin can be promoted even more.

However, what many studies related to Nutri-score fail to emphasize is that it considers a specific product category and compares the products in their own categories, as mentioned by Kelly and Jewell (2018), Nutri-score indicates relative healthiness only. Accordingly, a Nutri-score 'A' rated product should not specifically indicate that the product itself is healthy, rather that compared to other products in that category, it is a healthy choice. An example for demonstrating this issue, Coca-Cola Zero has a Nutri-score 'B' because of its zero-sugar content, which is relatively good, however Coca-Cola itself is not healthy at all. Therefore, when studies conclude – including my research – that a Nutri-score 'A' influences purchase intentions and enhances healthiness perceptions, it's important to consider possible downside effects. This would involve misleading consumers, as a product is perceived healthier than it is in reality. This issue of the Nutri-Score system highlights the need for education of consumers, so that they understand these labels better and exercise caution and critical thinking when interpreting Nutri-Score labels.

For improvement of this situation, the Nutri-score could be modified so that it shows clearly that it only refers to a product category. In digital settings, where more and more services are personalized, a personalized nutrition score could be implemented. Thanks to this, the system would calculate scores not based on general health recommendations, but for individual dietary habits and requirements. Consumers would indicate what factors are important for them: for example, a person with cardiovascular disease would indicate that low-fat meals are important and therefore the contribution of fat-content to the score would be higher than e.g. for protein content.

I conclude that there is still a need for education about Nutri-score based on my sample, as only 58,3% indicated that they are familiar with the concept. Because of the sample size and convenience sampling my research is not representative and therefore cannot conclude these findings to the whole population neither can I generalize the findings, however, as interviews by Tóth and Szakály (2023) suggest, introduction of such labels must be accompanied by a broad consumer education campaign. They highlighted a very similar problem: consumers may misinterpret labels or not have detailed knowledge about them and consume too much of a good-rated product, which overconsumption is bad for health and leads to the exceeding of recommended daily calorie intake. To sum up, based on my research finding of Nutri-score having effect on healthiness perceptions and purchase intentions, it would be important to emphasise consumers, that Nutri-score shows relative healthiness, and they should not judge products only based on the Nutri-score label.

A further improvement for the research could be a model based on the SOR model – firstly proposed by Mehrabian and Russell (1974) -, which has been validated in various contexts, such as food behaviour (Liang & Lim, 2020) or online shopping behaviour (Peng & Kim, 2014). The SOR model is used to examine the links among a stimulus, processes (such as cognitive or affective processes), and response (Kim et al., 2019). In further research Nutri-score could be used as a stimulus, perception of healthiness as an organism factor, and intention to buy as a possible response action. The draft for the conceptual model instead of the several research models I used in the research can be found on Figure 17.



17. Figure: Proposed research model for further research (own editing)

VI. SUMMARY

The aim of the search was to examine the effect of Nutri-score on healthiness perception and purchase intentions in online setting, and to reveal implicit associations, while covering aspects of personal factors like nutrition knowledge, general health interest and body weight discrepancy.

In the research I highlighted key concepts from neuroscience as the research method included implicit method as well, then covered relevant research findings on this field. I presented the research method more in details in the Methodology chapter and presented my sample. Lastly, I analysed the data with various statistical methods, such as crosstabulation, ANOVA, t-test, z-test, and linear regression. I conclude that Nutri-score influences explicit and implicit healthiness perceptions and may enhance purchase intentions as well. Respondents had moderate implicit association for Nutri-score-healthy, which is indicated by the positive value of D-score (0,55). Personal factors did not affect explicit perceptions and purchase intention, however general health interest had a significant effect on D-score, however model fit was weak. Women had stronger implicit associations for Nutri-score-healthy than men, moreover, there was a significant correlation between age and D-score, meaning that the older respondents were, the stronger implicit associations they had.

Limitation of the research include having a relatively small and not representative sample, which does not make it possible to draw conclusions for the entire population. Another limitation regarding the sample is the uneven demographical distribution for example in the case of gender or age. Moreover, as IAT test was not conducted in a supervised environment, I could not control factors of the environment where respondents completed the questionnaire, which may modify reaction times. Moreover, self-reported weight and height for calculating BMI was also not controlled and so respondents might not report the truth about it. The questionnaire was quite long (at least 10-15 minutes to finish), and so attention of respondents may be dropped for the explicit scales in the end. As mentioned before and a draft of the model presents, statistically more reliable results could have been achieved with more advanced data analysis methods, such as SEM analysis.

Nutri-score is getting more and more popular in EU counties, but as mentioned by Kelly and Jewell (2018) various kinds of labels exist across Europe, which make it difficult to stay updated and be well-educated about their exact meanings. Further studies could examine the exact understanding of the Nutri-score system and with other neuromarketing methods (such as eye-

tracking) the areas of interest could be identified on packages, including the importance of FoPLs. This would allow researchers to determine how noticeable these FoPLs are and could potentially improve package designs.

In offline setting, various product packaging elements can affect behaviour and choices, as consumers can touch products. Accordingly, in online environments package elements like size and material may play less role than in traditional setting, however, technological factors (Petcharat & Leelasantitham, 2021) like platform ease of use and quality – as described in chapter 2.2 – are of greater importance. In the implicit association test, I only aimed to investigate the effect of Nutri-score, however, other package-related factors were not considered. In further research, multiple IAT test could be done separately for specific products attributes to examine implicit associations about e.g. colours, as done previously with explicit method by Mai et al. (2016). Also the effect of shape could be examined with implicit association test, as shape (e.g. round and angular) can affect healthiness perceptions as concluded by Fenko et al. (2016). Implicit association test should add more validity to these concepts, as being a neuromarketing tool which examines unconscious processes of the mind (Martin & Morich, 2011).

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APPENDIX

APPENDIX 1.: Questionnaire

Dear Participant!

I'm Evelin Németh, master student in Marketing Strategy and Innovation at Corvinus University of Budapest.

With the following questionnaire you are helping me to prepare my thesis on consumers' perceptions regarding nutritional product labels.

Responses are voluntary and anonym. I will keep strictly confidential any information collected in the context of this research.

Completion will take 10-15 minutes. First, you will need to categorise the words and pictures provided, then I will ask you a few short questions. If you would like to receive information about the research results, please provide your e-mail address at the end of the questionnaire to be contacted I can inform you!

If you have any questions, feel free to contact me in email: evelin.nemeth@stud.uni-corvinus.hu

Thank you for taking the time to fill it in!

Evelin Németh

Have you ever **heard of Nutri-score label?**



- yes
- no
- I am not sure.

After this, a short description of Nutri-score label: *The Nutri-Score is a five-colour nutrition label. It assigns products a rating letter from A (best) to E (worst), with associated colours from green to red.*

Based on the Nutri-score labels, please put the products shown below in order according to their nutritional value (1=worst, 5=best) (*pictures in randomized order*)



IMPLICIT EVALUATION: IAT block

EXPLICIT EVALUATION:

Please indicate which product do you find healthier.

Labels: B is much more healthy (1), B is moderately more healthy (2), B is slightly more healthy (3), A and B are equally healthy (4), A is slightly more healthy (5), A is moderately more healthy (6), and A is much more healthy (7).” (Hartmann et al., 2018)

‘B’ termék

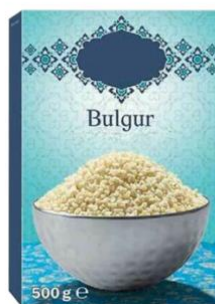


‘A’ termék

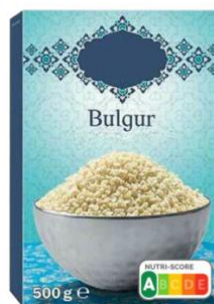


1 2 3 4 5 6 7

‘B’ termék



‘A’ termék



1 2 3 4 5 6 7

(reversed)



VALIDATED SCALES:

perceived product healthiness (Fenko et al., 2016) with Nutri-score

Please rate how much you agree with the following statements about the product in the picture based on its packaging (5-point Likert-scale: 1- I do not agree at all, 5 – I completely agree.)

- I expect this product to be healthy.
- I would consider this product as good for me.
- The product sounds healthy.
- The product looks healthy.
- This product looks low on calories.
- I have an impression that this product is healthy.
- This product looks healthier than similar products.

purchase intention (Fenko et al., 2016) with Nutri-score

- I would like to try this product.
- I would seriously consider buying this product.
- I would buy this product.



perceived product healthiness (Fenko et al., 2016) without Nutri-score

Please rate how much you agree with the following statements about the product in the picture based on its packaging (5-point Likert-scale)

- I expect this product to be healthy.

- I would consider this product as good for me.
- The product sounds healthy.
- The product looks healthy.
- This product looks low on calories.
- I have an impression that this product is healthy.
- This product looks healthier than similar products.

purchase intention (Fenko et al., 2016) without Nutri-score

- I would like to try this product.
- I would seriously consider buying this product.
- I would buy this product.



general health interest (Roininen et al., 1999)

Please indicate to what extent to you agree with the following sentence.
(5-point Likert-scale: 1- I do not agree at all, 5 – I completely agree.)

- The healthiness of food has impact on my food choices.
- I am very particular about the healthiness of food I eat.
- I eat what I like, and I do not worry much about the healthiness of food. (R)
- It is important for me that my diet is low in fat. (R)
- I always follow a healthy and balanced diet.
- It is important for me that my daily diet contains a lot of vitamins and minerals.
- The healthiness of snacks makes no difference to me. (R)
- I do not avoid foods, even if they may raise my cholesterol. (R)

nutrition knowledge, (Dickson-Spillmann et al., 2011)

Please indicate whether the statements below are true or false according to your opinion:

- Lentils contain only few useful nutrients, therefore their health benefit is not great. (F)
- Fat contains fewer calories than the same amount of fibre. (F)
- Pasta with tomato sauce is healthier than pasta with mushroom and cream sauce. (T)
- The health benefit of fruit and vegetables lies alone in the supply of vitamins and minerals. (F)

- Oily fish (salmon, mackerel) contain healthier fats than red meat. (T)
- To eat healthily, you should eat less fat. Whether you also eat more fruit and vegetables does not matter. (F)
- A scoop of chocolate ice cream is just as healthy as a scoop of lemon sorbet. (F)
- The same amount of sugar and fat contains equally many calories. (F)
- For a healthy nutrition, dairy products should be consumed in the same amounts as fruit and vegetables. (F)
- Skimmed milk contains fewer minerals than full-fat milk. (F)
- Brown sugar is much healthier than white sugar. (F)

self reported health status, (X. Chen et al., 2012)

What do you think you are:

- underweight
- about the right weight,
- somewhat overweight
- obese

BMI:

- Weight (in kgs):
- Height: (in cms):

DEMOGRAPHY:

gender: man/woman

age: Please tell me your age (drop down list)

education: What is your education level?

- No completed primary education
- Completed primary school
- Technical college, technical school
- Technical secondary school
- Secondary school
- College (BA/BSc equivalent)
- University (MA/MSc equivalent)
- Doctoral studies

place of living:

- Budapest
- Budapest agglomeration
- county town
- town
- village

What is your main occupation?

- Employee
- Entrepreneur
- Unemployed
- Student
- Retired
- Inactive (unable to work)
- Household person
- I do not wish to answer
- other:

What is your marital status?

- Single
- In a relationship
- Married
- Divorced
- Widowed
- I do not wish to answer

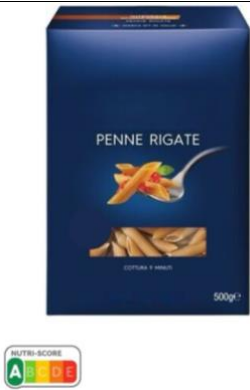
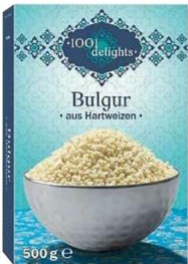
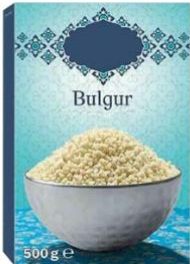
income: How much money do you earn in a month? (net income)

- below 100 000 HUF
- 100 000 – 200 000 HUF
- 200 000 – 300 000 HUF
- 300 000 – 400 000 HUF
- 400 000 – 500 000 HUF
- 500 000 – 600 000 HUF
- 600 000 – 700 000 HUF
- 700 000 – 800 000 HUF
- 800 000 – 900 000 HUF
- 900 000 – 1 million HUF
- above 1 million HUF
- I do not wish to answer

Your email address, if you are interested in the results of the study:

- I am interested, my email address:
- I am not interested

APPENDIX 2.: Visual stimuli for the IAT test

Original	Not labelled	Nutri-Score labelled
		
		
		
		

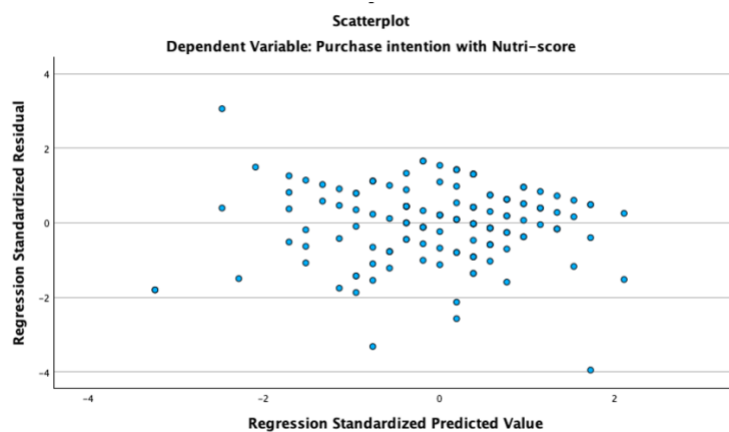
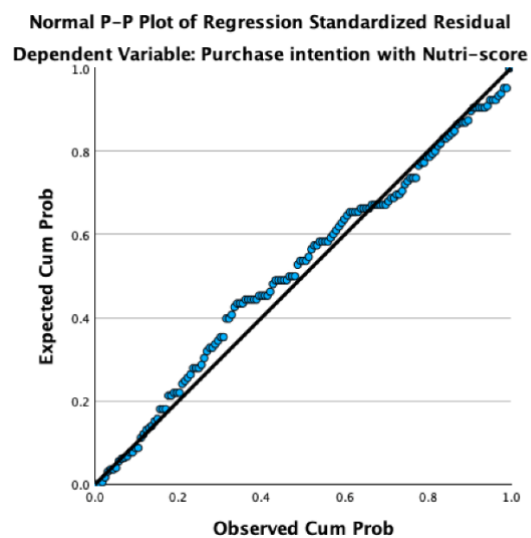
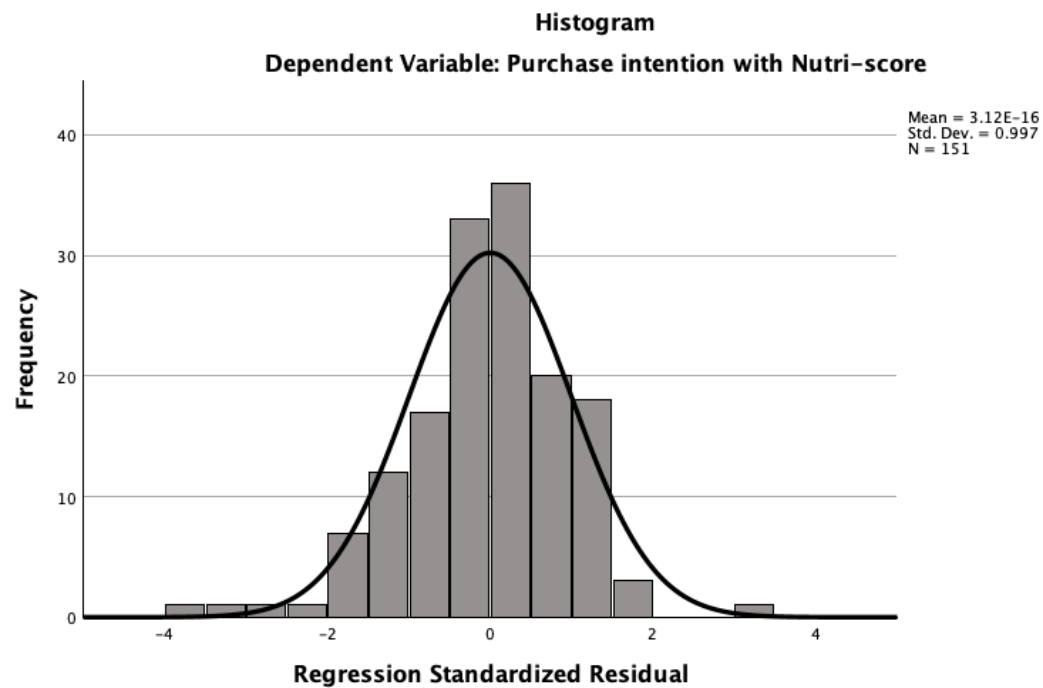


Appendix 3. Validated scales item statistics

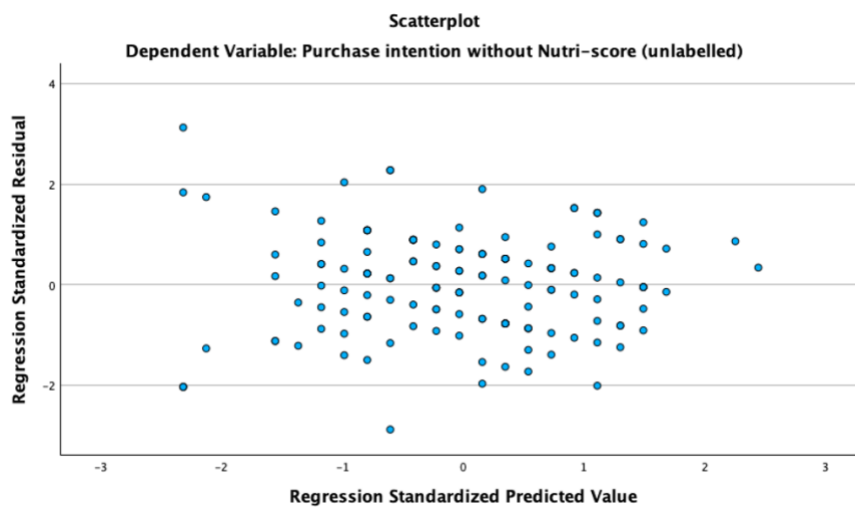
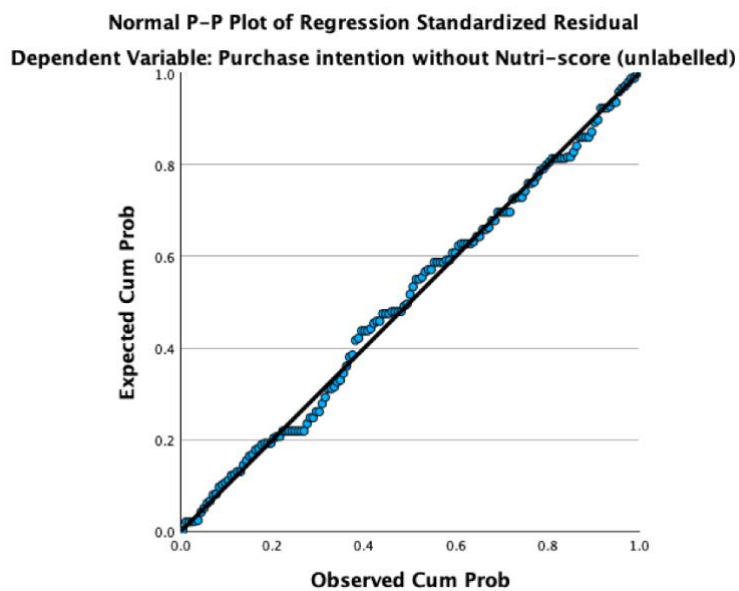
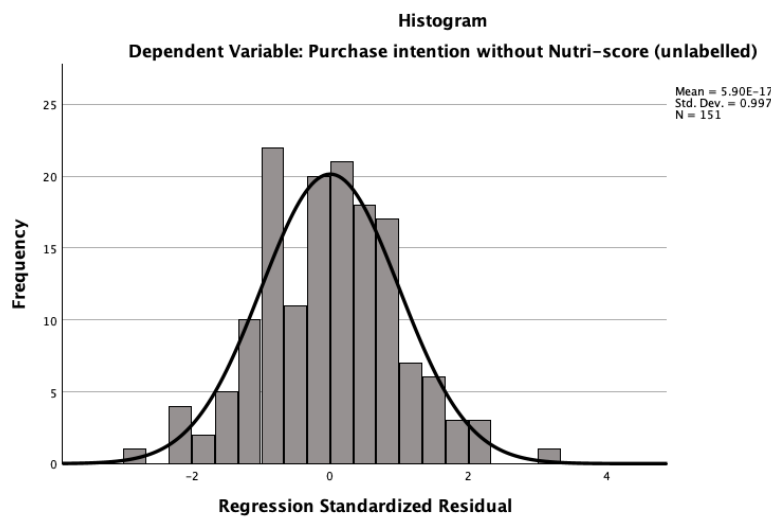
	N	Mean	Variance	Std. deviation	Cronbach's Alpha, ha törölnénk az itemet	Referencia
Healthiness perception with Nutri-score (HPNS) (Cronbach's Alpha= ,861, number of items: 7)	151	23,98	27,486	5,243		Fenko et al. (2016)
HPNS1: I expect this product to be healthy	151	3,48		1,012	,823	
HPNS2: I would consider this product as good for me	151	3,36		1,010	,828	
HPNS3: The product sounds healthy	151	3,53		1,005	,836	
HPNS4: The product looks healthy	151	3,64		,970	,832	
HPNS5: This product looks low on calories	151	2,64		1,122	,890	
HPNS6: I have an impression that this product is healthy	151	3,64		,969	,822	
HPNS7: This product looks healthier than similar products	151	3,70		1,000	,853	
Healthiness perception without Nutri-score (unlabelled) (HPUL) (Cronbach's Alpha= ,899, number of items: 7)	151	19,18	27,588	5,252		Fenko et al. (2016)
HPUL1: I expect this product to be healthy	151	2,80		,952	,867	
HPUL2: I would consider this product as good for me	151	2,76		,885	,880	
HPUL3: The product sounds healthy	151	2,89		,925	,882	
HPUL4: The product looks healthy	151	2,81		,950	,874	
HPUL5: This product looks low on calories	151	2,26		,978	,913	
HPUL6: I have an impression that this product is healthy	151	2,87		,961	,874	
HPUL7: This product looks healthier than similar products	151	2,77		1,001	,895	
Purchase intention with Nutri-score (PINS) (Cronbach's Alpha= ,858, number of items: 3)	151	11,52	76,931	2,633		Fenko et al. (2016)
PINS1: I would like to try this product	151	3,94		,933	,832	
PINS2: I would seriously consider buying this product	151	3,73		1,064	,810	
PINS3: I would buy this product	151	3,85		,982	,758	
Purchase intention without Nutri-score (unlabelled) (PIUL) (Cronbach's Alpha= ,882, number of items: 3)	151	10,40	6,696	2,588		Fenko et al. (2016)
PIUL1: I would like to try this product	151	3,54		,944	,883	
PIUL2: I would seriously consider buying this product	151	3,42		,955	,822	
PIUL3: I would buy this product	151	3,45		,978	,790	
General health interest (Cronbach's Alpha=,889; number of items: 8)	151	25,79	43,151	6,569		Roininen et al. (1999)
GHI1: The healthiness of food has impact on my food choices	151	3,48		1,076	,870	
GHI2: I am very particular about the healthiness of food I eat	151	3,43		1,055	,867	
GHI3: I eat what I like, and I do not worry much about the healthiness of food (R)	151	3,22		1,210	,874	
GHI4: It is important for me that my diet is low in fat	151	3,07		1,093	,884	
GHI5: I always follow a healthy and balanced diet	151	2,88		,959	,873	
GHI6: It is important for me that my daily diet contains a lot of vitamins and minerals	151	3,73		,959	,884	
GHI7: The healthiness of snacks makes no difference to me (R)	151	3,21		1,245	,877	
GHI8: I do not avoid foods, even if they may raise my cholesterol (R)	151	2,78		1,107	,880	

APPENDIX 4.: Assumptions for linear regression

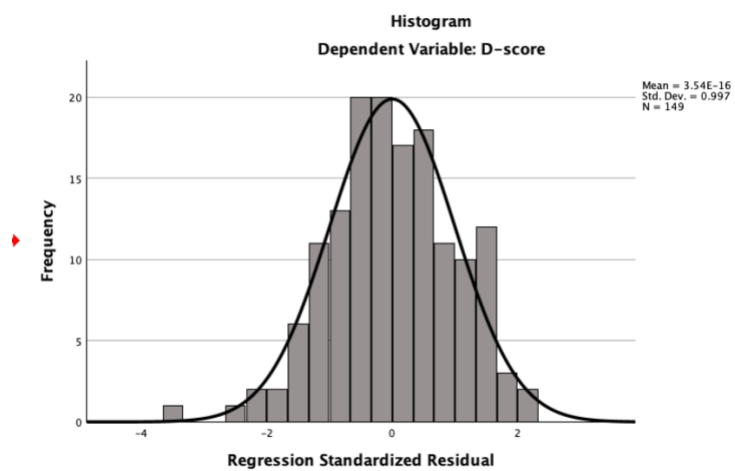
Healthiness perception with Nutri-score – Purchase intention with Nutri-score



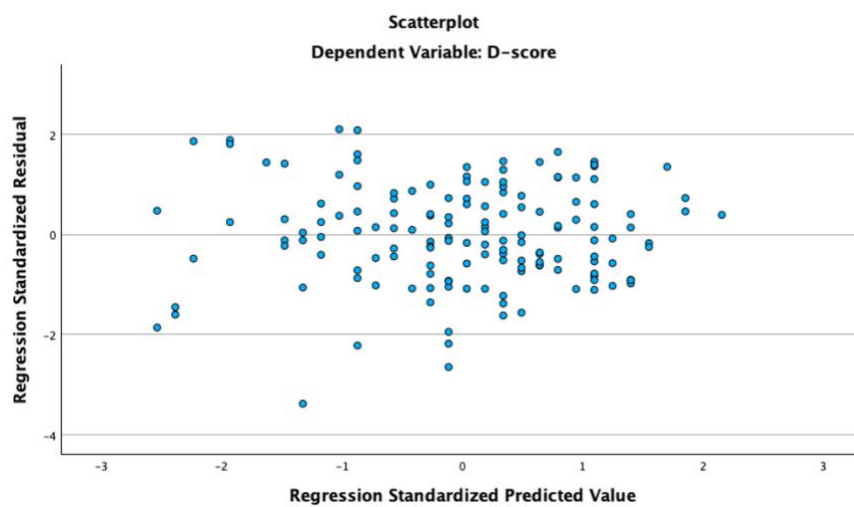
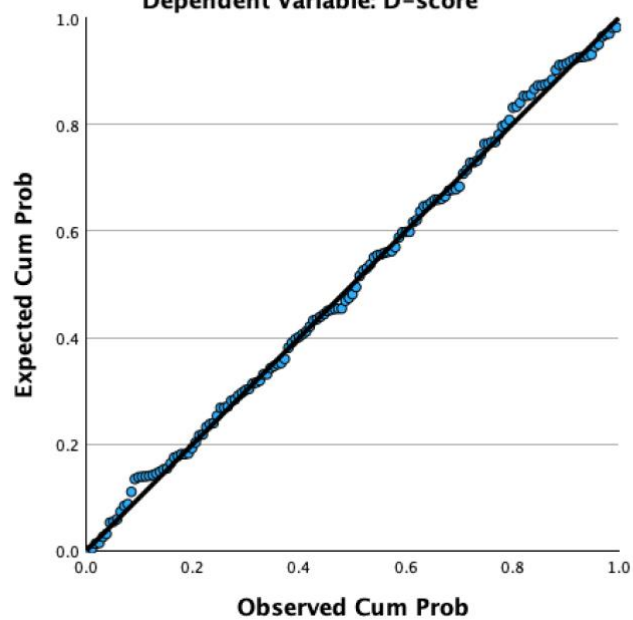
Healthiness perception without Nutri-score – Purchase intention without Nutri-score



General health interest, body weight discrepancy, Nutrition knowledge – D-score



Normal P-P Plot of Regression Standardized Residual
Dependent Variable: D-score



APPENDIX 5.: ANOVA tables for linear regression

GHI, BWD, NK →HPNS						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	0,393	3	0,131	0,230	0,875 ^b
	Residual	83,748	147	0,570		
	Total	84,142	150			
2	Regression	0,308	2	0,154	0,271	0,763 ^c
	Residual	83,834	148	0,566		
	Total	84,142	150			
3	Regression	0,196	1	0,196	0,348	0,556 ^d
	Residual	83,946	149	0,563		
	Total	84,142	150			
4	Regression	0,000	0	0,000	.	. ^e
	Residual	84,142	150	0,561		
	Total	84,142	150			

a. Dependent Variable: Healthiness perception with Nutri-score

b. Predictors: (Constant), Nutrition knowledge, Body weight discrepancy, General health interest

c. Predictors: (Constant), Body weight discrepancy, General health interest

d. Predictors: (Constant), General health interest

e. Predictor: (constant)

GHI, BWD, NK →HPUL						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	0,497	3	0,166	0,290	0,832b
	Residual	83,955	147	0,571		
	Total	84,452	150			
2	Regression	0,494	2	0,247	0,436	0,648c
	Residual	83,958	148	0,567		
	Total	84,452	150			
3	Regression	0,456	1	0,456	0,810	0,370d
	Residual	83,996	149	0,564		
	Total	84,452	150			
4	Regression	0,000	0	0,000	.	.e
	Residual	84,452	150	0,563		
	Total	84,452	150			

a. Dependent Variable: Healthiness perception without Nutri-score (unlabelled)

b. Predictors: (Constant), Nutrition knowledge, Body weight discrepancy, General health interest

c. Predictors: (Constant), Body weight discrepancy, General health interest

d. Predictors: (Constant), General health interest

e. Predictor: (constant)

GHI, BWD, NK →PINS						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	0,397	3	0,132	0,169	0,917b
	Residual	115,121	147	0,783		
	Total	115,519	150			
2	Regression	0,324	2	0,162	0,208	0,812c
	Residual	115,195	148	0,778		
	Total	115,519	150			
3	Regression	0,235	1	0,235	0,303	0,583d
	Residual	115,284	149	0,774		
	Total	115,519	150			
4	Regression	0,000	0	0,000	.	.e
	Residual	115,519	150	0,770		
	Total	115,519	150			

a. Dependent Variable: Purchase intention with Nutri-score

b. Predictors: (Constant), Nutrition knowledge, Body weight discrepancy, General health interest

c. Predictors: (Constant), Nutrition knowledge, General health interest

d. Predictors: (Constant), Nutrition knowledge

e. Predictor: (constant)

GHI, BWD, NK →PIUL						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2,098	3	0,699	0,939	0,424b
	Residual	109,498	147	0,745		
	Total	111,595	150			
2	Regression	1,929	2	0,965	1,302	0,275c
	Residual	109,666	148	0,741		
	Total	111,595	150			
3	Regression	1,185	1	1,185	1,599	0,208d
	Residual	110,411	149	0,741		
	Total	111,595	150			
4	Regression	0,000	0	0,000	.	.e
	Residual	111,595	150	0,744		
	Total	111,595	150			
a. Dependent Variable: Purchase intention without Nutri-score (unlabelled)						
b. Predictors: (Constant), Nutrition knowledge, Body weight discrepancy, General health interest						
c. Predictors: (Constant), Nutrition knowledge, General health interest						
d. Predictors: (Constant), Nutrition knowledge						
e. Predictor: (constant)						