



Food consumption motivations override and moderate the effect of nutrition label on responses to (un)healthy products

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ABSTRACT

Front-of-package (FOP) labels, highlighting key nutrition information of food products, have garnered interest as a means to promote healthy eating. However, previous studies have shown limited effects of FOP labels, warranting further investigation. This paper examines how an interpretive summary indicator FOP label influences consumers' cognitive, senso-emotional, and behavioural responses to (un)healthy ready-to-eat meals. Additionally, it explores the role of consumer motivations (health, pleasure, and sustainability) in relation to a FOP label. Two between-subject studies were conducted online (Study 1: $N = 516$) and in a lab (Study 2: $N = 116$), along with a real-life experiment in a lunch buffet (Study 3: $N = 1166$). Studies 1 and 2 revealed that consumer motivations had a greater impact than a FOP label on cognitive (nutrient content and healthiness perceptions, purchase intention) and senso-emotional (taste perceptions and emotions) responses. Motivations also moderated the FOP label's impact: FOP label improved emotions related to the unhealthy product among health-conscious consumers, suggesting a health halo effect. FOP label might also be a sign to consume more among those not motivated by health, pleasure, or sustainability. In Study 3, demonstrating the behavioural impact, FOP label either increased or had no effect on the proportion of healthy food consumed, depending on the product. The results indicate that FOP labels have limited and mixed effects on product responses and may even be counterproductive in promoting healthy diets among some consumers. These findings assist policymakers and food marketers in identifying consumer groups and products that benefit from FOP labels indicating better nutritional quality.

1. Introduction

As many consumers struggle to maintain a healthy diet, health authorities seek ways to facilitate food choices that align with nutritional recommendations (Kelly et al., 2024). Likewise, food marketers cannot ignore consumer health. To guide consumers toward healthier options, front-of-package (FOP) nutrition labels indicating food products with better nutritional quality are increasingly used (Ikonen et al., 2020). Implementing FOP labels is also expected to encourage manufacturers to improve the nutritional quality of their products (Kelly et al., 2024; Meijer et al., 2023; Shanguan et al., 2019). As the essential aim of FOP labels is to enable consumers to identify healthier options at a glance from a set of products, different types of FOP labels have been compared in terms of consumer understanding, with interpretive FOP labels

performing best (Ikonen et al., 2020; Kelly et al., 2024; Talati et al., 2016). An example of an interpretive FOP label type is an interpretive summary indicator FOP label, which provides an overall evaluation of a product's healthfulness (Ikonen et al., 2020).

However, earlier research has only found a weak positive impact of FOP labels on dietary choices and health outcomes (An et al., 2021; Anastasiou et al., 2019; Ikonen et al., 2020; Meijer et al., 2023; Shanguan et al., 2019; Zlatevska et al., 2024). Berry et al. (2019) suggested that the minor and mixed aggregate results could, in part, be explained by consumers' varying food consumption orientations: while some give more weight to healthfulness, others prioritise taste as the dominant factor in food choices. Thus, examining food consumption motivations is crucial to understand the limited effectiveness of FOP labels, as consumers motivated by different aspects of food may not consistently

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respond positively to labelled products. This variability could help explain why the implementation of FOP labels may not lead to the expected results.

Alongside product characteristics and consumers' personal processes, consumer characteristics (such as motivation, nutrition knowledge, and demographics) are held as one of the main factors determining the effectiveness of nutrition information (Ballco & Gracia, 2022). A recent meta-analysis by Ikonen et al. (2020) has also called for the investigation of consumer characteristics in relation to FOP labels, to gain a more precise understanding of how various consumer motivations interact with nutrition labels. Therefore, different consumer groups, rather than consumers in general, need to be examined to identify the preconditions for FOP label effects.

Despite the extensive literature on FOP labels over the last decade, surprisingly few studies have addressed this issue. Earlier research has mainly focussed on cognitive processes related to FOP labels, such as attention to, understanding of, and time spent reading them (e.g., Egnell et al., 2018; Grunert & Wills, 2007; Ma & Zhuang, 2021). When consumer-specific factors related to FOP labels have been considered, they have predominantly dealt with health and nutrition-related features, such as health consciousness, nutrition knowledge, and the ability to interpret labels (e.g., Andrews et al., 2021; Ballco & Gracia, 2022; Grunert et al., 2010; Grunert & Wills, 2007; Méjean et al., 2012). Despite their importance, other relevant motivations guiding food choices and their interaction with FOP labels remain less understood. As FOP labels may only meet the needs of a small subgroup of consumers motivated by health, responses to products with FOP labels should be examined among other groups as well, as they may require the most support in making healthier dietary choices (see Ikonen et al., 2020; Meijer et al., 2023).

FOP labels should not have negative consequences on the liking of products with enhanced nutritional quality for consumers to adopt them and improve their diets and health. It is known that taste and sensory qualities should not be inferior in labelled products for consumers to accept them (Meijer et al., 2023). This is why it is meaningful to examine how a FOP label indicating better nutritional quality affects both consumer's expected and actual cognitive and senso-emotional responses to food products, and how this depends on consumer- and product-related factors, such as food consumption motivations and healthfulness image of the product. Furthermore, there is a lack of field-based research investigating the behavioural effects of FOP labels promoting healthy eating (see Zlatevska et al., 2024).

Hence, the present research examines how a FOP label indicating better nutritional quality influences consumers' cognitive, senso-emotional, and behavioural responses to (un)healthy ready-to-eat meals. Additionally, it explores the role of consumer motivations (health, pleasure, and sustainability) in food responses and in relation to a FOP label. Two between-subject studies were conducted online (Study 1: $N = 516$) and in a lab (Study 2: $N = 116$) to investigate expected and actual cognitive (nutrient content and healthiness perceptions, purchase intention) and senso-emotional (taste perceptions, emotions) product responses, when a FOP label was present vs. not. In addition, one real-life experiment was conducted in a lunch buffet (Study 3) to investigate the behavioural responses to (un)healthy foods with a FOP label in terms of healthy food consumption. In the studies, a well-known Finnish interpretive summary indicator FOP label (the Heart Symbol) with a nutrition claim was used. In this case, it marks products with better nutritional quality within a product category. As target products, we used the same ready-to-eat meals representing healthy (vegetable lentil soup) and unhealthy products (fried potatoes with sausage) across studies. This adds to the range of food categories explored in relation to FOP labels, as the majority of earlier studies have focussed on snacks or drinks rather than whole meals (see Ballco & Gracia, 2022).

Integrating insights from consumer and sensory science (Grunert, 2015; Jaeger et al., 2025), this paper contributes to food consumption research in three prominent ways. First, conceptually, it extends prior

research concerning nutrition labels by introducing the theoretical rationale for the direct effects of an interpretive summary indicator FOP label and various food consumption motivations (health, pleasure, and sustainability) and for their potential moderation effects on cognitive, senso-emotional, and behavioural consumer responses to (un)healthy meal products. Second, empirically, it takes a holistic look at the direct effects of a FOP label on expected and actual product perceptions and real-life healthy food consumption. Third, the role of individual food consumption motivations and their interplay with a FOP label in shaping the food experience are considered. The findings of this research help marketers of healthy foods and health authorities determine whether a FOP label indicating better nutritional quality of the product is beneficial and what kinds of consumers it might appeal to. In addition, a better understanding of preferences for healthy and unhealthy foods enables identifying viable target groups for healthier products and tailoring more effective healthy eating interventions.

Next, we introduce our hypotheses based on a literature review. After that, we test the hypotheses across three empirical studies. Cognitive and senso-emotional responses are examined in Studies 1 and 2, moving from expected responses online to actual (un)healthy product responses in a lab. In Study 3, behavioural responses in terms of real-life healthy food consumption are explored in a field experiment conducted in a lunch buffet. We conclude by discussing the results and detailing practical implications, limitations, recommendations for future research, and conclusions.

1.1. Hypothesis on interpretive summary indicator FOP label and responses to (un)healthy products

Nutrition-related information can significantly affect a consumer's product experience, shaping expectations and even sensory assessments of foods (Piqueras-Fiszman & Spence, 2015). Earlier research on FOP labels' effect on product responses has yielded in mixed results. Regarding cognitive responses such as healthfulness perception and purchase intention, Ikonen et al. (2020) found in their meta-analysis that interpretive summary indicator FOP labels improved the healthfulness perceptions of healthier products. Conversely, Bialkova et al. (2016) found that FOP labels claiming reduced fat or sugar content decreased the healthiness perception of both healthy and unhealthy products, while health communication on food packages did not affect healthfulness perceptions according to Orquin & Scholderer (2015). Although interpretive summary indicator FOP labels increased the intention to buy healthier products according to Ikonen et al. (2020), others found that FOP labels and health communication lowered purchase intentions (Bialkova et al., 2016; Orquin & Scholderer, 2015). Products with health claims can also be perceived as less natural and attractive compared to those without such claims (Lähteenmäki et al., 2010).

Regarding senso-emotional responses, interpretive summary indicator FOP labels can decrease taste perceptions of healthier products (Ikonen et al., 2020). Products with health or reduced fat/sugar claims can also be perceived as less tasty (Bialkova et al., 2016; Lähteenmäki et al., 2010), and health communication can decrease sensory expectations (Orquin & Scholderer, 2015). Oliveira et al. (2018), in turn, found that health claims did not affect sensory perceptions of the products at the aggregate level, but consumer's sensitivity to sugar reduction modulated some of them. Decreased product expectations can also be demonstrated by measuring physiological responses, suggesting that while people explicitly state liking products with health information, their implicit reactions may indicate otherwise (Stickel et al., 2025). There might also be a difference between expected vs. actual perceptions, as Liem et al. (2012) observed that FOP labels lowered the expected salt intensity of chicken soup, but when actually tasting the product, liking or desire to consume were not affected. Additionally, when tasting the soup featuring a FOP label, consumers liked it more than they had expected. On the other hand, Oliveira et al. (2018) noticed

that while health claims increased the expected overall liking of sugar-reduced nectars, there was no effect when tasting the products.

As stated earlier, the actual behavioural outcomes of FOP labels, such as their impact on dietary choices, have only been weakly positive in earlier research (An et al., 2021; Anastasiou et al., 2019; Ikonen et al., 2020; Meijer et al., 2023; Shangguan et al., 2019; Zlatevska et al., 2024). Zlatevska et al. (2024) found in their second-order meta-analysis that interventions promoting healthy food were more effective than those aimed at preventing unhealthy consumption.

Perceived healthiness of the product may also moderate the effect of FOP labels (Bialkova et al., 2016; Ikonen et al., 2020; Meijer et al., 2023; Profeta, 2020). For instance, health logos have been criticised for promoting unhealthier foods, as they may misleadingly enhance healthiness perceptions and lead to increased consumption (Ikonen et al., 2020; Penzavecchia et al., 2022).

Given the somewhat mixed results of earlier studies on FOP labels' impact on (un)healthy product experience, we expect the impact to be limited. However, the impact may be more beneficial for unhealthier products (Ikonen et al., 2020). As our first hypothesis, we propose that:

H1. Interpretive summary indicator FOP label improves responses to unhealthy products but does not affect responses to healthy products.

1.2. Hypotheses on food consumption motivations and responses to (un) healthy products

Earlier, consumer-specific characteristics considered in relation to FOP labels have focussed on demographic factors, suggesting that women are more likely to use FOP labels than men, and older consumers may be more interested in nutrition information as they are more concerned with their health (Ballco & Gracia, 2022; Christoph et al., 2015; Grunert et al., 2010; Grunert & Wills, 2007). When it comes to the income and educational level of consumers and their interest in buying foods with nutrition or health claims, results remain mixed across studies (Ballco & Gracia, 2022). However, lower-income individuals may use nutrition labels less and have lower levels of nutrition knowledge (Campos et al., 2011). A recent study by Andretti et al. (2025) also indicates that lower-income consumers are more likely to choose unhealthier options and perceive healthy foods as less filling and tasty.

Nutrition knowledge, meaning, for example, knowing how diet relates to health and disease, which foods are main sources of nutrients, and what dietary guidelines recommend, has also been investigated widely before in relation to FOP label understanding and use (Ballco & Gracia, 2022; Grunert et al., 2010; Méjean et al., 2012; Miller & Cassady, 2015). Nutrition knowledge relates to understanding nutrition information and making healthiness inferences about products (Grunert et al., 2010). In a review paper, nutrition knowledge has been recognised to support FOP label use, as individuals with higher knowledge are able to process nutrition information on labels more effectively, understand it, and base their decisions on this information (Miller & Cassady, 2015). More complex FOP label formats (such as 'multiple traffic lights') are usually preferred by individuals with higher knowledge and interest in nutrition information, whereas those with lower levels of knowledge and interest may find simpler formats more attractive (Méjean et al., 2012).

Out of the consumer-specific characteristics in relation to FOP labels, less attention has been given to motivational factors, even though they might be the actual drivers behind FOP label interest, with demographic factors just correlating with them (see Grunert et al., 2010; Grunert & Wills, 2007). According to Grunert et al. (2010), even though nutrition knowledge leads to a better understanding of FOP labels, interest in healthy eating has a stronger influence on FOP label use. Hence, we recognise nutrition knowledge as a prerequisite for FOP label use, as it enables cognitive processing of FOP labels, but in this paper, we focus on various food consumption motivations that could either hinder or drive the liking of foods with FOP labels.

Key food consumption motivations identified by past research include health, pleasure (taste), and sustainability. Their relative importance as guiders of food choices varies from consumer to consumer (Dana et al., 2021). Consumers have been segmented based on the differences in their food motivations and beliefs before, the Food-Related Lifestyle approach perhaps being the most notable (see e.g., Ahmadi Kaliji et al., 2022), and they can even be segmented on the basis of why or in what ways they pursue health, pleasure, or sustainability (Hyldelund et al., 2022; O'Neill et al., 2023; Verain et al., 2024). In a similar vein, it is also possible that the effectiveness of FOP labels depends on the differences in the health, pleasure, and sustainability motivations of the food consumers. Thus, consumer motivation-based segmentation can essentially help to design appealing foods, persuasive communication and successful policy interventions.

Next, we elaborate on health, pleasure, and sustainability motivation and their potential interaction with FOP labels and introduce the rest of the hypotheses. These motivations were chosen as health and pleasure motivations represent the typical competing goals in food choices with potential implications on healthy eating. Sustainability motivation, on the other hand, represents an emerging perspective in healthy eating, warranting further consideration also in the context of FOP labels.

1.2.1. Health motivation and its potential interaction with a FOP label

Of the motivational factors, health motivation has likely received the most research attention in relation to FOP labels (see Ballco & Gracia, 2022; Cavaliere et al., 2016; Grunert et al., 2010; Hung et al., 2017; Mai & Hoffmann, 2015; Steinhäuser et al., 2019). For instance, Bialkova et al. (2016) found that highly health-motivated consumers preferred buying the healthier product over the unhealthier one and perceived the unhealthy product as less healthy than consumers with low health motivation. Liem et al. (2012), on the other hand, did not find a correlation between general health interest and how consumers perceived the product with a FOP label or whether they intended to buy it. In another study, however, higher health consciousness was found to increase purchase intentions and willingness to pay for labelled products, but not to influence healthiness perceptions of them (Hwang et al., 2016). Higher health motivation has also been linked to longer time spent looking at FOP labels but not to increased purchase decisions (Steinhäuser et al., 2019). Thus, health motivation should be studied further to gain more robust insights into its influence on (un)healthy food responses and potential interaction with a FOP label. We propose that:

H2a. Higher health motivation leads to improved responses to healthy products and impeded responses to unhealthy products.

H2b. Interpretive summary indicator FOP label improves responses to healthy and unhealthy products among consumers with higher health motivation.

1.2.2. Pleasure motivation and its potential interaction with a FOP label

Hedonic motives often counteract health motives, prompting consumers to seek immediate pleasure and satisfaction rather than pursuing long-term health goals (Penzavecchia et al., 2022). While health-motivated consumers search for and utilise nutrition information, more pleasure-oriented ones make less effort to do so (Zhu et al., 2019). Similarly, Mai and Hoffmann (2012) have identified two major consumer segments: those who seek nutrition information and those who value taste over other product attributes. The possible health-pleasure trade-off may lead some consumers to perceive products with FOP labels as less tasty or pleasant (Bialkova et al., 2016; Grunert & Wills, 2007; Mai & Hoffmann, 2015; Raghunathan et al., 2006). At a restaurant, taste-oriented individuals might end up ordering dishes with more calories when menu calorie labels are present, thereby counteracting the intended purpose of the labels (Berry et al., 2019). Tastiness might also be a leading factor in food choices among consumers who fail to shop for healthy food (Mergelsberg et al., 2019). Thus, researchers should study

how this group could be assisted in reaching their well-being goals. Accordingly, we propose that:

H3a. Higher pleasure motivation leads to impeded responses to healthy products and improved responses to unhealthy products.

H3b. Interpretive summary indicator FOP label impedes responses to healthy and unhealthy products among consumers with higher pleasure motivation.

1.2.3. Sustainability motivation and its potential interaction with a FOP label

Sustainability, alongside the health consequences of food choices, is part of a larger responsibility trend in food consumption (Grunert, 2015). Healthiness and sustainability aspects of food are strongly interrelated among some consumer groups (Arbit et al., 2017; Van Loo et al., 2017), and consumers pursuing health or sustainability even share the same identity characteristics (Piracci et al., 2023). Both aspects are also promoted in recent dietary recommendations and initiatives, such as the Nordic Nutrition Recommendations (Blomhoff et al., 2023) and the planetary health diet (Willett et al., 2019). Thus, sustainable eating – such as avoiding meat and food waste, eating local or organic produce, and making food choices based on environmental friendliness – should be seen as complementary to, rather than separate from, healthy eating. It has also been encouraged to examine these two pivotal aspects of food consumption simultaneously (Aschemann-Witzel, 2015), and the development of eating scales measuring sustainable healthy diets has advanced in recent years (Tepper et al., 2021). Hence, the political and academic climate has evolved to consider sustainability in conjunction with healthy eating.

The interconnectedness of healthiness and sustainability in consumer judgements is already seen in several studies. Verain et al. (2016) found that consumers assigning the most importance to sustainability perceived health and sustainability qualities of food as going hand in hand. For instance, plant-based meat alternatives are perceived not just as environmentally friendly but also as healthier than traditional meat, implying a health halo related to sustainable food (Gonzales et al., 2023). On the other hand, foods typically seen as unhealthy and tasty “comfort foods” (Shen & Liu, 2024), can be considered as unsustainable, as they often contain dairy and meat. Furthermore, consuming them is not vital to human health, making them also in that sense more unsustainable choices.

Another example of consumers valuing both healthy and sustainable qualities are buyers of organic foods, which are generally considered to be healthier (Nadricka et al., 2020). Choices to eat organic are typically motivated by health and environmental concerns (Hughner et al., 2007; Janssen, 2018; Rana & Paul, 2020), with a connection detected between these motivations (Valero-Gil et al., 2023). A study by Aschemann-Witzel et al. (2013) concludes that nutrition labels can attract especially those consumers who occasionally buy organic products, indicating that nutritional aspects are somewhat salient to organic consumers. Kantola et al. (2023) demonstrate that in some cases, higher environmental concern enhances understanding of nutrition labels, leading to the assumption that FOP labels may be of interest to sustainability-oriented consumers. In this paper, we extend the current knowledge of how products with interpretive summary indicator FOP labels are perceived by consumers motivated by sustainability, and propose that:

H4a. Higher sustainability motivation leads to improved responses to healthy products and impeded responses to unhealthy products.

H4b. Interpretive summary indicator FOP label improves responses to healthy and unhealthy products among consumers with higher sustainability motivation.

1.3. Conceptual model

In the conceptual model in Fig. 1, the impact and interplay of FOP

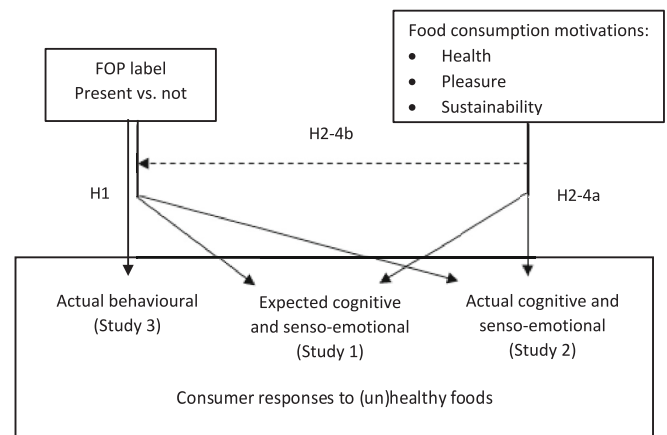


Fig. 1. Conceptual framework.

label and food consumption motivations in responses to (un)healthy foods are depicted in terms of cognitive, senso-emotional, and behavioural responses. As consumers may react differently to products typically perceived as healthy or unhealthy and to FOP labels on them (Bialkova et al., 2016; Ikonen et al., 2020; Meijer et al., 2023; Profeta, 2020; Talati et al., 2016), it is meaningful to examine both product types with a FOP label. Including both expected and actual product responses responds to Balco and Gracia (2022) and Sunstein (2021), who have called for more realistic sensory analysis and investigation of food labels' influence on actual consumer experiences. Furthermore, even though FOP labels may encourage choosing healthier products, sensory properties may override these effects when consumers actually taste the foods (Lima et al., 2019). The critical part is whether FOP labels emphasising healthiness undermine other expected or experienced product qualities, such as taste (see Bialkova et al., 2016; Lähteenmäki et al., 2010; Liem et al., 2012; Raghunathan et al., 2006), and which consumer groups might be concerned by this issue. Gaining more insight into the effects of a FOP label on actual food consumption in natural settings is also crucial for understanding the real-life potential of FOP labels as healthy eating interventions (see Ikonen et al., 2020; Zlatevska et al., 2024).

In this paper, we target the empirical objectives with an experimental approach, where FOP label serves as a between-group factor. We conducted two studies, one online and one in a lab, where consumers evaluated meal products with healthy and unhealthy images in multiple aspects, when a FOP label indicating better nutritional quality was present vs. not. Outcome measures included cognitive (nutrient content and healthiness perceptions, purchase intention) and senso-emotional responses (perceived taste/pleasantness, product-elicited emotions). The third study investigated the direct effects of a FOP label on behavioural responses (actual healthy food consumption) in a natural setting, spa hotel lunch buffet.

2. Study 1: The effect of FOP label and food consumption motivations on expected responses to (un)healthy foods

2.1. Materials and methods

2.1.1. Study design

To test the effect of FOP label and consumer motivations on the expected cognitive and senso-emotional responses to (un)healthy ready-to-eat meal products (H1-H4), we conducted an online experiment with two between-subject conditions: FOP label present vs. not. Each participant evaluated one healthy and one unhealthy product in a randomised order based on pictures. First, participants evaluated the products in terms of expected taste, healthiness, purchase intention, emotions elicited by the products, and nutritional content. After this,

participants completed the rest of the questionnaire, which measured food consumption motivations and collected background information.

2.1.2. Participants

A consumer research agency conducted the online survey between 27 January and 9 February 2021. The sample was considered to represent the Finnish adult population ($N = 516$; 51 % women; aged 18–71, $M_{age} = 44.9$, $SD = 14.7$; 45 % with an academic degree) based on gender, age, and educational level (see Table 1). Informed consent was obtained at the beginning of the survey. Participants were compensated with points that could be used to redeem online store gift cards. Ethical approval was deemed unnecessary by the University of Vaasa Human Science Ethics committee [statement 3 December 2020].

2.1.3. Products

Two fictitious ready-to-eat meal products were used in the survey (see Fig. 2). Vegetable lentil soup represented the healthy product, and fried potatoes with sausage represented the unhealthy product. The perceived healthiness difference of the products was confirmed in an earlier study (Paakki et al., 2022).

2.1.4. FOP label

As a FOP nutrition label, the Heart Symbol – governed by the Finnish Heart and Diabetes Associations – was used. The symbol is widely known and understood by Finnish adults compared to other FOP labels (Kantola et al., 2023) and in 2024, it was ranked as the ninth most valued brand among Finnish consumers (Taloustutkimus, 2024). The Heart Symbol is an interpretive summary indicator FOP label, indicating nutritionally better choices in various product categories, and it may be attached to both vice and virtue products. It is used in approximately 2500 food products in Finland that are available in supermarkets and food service (Sydänmerkki, 2025). Despite the wide recognition of the FOP label, to ensure understanding, it was accompanied by the claim: “Better choice in its product group regarding fat and salt.” According to Míklavec et al. (2016), the effect of a FOP label can be further enhanced by adding a claim clearly describing the meaning of the symbol. Comparing the effects between alternative FOP label systems was beyond the scope of this article.

2.1.5. Survey

Dependent and independent variables are listed in Appendix A. **Dependent variables.** In the online survey, participants were first randomised into one of two conditions: FOP label and nutrition claim present ($N = 255$) vs. not present ($N = 261$). Participants evaluated the products in a randomised order in terms of expected taste, healthiness, and purchase intention (see Appendix A). In addition, participants evaluated the expected nutritional content of the products in terms of salt, fat, and energy. Respondents were also asked in a randomised order

about the positive and negative emotions they expected to feel when tasting and eating the product (positive emotions: feeling soothed, satisfied, and energetic; negative emotions: feeling bored, guilty, and disgusted). These emotions were used as they represent emotions commonly used in product research (e.g., Nestrud et al., 2016; Spinelli et al., 2014). All ratings were made on a 7-point Likert scale (1 = fully disagree to 7 = fully agree).

Food consumption motivations were measured with items presented in a randomised order on a 7-point Likert scale (1 = fully disagree to 7 = fully agree) after product evaluations. The survey contained items representing health, pleasure, and sustainability motivations in food consumption (see Appendix A).

Socio-demographic information, including gender, year of birth, educational level, and special diets (such as plant-based), was collected at the end of the survey.

2.1.6. Analysis

Direct effects of FOP label and food consumption motivations on responses to the healthy and unhealthy product were determined using multiple linear regression models with FOP label (dummy-coded), health, pleasure, and sustainability motivations as explanatory variables, and gender, age, education (academic degree vs. not), and plant-based diet (vs. not) as control variables.

Interaction effects of FOP label with health, pleasure, and sustainability motivation were investigated for each motivation using Hayes’s (2017) PROCESS Macro (Model 1, with 5000 resamples) with FOP label (dummy-coded), mean-centred food consumption motivation variable and interaction term as independent variables. Gender, age, education, and plant-based diet were controlled for in the models. Floodlight analysis (Johnson-Neyman technique) was used to identify regions of significance (ROS) for the interaction effects.

All results were obtained using IBM SPSS Statistics version 28.0.1.1. Effects were considered significant at a p -value of 0.05.

2.2. Results

2.2.1. Direct effects of FOP label and food consumption motivations on expected responses to (un)healthy foods

Results for the direct effects of the FOP label and food consumption motivations can be seen in Table 2.

FOP label. The effect of the FOP label was significant in three expected cognitive responses to the unhealthy product: expected salt ($\beta = -0.238$, $p < 0.001$, $R^2 = 0.096$, $F(8,505) = 6.69$, $p < 0.001$), fat ($\beta = -0.225$, $p < 0.001$, $R^2 = 0.076$, $F(8,505) = 5.23$, $p < 0.001$), and energy contents ($\beta = -0.090$, $p = 0.035$, $R^2 = 0.099$, $F(8,505) = 6.97$, $p < 0.001$) decreased when the FOP label was present on the product. There were no significant direct effects of the FOP label on the healthy product.

Health motivation impeded expected cognitive and senso-emotional responses to the unhealthy product; purchase intention ($\beta = -0.165$, $p < 0.001$, $R^2 = 0.181$, $F(8,505) = 14.00$, $p < 0.001$), positive emotions ($\beta = -0.126$, $p = 0.009$, $R^2 = 0.141$, $F(8,505) = 10.37$, $p < 0.001$) and expected taste ($\beta = -0.098$, $p = 0.043$, $R^2 = 0.144$, $F(8,505) = 10.58$, $p < 0.001$) decreased, whereas negative emotions elicited by the product increased ($\beta = 0.126$, $p = 0.011$, $R^2 = 0.096$, $F(8,505) = 6.69$, $p < 0.001$) with higher health motivation. For the healthy product, there were no significant direct effects.

Pleasure motivation increased expected cognitive responses to the unhealthy product, as energy content perception ($\beta = 0.208$, $p < 0.001$, $R^2 = 0.099$, $F(8,505) = 6.97$, $p < 0.001$) and purchase intention ($\beta = 0.124$, $p = 0.005$, $R^2 = 0.181$, $F(8,505) = 14.00$, $p < 0.001$) augmented. The senso-emotional responses to the unhealthy product were also ameliorated, as the expected positive emotions ($\beta = 0.127$, $p = 0.005$, $R^2 = 0.141$, $F(8,505) = 10.37$, $p < 0.001$) and taste ($\beta = 0.125$, $p = 0.005$, $R^2 = 0.144$, $F(8,505) = 10.58$, $p < 0.001$) increased while negative emotions elicited by the product attenuated with higher pleasure motivation ($\beta = -0.095$, $p = 0.038$, $R^2 = 0.096$, $F(8,505) = 6.69$, $p <$

Table 1
Sample characteristics in Study 1 ($N = 516$).

	N	%	Finnish population 2019 (%)*
Gender			
Men	252	49	49
Women	262	51	51
Age, years			
18–24	52	10	11
25–34	105	20	18
35–44	92	18	18
45–54	104	20	17
55–64	103	20	18
65–74	60	12	18
Educational level			
Primary and secondary school	57	11	11
High school/vocational school	227	44	46
University/Higher education	232	45	43

* Statistics Finland (2022), OECD (2025).



Fig. 2. Pictures of the food products with a FOP label and nutrition claim used as stimulus in Study 1: vegetable lentil soup (left) and fried potatoes with sausage (right).

Table 2

Direct effects of FOP label and food consumption motivations on product responses in multiple linear regressions ($N = 514$) in Study 1.

Panel A: Healthy product								
	Taste	Positive emotions	Negative emotions	Salt content	Fat content	Energy content	Healthiness	Purchase intention
FOP label (0 = no, 1 = present)	0.001	−0.010	−0.035	−0.042	−0.054	0.006	−0.055	0.016
Health motivation ^{a)}	0.005	0.045	−0.044	−0.027	0.013	0.000	0.000	0.070
Pleasure motivation ^{a)}	0.052	0.040	−0.023	−0.070	−0.022	0.030	0.167***	0.042
Sustainability motivation ^{a)}	0.328***	0.348***	−0.120*	0.182***	0.173**	0.212***	0.198***	0.367***
Gender (0 = female, 1 = male)	−0.122**	−0.083*	0.196***	0.049	0.062	0.029	−0.058	−0.076
Age	0.104*	0.050	−0.187***	−0.100*	−0.135**	−0.016	0.050	0.043
Academic degree (0 = no, 1 = yes)	−0.050	−0.039	0.016	0.012	−0.007	−0.109*	−0.035	−0.052
Plant-based diet (0 = no, 1 = yes)	0.053	0.037	−0.086	−0.053	−0.095*	−0.064	−0.003	0.064
R^2	0.179	0.180	0.132	0.033	0.042	0.050	0.102	0.217
Adj. R^2	0.166	0.167	0.119	0.018	0.027	0.035	0.087	0.204
Panel B: Unhealthy product								
	Taste	Positive emotions	Negative emotions	Salt content	Fat content	Energy content	Healthiness	Purchase intention
FOP label (0 = no, 1 = present)	−0.049	−0.023	−0.032	−0.238***	−0.225***	−0.090*	0.047	−0.022
Health motivation ^{a)}	−0.098*	−0.126**	0.126*	0.091	0.069	0.012	−0.091	−0.165***
Pleasure motivation ^{a)}	0.125**	0.127**	−0.095*	0.041	0.031	0.208***	0.039	0.124**
Sustainability motivation ^{a)}	0.109*	0.137**	0.044	0.010	0.032	0.085	0.210***	0.132**
Gender (0 = female, 1 = male)	0.197***	0.235***	−0.081	−0.084*	−0.069	−0.009	0.260***	0.270***
Age	0.012	0.021	−0.105*	−0.038	0.001	0.120**	0.050	0.003
Academic degree (0 = no, 1 = yes)	−0.124**	−0.073	0.105*	0.120**	0.087*	0.055	−0.072	−0.093*
Plant-based diet (0 = no, 1 = yes)	−0.225***	−0.191***	0.150***	0.015	−0.003	−0.060	−0.150***	−0.209***
R^2	0.144	0.141	0.213	0.096	0.076	0.099	0.053	0.181
Adj. R^2	0.130	0.128	0.203	0.081	0.062	0.085	0.040	0.169

^{a)} Measured on a 7-point scale where 1 = low, 7 = high.

* $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$.

0.001). For the healthy product, higher pleasure motivation increased the expected healthiness of the product ($\beta = 0.167$, $p < 0.001$, $R^2 = 0.102$, $F(8,505) = 7.13$, $p < 0.001$).

Sustainability motivation increased both the expected cognitive and senso-emotional responses to the unhealthy product: healthiness perception ($\beta = 0.210$, $p < 0.001$, $R^2 = 0.128$, $F(8,505) = 9.26$, $p < 0.001$), purchase intention ($\beta = 0.132$, $p = 0.010$, $R^2 = 0.181$, $F(8,505) = 14.00$, $p < 0.001$) as well as the positive emotions ($\beta = 0.137$, $p = 0.010$, $R^2 = 0.141$, $F(8,505) = 10.37$, $p < 0.001$) and taste perception ($\beta = 0.109$, $p = 0.038$, $R^2 = 0.144$, $F(8,505) = 10.58$, $p < 0.001$) were higher. For the healthy product, higher sustainability motivation affected all dependent variables. Cognitively, purchase intention increased ($\beta = 0.367$, $p < 0.001$, $R^2 = 0.217$, $F(8,505) = 17.48$, $p < 0.001$) and the product was perceived as healthier ($\beta = 0.198$, $p < 0.001$, $R^2 = 0.102$, $F(8,505) = 7.13$, $p < 0.001$) and as containing more energy ($\beta = 0.212$, $p < 0.001$, $R^2 = 0.050$, $F(8,505) = 3.33$, $p = 0.001$), salt ($\beta = 0.182$, $p = 0.001$, $R^2 = 0.033$, $F(8,505) = 2.15$, $p = 0.030$), and fat ($\beta = 0.173$, $p = 0.002$, $R^2 = 0.042$, $F(8,505) = 2.79$, $p = 0.005$) with higher sustainability motivation. Senso-emotionally, positive emotions ($\beta = 0.348$, $p < 0.001$, $R^2 = 0.180$, $F(8,505) = 13.82$, $p < 0.001$) and taste perception ($\beta = 0.328$, $p < 0.001$, $R^2 = 0.179$, $F(8,505) = 13.77$, $p < 0.001$) were stronger, whereas negative emotions ($\beta = -0.120$, $p = 0.023$, $R^2 = 0.132$, $F(8,505) = 9.63$, $p < 0.001$) diminished.

0.001) were stronger, whereas negative emotions ($\beta = -0.120$, $p = 0.023$, $R^2 = 0.132$, $F(8,505) = 9.63$, $p < 0.001$) diminished.

2.2.2. Interaction effects between FOP label and food consumption motivations

Four interaction effects were detected between the FOP label and food consumption motivations on the expected responses to (un)healthy foods in the online survey (see Fig. 3). Senso-emotionally, with FOP label, the unhealthy product was expected to be less tasty among consumers with lower health motivation ($\beta = 0.267$, $p = 0.042$, $R^2 = 0.120$, $F(7,506) = 9.85$, $p < 0.001$, ROS with negative effect below value -0.66 on mean-centred moderator) and higher pleasure motivation ($\beta = -0.298$, $p = 0.037$, $R^2 = 0.141$, $F(7,506) = 11.83$, $p < 0.001$, ROS with negative effect above 0.39). Cognitively, higher pleasure motivation with the FOP label also led to lower expected energy content of the unhealthy product ($\beta = -0.239$, $p = 0.053$, $R^2 = 0.100$, $F(7,506) = 8.04$, $p < 0.001$, ROS with negative effect above -0.10), whereas lower pleasure motivation with the FOP label increased the expected healthiness of the product ($\beta = -0.219$, $p = 0.049$, $R^2 = 0.108$, $F(7,506) = 8.72$, $p < 0.001$, ROS with positive effect below -0.75).

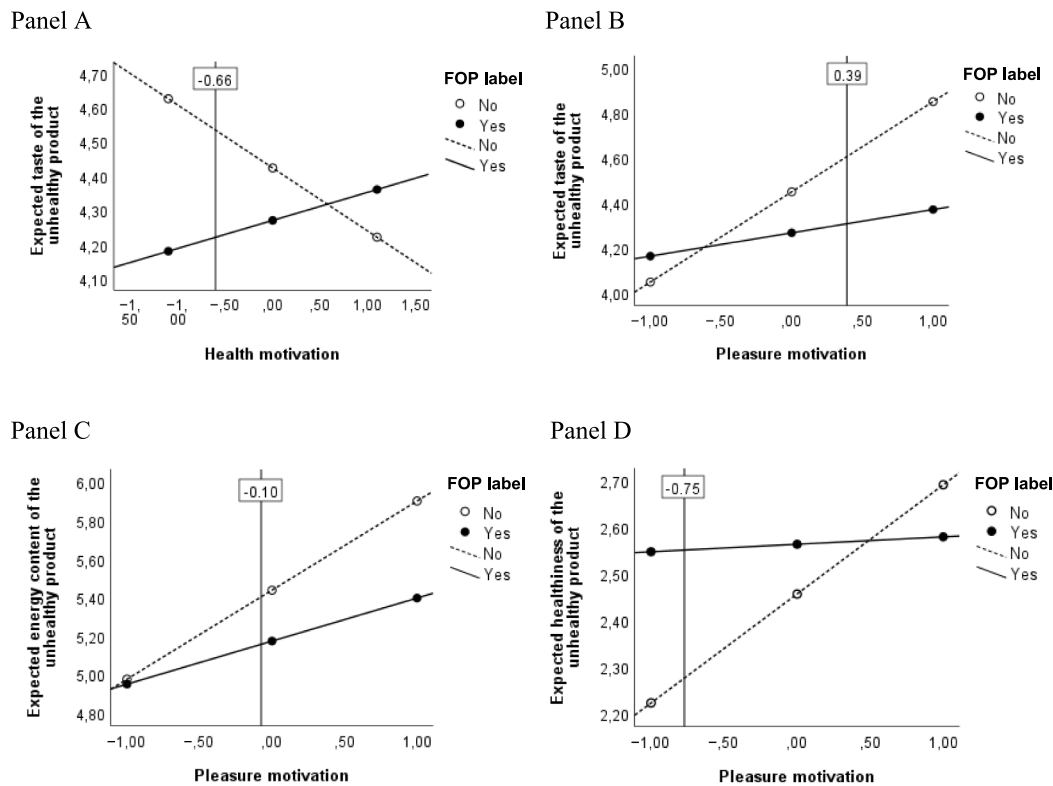


Fig. 3. The significant interaction effects of FOP label and food consumption motivations on the expected product responses in Study 1. Vertical lines mark Johnson-Neyman points.

2.3. Discussion

In the online experiment, the FOP label only had minor direct effects on the expected cognitive and senso-emotional responses to (un)healthy foods, as it reduced the expected salt, fat, and energy contents of the unhealthy product. Apart from this, the FOP label seemed to neither enhance nor disturb the expected food experience, including the healthiness perception of the products. Compared to the FOP label, food consumption motivations turned out to be more influential in shaping the expected product responses. Higher health motivation was connected to more negative responses to the unhealthy product, whereas higher pleasure motivation improved responses to it. Interestingly, higher sustainability motivation seemed to have a particularly strong positive effect on responses to the healthy product while also improving the liking of the unhealthy product.

In Study 1, there were just a few interactions between the FOP label and food consumption motivations, indicating that the FOP label may impede taste perception of the unhealthy product for less health-motivated and more pleasure-oriented individuals. This can be interpreted as the “healthy = untasty” belief that prevails among some consumers valuing hedonic aspects of food over health properties (see [Mai & Hoffmann, 2015](#); [Paakki et al., 2022](#); [Raghunathan et al., 2006](#)), but more evidence is needed to draw robust conclusions. On the other hand, the healthiness perception of the unhealthy product was improved with the FOP label for those less motivated by pleasure.

3. Study 2: The effect of FOP label and food consumption motivations on actual responses to (un)healthy foods

3.1. Materials and methods

3.1.1. Study design

To deepen and confirm the findings of Study 1 on the effect of the FOP label and food consumption motivations on cognitive and senso-

emotional product responses (testing H1-H4), a taste experiment with actual products was conducted, following a similar design to Study 1. Instead of expected responses, Study 2 concerned perceived product qualities experienced during consumption. This is important, since while initial product choices may be made based on the product package and information available on it, repurchasing requires actually liking the product. Therefore, it is meaningful to examine the actual effects of the FOP label on product liking.

3.1.2. Participants

A total of 116 participants took part in the experiment between 31 August and 16 September 2021 (73 % women; aged 19–70, $M_{age} = 38.1$, $SD = 15.2$; 63 % with an academic degree). The study was conducted in an ISO-standard compliant sensory laboratory at the University of Turku facilities. Participants were recruited from a consumer panel, universities, and other institutions near the research location. They were compensated with a goody bag containing food products.

3.1.3. Procedure and products

Recipes for two products corresponding to those in Study 1 – vegetable lentil soup and fried potatoes with sausage – were developed to meet the nutritional criteria for the Heart Symbol (see [Junkkari et al., 2023](#)). Similar to Study 1, vegetable lentil soup represented the healthy product, while fried potatoes with sausage represented the unhealthy product. A professional chef prepared the products before each evaluation session, and research assistants plated portions of approximately 100 g before serving them to the participants. Participants were randomised into either the FOP label present ($N = 57$) or not ($N = 59$) condition. Both conditions evaluated the same two products one by one in a counterbalanced order. The products were served with an info sheet displaying the ingredient list, either with the FOP label and nutrition claim present or not (see Appendix B). Participants were instructed to review the info sheet before assessing the product, as the sheets were handed out before the food was served. After tasting the samples and

completing product evaluations and the rest of the survey on a tablet, participants were thanked, debriefed, and given their goody bag. The research was approved by the Ethics Committee for Human Sciences at the University of Turku [statement 12 May 2021].

3.1.4. Survey

The same product assessment items were used as in Study 1 (see Appendix A), apart from pleasantness (in terms of appearance, smell, taste, texture, and overall) which was evaluated instead of taste, and fillingness perception, which was an additional item. To represent a hypothetical choice between the products, an item formulated as “If you had to choose which of the products you reviewed would you rather eat right now?” was also added. After product assessments, participants answered the same food motivation items in a randomised order as in Study 1 (see Appendix A). At the end of the survey, respondents were asked to provide the same socio-demographic information as in Study 1.

3.1.5. Analysis

The same analytical approach was used to process the results as in Study 1.

3.2. Results

3.2.1. Direct effects of FOP label and food consumption motivations on actual responses to (un)healthy foods

Results for the direct effects of the FOP label and food consumption motivations can be seen in Table 3.

FOP label had no direct effects on the product responses.

Health motivation. Unlike in Study 1, health motivation was not found to influence product responses.

Pleasure motivation influenced both actual cognitive and senso-

emotional product responses. Higher pleasure motivation increased the perceived energy contents of the unhealthy product ($\beta = 0.215$, $p = 0.032$, $R^2 = 0.104$, $F(8,106) = 1.53$, $p = 0.155$). For the healthy product, higher pleasure motivation enhanced perceived healthiness ($\beta = 0.228$, $p = 0.024$, $R^2 = 0.093$, $F(8,106) = 1.37$, $p = 0.220$) and pleasantness ($\beta = 0.208$, $p = 0.034$, $R^2 = 0.129$, $F(8,106) = 1.96$, $p = 0.058$).

Sustainability motivation. Higher sustainability motivation diminished liking of the unhealthy product in terms of cognitive and senso-emotional responses, as purchase intention decreased ($\beta = -0.263$, $p = 0.028$, $R^2 = 0.167$, $F(8,106) = 2.65$, $p = 0.011$) and negative emotions associated with the product increased ($\beta = 0.334$, $p = 0.005$, $R^2 = 0.202$, $F(8,106) = 3.35$, $p = 0.002$). There were no direct effects for the healthy product. Out of the food consumption motivations and the FOP label, sustainability motivation was the only factor that predicted the choice of the healthy product over the unhealthy one in a binary logistic regression (95 % CI [1.44, 5.32]).

3.2.2. Interaction effects between FOP label and food consumption motivations

Several interaction effects between the FOP label and food consumption motivations were found in the taste experiment (see Fig. 4).

Health motivation. Senso-emotionally, positive emotions elicited by the unhealthy product were decreased with the FOP label among consumers with lower health motivation and increased among consumers with higher health motivation ($\beta = 0.629$, $p = 0.005$, $R^2 = 0.134$, $F(7,107) = 2.36$, $p = 0.028$, ROS with negative effect below -0.67 and positive effect above 1.45). Cognitively, lower health motivation with the FOP label also led to reduced perception of energy content ($\beta = 0.490$, $p = 0.005$, $R^2 = 0.106$, $F(7,107) = 1.82$, $p = 0.090$, ROS with negative effect below -0.34) and fillingness ($\beta = 0.333$, $p = 0.094$, $R^2 = 0.064$, $F(7,107) = 1.04$, $p = 0.409$, ROS with negative effect below

Table 3

Direct effects of FOP label and food consumption motivations on product responses in multiple linear regressions ($N = 115$) in Study 2.

Panel A: Healthy product									
	Pleasantness	Positive emotions	Negative emotions	Fillingness	Salt content	Fat content	Energy content	Healthiness	Purchase intention
FOP label (0 = no, 1 = present)	-0.130	-0.114	0.015	-0.108	-0.057	-0.123	-0.098	-0.054	-0.034
Health motivation ^a	0.017	0.068	-0.092	0.136	-0.076	0.072	0.025	-0.001	0.147
Pleasure motivation ^a	0.208*	0.105	-0.131	0.057	0.011	-0.088	0.058	0.228*	0.119
Sustainability motivation ^a	0.106	0.168	0.098	-0.051	0.121	0.082	-0.011	0.055	0.148
Gender (0 = female, 1 = male)	-0.019	0.051	0.152	-0.117	-0.094	0.000	-0.042	0.115	-0.005
Age	0.110	0.089	-0.209*	0.279**	-0.062	0.023	0.128	0.127	-0.011
Academic degree (0 = no, 1 = yes)	-0.213*	-0.044	0.186	-0.042	0.023	-0.044	-0.178	-0.025	-0.101
Plant-based diet (0 = no, 1 = yes)	0.045	0.040	-0.103	0.098	-0.176	-0.143	0.024	0.033	-0.013
R^2	0.129	0.102	0.104	0.127	0.049	0.046	0.049	0.093	0.095
Adj. R^2	0.063	0.034	0.036	0.061	-0.023	-0.026	-0.023	0.025	0.027
Panel B: Unhealthy product									
	Pleasantness	Positive emotions	Negative emotions	Fillingness	Salt content	Fat content	Energy content	Healthiness	Purchase intention
FOP label (0 = no, 1 = present)	-0.077	-0.075	0.014	-0.138	-0.059	-0.117	-0.123	-0.114	-0.069
Health motivation ^a	-0.010	-0.002	0.031	-0.161	-0.018	-0.141	-0.038	-0.059	0.015
Pleasure motivation ^a	0.112	0.123	-0.036	0.136	0.162	0.028	0.215*	0.080	0.096
Sustainability motivation ^a	-0.133	-0.176	0.334**	0.115	-0.048	0.174	0.125	-0.055	-0.263*
Gender (0 = female, 1 = male)	-0.034	0.146	0.112	-0.078	-0.149	-0.089	-0.048	0.098	0.040
Age	-0.177	-0.133	0.018	0.008	-0.224*	-0.197	-0.143	-0.023	-0.194*
Academic degree (0 = no, 1 = yes)	-0.032	0.104	0.169	-0.052	0.038	0.080	-0.053	0.014	0.075
Plant-based diet (0 = no, 1 = yes)	-0.172	-0.034	0.112	0.021	-0.122	-0.092	-0.092	-0.032	-0.131
R^2	0.120	0.091	0.202	0.072	0.132	0.111	0.104	0.038	0.167
Adj. R^2	0.053	0.022	0.141	0.001	0.066	0.044	0.036	-0.035	0.104

^aMeasured on a 7-point scale where 1 = low, 7 = high. * $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$.

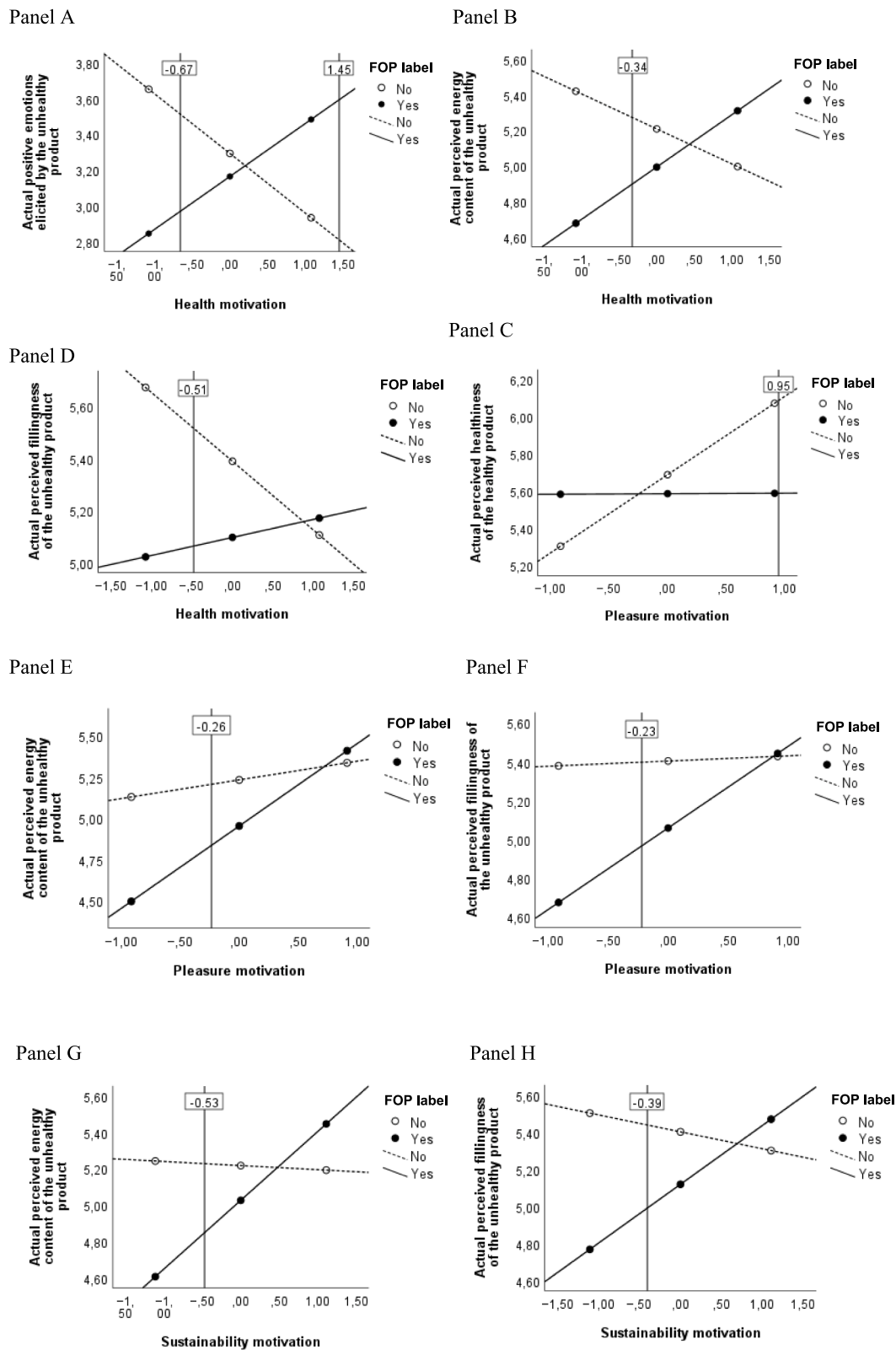


Fig. 4. The significant interaction effects of FOP label and food consumption motivations on the actual product responses in Study 2. Vertical lines mark Johnson-Neyman points.

–0.51) of the unhealthy product.

Pleasure motivation moderated the effect of the FOP label on actual cognitive product responses. Higher pleasure motivation coupled with the FOP label decreased the healthiness evaluation of the healthy product ($\beta = -0.418, p = 0.035, R^2 = 0.129, F(7,107) = 2.26, p = 0.035$,

ROS with negative effect above 0.95). In addition, energy content ($\beta = 0.385, p = 0.061, R^2 = 0.124, F(7,107) = 2.16, p = 0.043$, ROS with negative effect below –0.26) and fillingness perception ($\beta = 0.392, p = 0.099, R^2 = 0.074, F(7,107) = 1.22, p = 0.298$, ROS with negative effect below –0.23) of the unhealthy product were decreased with the FOP

label among consumers with lower pleasure motivation.

Sustainability motivation. Lower sustainability motivation coupled with the FOP label also affected actual cognitive product responses, as the perceived energy content ($\beta = 0.399$, $p = 0.017$, $R^2 = 0.111$, $F(7,107) = 1.91$, $p = 0.074$, ROS with negative effect below -0.53) and fullness ($\beta = 0.406$, $p = 0.034$, $R^2 = 0.076$, $F(7,107) = 1.26$, $p = 0.280$, ROS with negative effect below -0.39) of the unhealthy product decreased.

As the reliability of the dependent variable negative emotions elicited by the healthy product was low ($\alpha = 0.50$; see Appendix A), the results were additionally investigated on an item-by-item basis (boredom, guilt, and disgust). However, the non-significant direct and indirect effects of the FOP label and food consumption motivations remained unchanged.

3.3. Discussion

The results of the taste experiment confirmed the limited effects of the FOP label on cognitive and senso-emotional responses at the aggregate level. Even the ameliorating effects on nutrient content perceptions of the unhealthy product found in Study 1 had now dissipated. It is possible that in the taste experiment, participants were more focussed on tasting the products and paid less attention to the FOP label than in the online experiment, where the package picture (displaying the FOP label) was the only stimulus they could base their judgements on. This is logical, as nutrition information on the package may affect product perceptions more prior to actual consumption, where the experience may be more influenced by the sensory properties of the product (cf. Lima et al., 2019).

Compared to Study 1, there were now fewer direct effects of food consumption motivations but more interaction effects with the FOP label. Unlike in Study 1, health motivation had no direct effects on product responses. As opposed to Study 1, higher pleasure motivation now barely affected the unhealthy product, whereas it slightly improved responses to the healthy product (also improving healthiness perception similar to Study 1). Interestingly, sustainability motivation now had no effect on the healthy product, but it had an inverse effect on the unhealthy product compared to Study 1, as higher sustainability motivation increased negative emotions and lowered purchase intention toward the unhealthy product. Sustainability motivation was also the only factor affecting the choice of the healthy product over the unhealthy one.

4. Study 3: The effect of FOP label on healthy food consumption in a spa hotel lunch buffet

Studies 1 and 2 provided insights into the effects of the FOP label and food consumption motivations on cognitive and senso-emotional product responses. The studies garnered empirical evidence that consumer motivations exert a stronger influence than FOP labels, although the latter is also interactively involved in producing the effects. However, due to the methodological solutions, Studies 1 and 2 did not deliver behavioural data. Thus, to gain a fuller picture of the effects of FOP labels in real life, a field experiment was conducted in a spa hotel restaurant. It supplements the previous studies by testing H1 in authentic commercial settings and by providing information on whether the Heart Symbol FOP label directly affects the amount of foods consumed.

4.1. Materials and methods

The field experiment followed a simple FOP label present vs. not present period design. The data collection took place in the spring of 2022 in a spa hotel lunch buffet on two Wednesdays and Thursdays – separated by a two-week break. The clientele mostly consisted of pensioners in rehabilitation (c. 70 %), regular employees, and a few families

with children making up the rest. The same main courses were served at the lunch buffet during both periods. On Wednesdays, the target product – vegetable lentil soup – was on offer, coupled with cooked potatoes, mashed potatoes, steamed vegetables, oven-baked salmon, and blood sausages. Correspondingly, on Thursdays, the other target product – fried potatoes with sausage – was supplied along with minced meat pea soup, cooked potatoes, fish casserole, and bean-root stew. Of the other products, cooked potatoes, steamed vegetables, and oven-baked salmon met the Heart Symbol criteria. During the FOP label not present period, these foods and the target products were available on the serving lines without the Heart Symbol stimuli, whereas during the FOP label present period, the point-of-choice Heart Symbol stickers and placards were placed in the focal visual fields of customers along their movement routes in the restaurant (for an illustration of the study setup, see Appendix C).

The data collection periods were deliberately chosen to be as similar as possible to each other (not close to any past or upcoming special occasions such as Easter). At the spa lunch restaurant, a hospitality management professional oversaw the fieldwork, including the implementation of one rehearsal before the actual study. The service concept of the restaurant allowed patrons to freely design and choose what they eat and how much within the limits of the menu. Various fresh vegetables and salads, but also more unhealthy options containing pasta, cheese, and mayonnaise, were available at the beginning of the serving line (see Appendix C). From the separate table (see Appendix C), guests could choose breads ranging from white to whole grain and rye; spreads from butter to margarine; and drinks from milk to water. Next, warm meals were offered every day consisting of vegetables, fish, meat, and potatoes in different forms (see Appendix C). Desserts were also served on the second table (see Appendix C) – however, their consumption was not measured due to resource constraints.

The customers of the spa hotel lunch buffet were not aware of the experiment, representing an unobtrusive approach to data collection. This study followed the guidelines of the Finnish National Board on Research Integrity and the Helsinki Declaration. According to the University of Vaasa Human Science Ethics Committee, no ethical review was required for this study [statement 21 January 2022]. Therefore, the number of washed plates was used to determine the Ns: 315 (FOP label not present period Wed), 243 (FOP label present period Wed), 319 (FOP label not present period Thu), and 289 (FOP label present period Thu), totalling 1166. Trained field researchers (acting as staff members) collected the consumption data on each research day by pre-weighing foods and recording each item offered on the buffet lines during lunchtime. To calculate the average consumption per customer, the total food intake over the FOP label present vs. not present periods was divided by the total number of customers patronising the lunch buffet on those days. Due to the approach, food consumption motivations and their potential influence could not be measured in this study.

4.2. Results

The average consumption (g/customer/day) of the 11 different main courses (see above, cooked potatoes available on both days) represented the key dependent variable. The demand was gauged by weighing the foods before putting them on offer and recording the readings every time when the replenishment of different items occurred. While Junkkari et al. (2024) reported the results at a more aggregate level (total consumption of main courses; also broken down into healthier vs. less healthy foods), here the focus is on the effect of the FOP label on the consumption of individual products, including the target items from Studies 1 and 2.

Table 4 reports the key results for the products that were available during both study periods. The consumption shares of the first target food, vegetable lentil soup, remained unaffected ($P_{\text{FOP label not present}} = 5.99$, $N = 315$ vs. $P_{\text{FOP label present}} = 3.80$, $N = 243$; $Z = 1.17$, $p = 0.24$), but its demand in relative terms sunk by 36.0 % and in absolute terms by

Table 4

The effect of FOP label on main course consumption in Study 3.

Main courses on offer during both the FOP label present vs. not periods	Absolute change in the main course consumption: FOP label not present vs. present period (g/customer/day)	Consumption shares during the FOP label not present period	Consumption shares during the FOP label present period	Relative change in the main course consumption
1) Vegetable lentil soup	−5.42	5.99 %	3.80 %	−36.01 %
2) Cooked potatoes (Wed)	−2.27	1.93 %	1.01 %	−46.71 %
3) Cooked potatoes (Thu)	−3.62	10.79 %	9.24 %	−13.35 %
4) Steamed vegetables	+15.04	9.04 %	14.88 %	+66.26 %
5) Oven-baked salmon	−4.22	47.96 %	45.85 %	−3.50 %
6) Fried potatoes with sausage	+2.81	24.29 %	25.18 %	+4.60 %

5.4 g/customer/day (see Table 4). The story is the same in the case of cooked potatoes: no difference in consumption shares (Wed: $P_{\text{FOP label not present}} = 1.93$, $N = 315$ vs. $P_{\text{FOP label present}} = 1.02$, $N = 243$; $Z = 0.87$, $p = 0.38$; Thu: $P_{\text{FOP label not present}} = 10.79$, $N = 319$ vs. $P_{\text{FOP label present}} = 9.25$, $N = 289$; $Z = 0.63$, $p = 0.53$), but relative decrements of 46.7 % and 13.35 % as well as reductions of 2.3 and 3.6 g/customer/day can be detected (see Table 4).

In turn, the consumption share of steamed vegetables was significantly larger during the FOP label present period ($P_{\text{FOP label not present}} = 9.04$, $N = 315$ vs. $P_{\text{FOP label present}} = 14.88$, $N = 243$; $Z = 2.14$, $p = 0.03$) and the relative change in demand, +66.3 %, and increase of 15.0 g/customer/day in consumption also pointed in the same direction (see Table 4). The consumption shares for oven-baked salmon and the second target food, fried potatoes with sausage, showed no evidence of significant effects (oven-baked salmon: $P_{\text{FOP label not present}} = 47.96$, $N = 315$ vs. $P_{\text{FOP label present}} = 45.85$, $N = 243$; $Z = 0.49$, $p = 0.62$; fried potatoes with sausage: $P_{\text{FOP label not present}} = 9.04$, $N = 319$ vs. $P_{\text{FOP label present}} = 14.88$, $N = 289$; $Z = 0.25$, $p = 0.80$); the relative changes in their demand are also minor, equalling −3.5 % and +4.6 %, respectively, and absolute reduction of 4.2 and increase of 2.8 g/customer/day (see Table 4).

4.3. Discussion

Diverging from the findings of Studies 1 and 2, Study 3 identifies one direct main effect of the FOP label: it increased the consumption of steamed vegetables – and two more suggestive ones: it seemed to reduce the relative consumption of vegetable lentil soup and cooked potatoes. To crown this ambivalence, the consumption of “heavier” main courses including meat or fish appeared unaffected by the presence of the FOP label. Apart from the fried potatoes with sausage, the other products under scrutiny here carry a healthier image at the outset. In other words, Study 3 can be considered a field test examining the effect of FOP labels on the consumption of (already) healthy foods, leaving the question of whether they really increase, decrease, or have no effect at all open. Interestingly, the total consumption of those foods that were on offer without the Heart Symbol during both study periods as a whole reduced (Junkkari et al., 2024), implying a potential negative carry-over effect. However, Study 3 showed that the consumption of a specific food with a healthy image in fact grew while at the same time the consumption of other foods with an equally healthy image reduced, although insignificantly. Considering the older clientele, who are generally more concerned about their health (Grunert & Wills, 2007), the exposure to the FOP label could have activated a health goal, causing them to eat more of the food that represents an extremely typical healthy food (steamed vegetables; see Newman, 2021; Van Duyn & Pivonka, 2000), as higher consumption of vegetables among older adults is associated with heightened importance placed on health benefits (Appleton et al., 2017).

To conclude, Study 3 extracts some empirical proof of the behavioural effects of FOP labels when choosing what specific dishes to eat for lunch. At the same time, it raises the question of whether they have product-specific effects, generating even opposite consumer actions within the “healthy” and “unhealthy” categories.

5. General discussion

This paper contributes to food consumption research by highlighting the role of food consumption motivations and their moderating effect with a FOP label on cognitive and senso-emotional responses to (un) healthy meal products. It also examines the effects of a FOP label on behavioural responses. The direct effects of a FOP label on product responses are minor, whereas food consumption motivations, particularly in the online Study 1, are more influential in shaping cognitive and senso-emotional responses. The interpretive summary indicator FOP label may also be counterproductive in some consumer segments (Studies 1 and 2; cf. Berry et al., 2019) and cause mixed results in behavioural responses (Study 3). A summary of the results supporting the hypotheses can be seen in Table 5.

FOP label. The few direct effects of an interpretive summary indicator FOP label with a nutrition claim were found for the unhealthy product, resulting in a decrease in expected salt, fat, and energy contents. This can be explained by the nutrition claim stating that the product is a better choice due to its lower fat and salt content. This effect was not found for the healthy product. Earlier research has also shown that interpretive summary indicator FOP labels may create a health halo for healthier products (Ikonen et al., 2020). This was true for health-interested consumers in Study 2, who attached more positive emotions to the unhealthy product with a FOP label. However, consumers with no specific food consumption motivation found the product less filling and energy dense. A similar backfire effect has been seen for calories-per-serving and low-fat labels on snack products, causing especially overweight consumers to eat more (Tangari et al., 2018; Wansink & Chandon, 2006). H1 was verified by Studies 1 and 2, as the limited effects of an interpretive summary indicator FOP label were found almost exclusively for the unhealthy product. However, Study 3 challenged this assumption, showing that the actual consumption of the unhealthy product was most unaffected by the FOP label.

Health motivation. In Study 1, health-motivated consumers tended to dislike the unhealthy product in terms of anticipated taste, emotions, and purchase intention, partially confirming H2a. However, a FOP label ameliorated emotions elicited by the unhealthy product for them in Study 2, but the more adverse effect of a FOP label for less health-motivated participants was more prominent in both studies. As there were no effects for the healthy product, H2b was partially supported. Health-motivated consumers can be more prone to justifying indulgent food consumption with external cues such as nutrition labels (Choi & Ju, 2023), which could explain the health halo effect for the unhealthy product. The lesser effects on the healthy product align with Liem et al. (2012), who found no correlation between general health interest and responses to chicken soup, comparable to the soup category of the present studies.

Pleasure motivation. Higher pleasure motivation generally improved responses to the unhealthy product, aligning H3a. Taste-oriented consumers may intuitively associate unhealthy with tasty, leading them to find the unhealthy product more appealing (see Mai & Hoffmann, 2015; Raghunathan et al., 2006). This contradicts Huang and Wu (2016), who found that higher pleasure orientation attenuates the unhealthy = tasty intuition. Interestingly, however, higher pleasure motivation also

Table 5
Summary of empirical support for the research hypotheses.

	Study 1: Online experiment	Study 2: Taste experiment	Study 3: Field experiment
H1. Interpretive summary indicator FOP label improves responses to unhealthy products but does not affect responses to healthy products.	The unhealthy product was perceived to contain less salt, fat, and energy. The perception of the healthy product was unaffected.	The perception of the healthy product was unaffected.	Three out of four healthy product consumption levels remained unaffected.
H2a. Higher health motivation leads to improved responses to healthy products and impeded responses to unhealthy products.	Purchase intention, positive emotions, and taste perception were lower, while negative emotions were stronger for the unhealthy product.	–	Not tested
H2b. Interpretive summary indicator FOP label improves responses to healthy and unhealthy products among consumers with higher health motivation.	–	Positive emotions were stronger for the unhealthy product.	Not tested
H3a. Higher pleasure motivation leads to impeded responses to healthy products and improved responses to unhealthy products.	Positive emotions, taste perception, and purchase intention were higher, while negative emotions were weaker for the unhealthy product.	–	Not tested
H3b. Interpretive summary indicator FOP label impedes responses to healthy and unhealthy products among consumers with higher pleasure motivation.	Taste and energy content perceptions were lower for the unhealthy product*.	The perception of healthiness was lower for the healthy product.	Not tested
H4a. Higher sustainability motivation leads to improved responses to healthy products and impeded responses to unhealthy products.	Purchase intention, positive emotions, and perceptions of taste, healthiness, energy, salt, and fat content were higher**, while negative emotions were weaker for the healthy product.	Negative emotions were stronger, and purchase intention was lower for the unhealthy product. Selection of the healthy product was more likely.	Not tested
H4b. Interpretive summary indicator FOP label improves responses to healthy and	–	–	Not tested

Table 5 (continued)

	Study 1: Online experiment	Study 2: Taste experiment	Study 3: Field experiment
unhealthy products among consumers with higher sustainability motivation.			

* Lower energy content perception was interpreted as an impeded response.

** Higher perceptions of energy, salt, and fat content were interpreted as improved responses.

somewhat improved responses to the healthy product. Specifically, the healthiness perception – both expected and actual – of the healthy product was pronounced among pleasure-oriented consumers. These results echo earlier findings by [Haasova and Florack \(2019\)](#), [Huang and Wu \(2016\)](#), [Jo and Lusk \(2018\)](#), and [Werle et al. \(2013\)](#), demonstrating a positive connection between healthiness and taste judgements. The present findings imply that both product types can be appealing to consumers valuing the hedonic aspects of food.

However, the presence of a FOP label on unhealthy products may reduce taste and energy content perceptions, while on healthy products, it may reduce healthiness perceptions among pleasure-motivated consumers, supporting H3b. [Bialkova et al. \(2016\)](#) also discovered that FOP labels claiming fat or sugar reduction decreased the perceived healthiness of products. As higher pleasure motivation alone increased the perceived healthiness of the healthy product, adding a FOP label to an already healthy product may have made these participants less convinced of the label's credibility. This is interesting because consumers are usually more suspicious of incongruent FOP labels, such as those claiming health benefits on unhealthy products ([Bialkova et al., 2016](#); [Fenko et al., 2016](#)). On healthy products, a FOP label should typically increase trust and healthiness perceptions ([Schneider & Ghosh, 2020](#)). However, a meta-analysis found that FOP labels are more likely to enhance the healthiness perception of unhealthy products, with more variation observed for healthy products ([Ikonen et al., 2020](#)). [Fisher \(2018\)](#) also found that displaying nutrition information generally lowered the healthiness perceptions of snacks, regardless of their nutritional content. More research is needed to unpack this intriguing finding.

Sustainability motivation, although less frequently studied in conjunction with FOP nutrition labels and healthy eating, emerged as a prominent factor shaping responses to (un)healthy food. In Study 1, sustainability-motivated consumers displayed increased liking of the healthy product across all dimensions (supporting H4a) and enhanced attitudes toward the unhealthy product. Pro-environmental consumers tend to perceive sustainable food (organic or plant-based) as healthier ([Gonzales et al., 2023](#); [Hughner et al., 2007](#); [Nadricka et al., 2020](#); [Schuldt & Schwarz, 2010](#); [Verain et al., 2016](#)), but in Study 1, both products were rated as healthier by sustainability-conscious participants, slightly contradicting earlier studies. However, Study 2 showed aversion toward the unhealthy product with higher sustainability motivation. The vegetarian aspect of the healthy product and the meat content of the unhealthy product may have influenced the perceptions of consumers preferring environmentally friendlier products (cf. [Greis et al., 2023](#)), especially in Study 2, where participants had to taste the product. Additionally, the plant-based diet had this adverse effect in Study 1, whereas in Study 2 it had no effect on product responses, implying that the meat-avoiding aspect of sustainability motivation drives the negative responses to the unhealthy product containing meat more than other sustainability aspects.

Sustainability motivation fostered the selection of the healthy product in Study 2, implying a possible connection between sustainability motivation and healthiness preferences for food (cf. [Piracci et al., 2023](#); [Van Loo et al., 2017](#)). The findings also highlight a health or sustainability halo effect: the healthy/sustainable product was

perceived as better in other aspects as well (Study 1), while the unhealthy/unustainable product was considered less desirable among consumers motivated by sustainability (Study 2). These findings support H4a. In Study 2, the FOP label undermined some responses to the unhealthy product among consumers with low sustainability motivation, similarly to low health/pleasure motivation, but no real support for H4b was found.

An interesting finding in the interaction effects between food consumption motivations and the FOP label was that the perception of the fillingness and energy content of the unhealthy product decreased when the FOP label was present among consumers low in either health, pleasure, or sustainability motivation. This indicates the effect for unhealthier products with interpretive summary indicator FOP labels, whereby consumers believe they need to eat more of the product to feel satiated (see Ikonen et al., 2020; Penzavecchia et al., 2022). Remarkably, this effect seems to hold true for consumers who are not motivated by any of the orientations examined and who are possibly uninterested in food in general. Previously, consumers with low socioeconomic status have been found to consider healthy food as less tasty and filling and to prefer fillingness over healthiness in food (Andretti et al., 2025). Our results imply that motivational factors could have similar effects on food preferences with possible health consequences.

Control variables. Gender and plant-based diet exerted a strong influence on product perceptions in Study 1, indicating that females are more susceptible to healthy products while males prefer the unhealthy product. This aligns with previous knowledge of gender differences in healthy eating (e.g., Grunert et al., 2010; Valsta et al., 2018; Wardle et al., 2004) and highlights the importance of considering gender when marketing healthier foods, as men are more susceptible to unhealthy dietary choices. On the other hand, consumers with an academic degree disliked the unhealthy product, as did those who favoured a plant-based diet. Notably, a plant-based diet had an opposite effect on responses to the unhealthy product compared to sustainability motivation, even though sustainability motivation also included items indicating meat reduction.

5.1. Practical implications

The present research provides evidence on how a FOP label affects anticipated and actual responses to meal products by identifying consumer groups and product types benefitting from FOP labels. This information can assist marketers and policymakers in promoting healthy eating while considering individual consumer motivations (cf. Choi & Ju, 2023). The results highlight the limited direct effects of FOP labels on product responses and underscore the importance of individual food consumption motivations in responses to healthy and unhealthy foods. The effect of a FOP label may also vary largely based on the carrier product.

Our studies indicate that the adverse responses of health-motivated consumers to the unhealthy product could somewhat be improved with an interpretive summary indicator FOP label. On the other hand, FOP label implying healthiness on an unhealthier product may signal to consume more for consumers with lower health, pleasure, or sustainability motivation. This outcome can be interpreted negatively for consumer health if interpretive summary indicator FOP labels lead consumers who typically avoid unhealthy foods to find them more attractive and prompt other consumers to eat more. Attaching health references to unhealthier products may backfire and create health halos, potentially resulting in overconsumption and increased sales of these products (Geyskens et al., 2007; Ikonen et al., 2020). On the other hand, a recent real-life study in a lunch buffet demonstrated that a point-of-choice interpretive summary indicator FOP label even reduced total food consumption among adolescents and the elderly, mainly through reduced consumption of main courses and salads without the label (Junkkari et al., 2024). Nevertheless, marketers need to exercise caution and avoid compromising consumer well-being when promoting

unhealthy products with such FOP labels. Labels indicating higher calorie, sodium, or saturated fat levels could be more suitable for unhealthy foods and health-interested consumers, as these FOP labels may decrease purchase intention and calories consumed (Andrews et al., 2021; Berry et al., 2019). Warning labels can also be effective in preventing consumption of unhealthier foods, but they can also boost consumption of healthy foods (Zlatevska et al., 2024). Additionally, graded labels such as Nutri-Score might make it easier for consumers to compare the healthiness of different foods across product types, which might also combat the health halo.

Based on the results, it appears that healthiness judgements, purchase intentions, or other product perceptions essential to food choices are not directly affected by FOP labels, nor is the actual consumption of most healthy foods. However, earlier studies have identified signs of mild positive outcomes in healthy food choices and nutrition with FOP labels (An et al., 2021; Anastasiou et al., 2019; Ikonen et al., 2020; Shangguan et al., 2019; Zlatevska et al., 2024). Our findings, together with previous knowledge, suggest that providing nutrition information to consumers may not be sufficient in promoting healthier choices. In turn, emphasising taste and hedonic aspects of healthier products may enhance their appeal to consumers seeking pleasure in food (Boles et al., 2022; Turnwald & Crum, 2019). Increasing the prevalence of healthy options may also make consumers perceive them as tastier (Kunz et al., 2024). As a nudging method, FOP labels often require active information processing from consumers, which is why affective or behavioural nudges operating on a more unconscious level could be more beneficial (see Cadario & Chandon, 2020). These methods could include (mental) imagery depicting hedonic food consumption as potentially leading to healthier subsequent dietary behaviour (Birau et al., 2021; Morewedge et al., 2010).

The findings demonstrate that sustainability is a substantial motivation guiding consumers' food judgements, and it cannot be ignored by marketers. This consumer group also appears to be a viable target for healthier products, suggesting that the promotion of healthy and sustainable diets could be implemented simultaneously, aligning with current policy intentions (Piracci et al., 2023). Polzin et al. (2023) proposed that sustainable healthy diets (SHD) are composed of three dimensions: economic security, socio-environment, and nutrition. To identify and target SHD consumers, demographic and behavioural data can be used. For example, consumers who believe in the health and sustainability benefits of "superfoods" are more likely to be older, well-educated females (Franco Lucas et al., 2023; Richter et al., 2024). On the other hand, food retailers have access to a more accurate approach: loyalty data. According to Brečić et al. (2021), shoppers with a high share of fruit, vegetables, fish, and Mediterranean cuisine purchases (representing a customer segment "Healthy") increased their local food products after exposure to a thematically congruent point-of-sale prime. This can indicate where SHD-conscious patrons move and stop in the shop – and can be communicated with. Lastly, SHD promoters can conduct surveys including well-established scales to track and profile consumers concerned with food sustainability, such as foodies (Pickering & Wilson, 2025). Based on our studies, a viable target group for healthier products appears to be females and those who favour plant-based diets.

5.2. Limitations and future research

Our studies concentrated on how an interpretive summary indicator FOP label and food consumption motivations shape the expected and actual responses to (un)healthy foods, both directly and jointly. However, the external validity of the results would have increased with a stronger emphasis on behavioural outcome variables, demonstrating the actual influence of a FOP label on food choices in more detail.

Possible explanations for the fewer direct effects found in Study 2 compared to Study 1 could be the lesser power in the analysis. Additionally, sustainability ($M = 5.00$ vs. $M = 4.13$) and pleasure ($M = 5.50$

vs. $M = 4.82$) motivations were more pronounced in the sample of Study 2. The negative effects of higher sustainability motivation on the unhealthy product in Study 2 could relate to the fact that participants had to taste the products, which could have elicited stronger adverse reactions among those who usually avoid products containing meat. In Study 2, a plant-based diet had no effect on product responses, but the proportion of those favouring a plant-based diet was higher than in Study 1 (33 % vs. 16 %) and it was more correlated with sustainability motivation ($r = 0.485, p < 0.001$ vs. $r = 0.372, p < 0.001$).

It is noteworthy that this paper employed only one type of FOP label, interpretive summary indicator FOP label (the Finnish Heart Symbol). Thus, the effects may change with other types of FOP labels (e.g., warning labels, grading labels such as Nutri-Score or Traffic Light; see Zlatevska et al., 2024), or even with the same type of FOP label but a different regime (e.g., Keyhole). This issue should be examined further in future studies. Even though the FOP label employed in this paper was widely known and understood by consumers in the Finnish context (Kantola et al., 2023), it exclusively signified products with better nutritional quality but not products that are less healthy. This is significant as such FOP label types may be less effective in promoting healthy foods than, for instance, calorie labels, warning labels, or labels comprising multiple components (Zlatevska et al., 2024). However, the health logo in the present studies was presented with a nutrition claim, adding a multicomponent aspect to the label.

The test products in Studies 1 and 2 represented ready-to-eat meals with both healthy and unhealthy images and main courses with mostly a healthy image in Study 3. However, additional product categories would have helped in shedding light on responses to healthy vs. unhealthy products. Additionally, the finding that sustainable consumers prefer healthier products remains somewhat uncertain, as the differing responses between the product types could be explained by the perceived healthiness or sustainability of the products, or a combination of the two. Further research is needed to reveal the interrelations of health and sustainability aspects in consumer behaviour to gain a deeper understanding of this segment and to market products promoting healthy and sustainable diets.

To understand the true significance of health interventions, future research should focus on diets as a whole, the long-term effects of FOP labels, and how healthy eating is embedded in daily routines, as opposed to responses to individual products (see De Kervenoael et al., 2021).

6. Conclusions

This paper addresses the gap in understanding how consumer-specific characteristics, food consumption motivations, moderate the effect of a FOP label on cognitive and senso-emotional responses to (un) healthy meal products. We demonstrate that nutrition information on a product's front has only minor or no direct effects on consumer responses. Instead, consumer motivations are more salient in shaping the

food experience and also moderate the effect of a FOP label. FOP label may ameliorate emotions related to the unhealthy product among consumers interested in healthy eating, suggesting that FOP labels on unhealthier products may lead to a health halo. On the other hand, FOP labels may signal to consume more among individuals not motivated by health, pleasure, or sustainability. In a real lunch buffet environment, FOP label seemed to either increase or have no effect on the proportional healthy food consumption. The results suggest that FOP labels have limited and mixed effects on product responses, and they may even be counterproductive in promoting healthy diets among some consumers. Thus, more tailored interventions are needed. Based on the results, a viable target group for healthier foods appears to be females, sustainability-oriented consumers, and those who favour plant-based diets.

CRediT authorship contribution statement

Maija Kantola: Writing – original draft, Visualization, Software, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Terhi Junkkari:** Writing – review & editing, Supervision, Resources, Project administration, Methodology, Investigation, Funding acquisition, Conceptualization. **Anu Hopia:** Writing – review & editing, Supervision, Resources, Project administration, Methodology, Investigation, Funding acquisition, Conceptualization. **Harri Luomala:** Writing – review & editing, Supervision, Resources, Project administration, Methodology, Investigation, Funding acquisition, Conceptualization.

Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this work the authors used Microsoft Copilot in order to proofread the manuscript and to improve readability. After using this tool/service, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

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Declaration of competing interest

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Appendix A. Items used in Study 1 and Study 2

Constructs	Scale items (1 = fully disagree to 7 = fully agree)	Study 1	Study 2
<i>Dependent variables</i>			
Taste (adapt. Raghunathan et al., 2006)	I expect this product to taste great.	HP: $M = 4.23; \alpha = 0.95$	–
	I expect to enjoy eating this product.	UP: $M = 4.35; \alpha = 0.96$	–
Pleasantness	Evaluate the pleasantness of the product on a scale 1 = very unpleasant to 7 = very pleasant	–	HP: $M = 5.73; \alpha = 0.83$
	– pleasantness of appearance	–	UP: $M = 5.04; \alpha = 0.88$
	– pleasantness of smell		
	– pleasantness of taste		
	– pleasantness of texture		
	– overall pleasantness		

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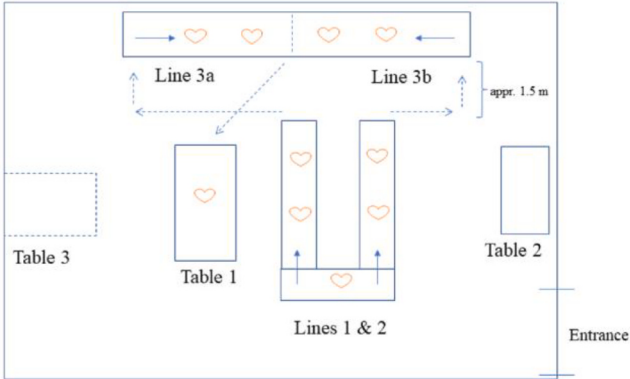
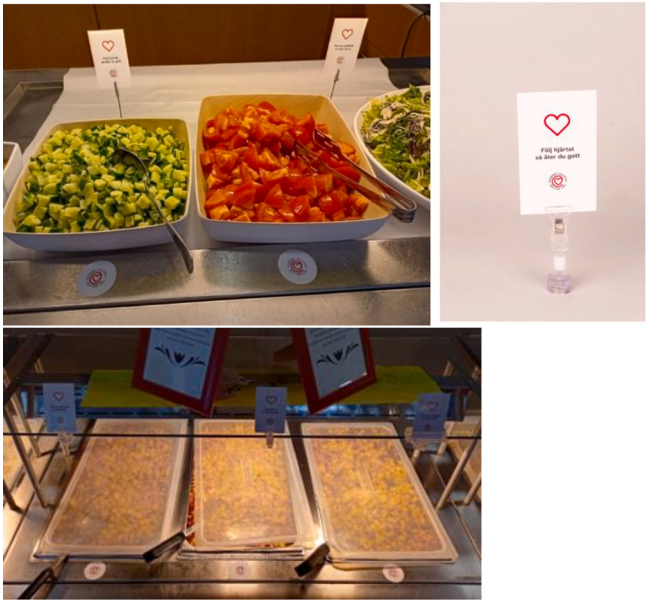
Constructs	Scale items (1 = fully disagree to 7 = fully agree)	Study 1	Study 2
	Evaluate the different qualities of the product on a scale 1 = the product does not contain the quality to 7 = the quality is very strong in the product		
Fillingness	– fillingness	–	HP: M = 4.44 UP: M = 5.25
Perceived salt content*	– saltiness	HP: M = 2.85 UP: M = 5.23	HP: M = 3.92 UP: M = 3.66
Perceived fat content*	– fattiness	HP: M = 2.41 UP: M = 5.48	HP: M = 2.89 UP: M = 4.16
Perceived energy content*	– energy content	HP: M = 3.45 UP: M = 5.31	HP: M = 4.03 UP: M = 5.11
	Evaluate the emotions elicited by eating the product on a scale 1 = does not elicit the emotion at all to 7 = elicits a very strong emotion		
Positive emotions	– makes me feel soothed – makes me feel satisfied – makes me feel energetic and active	HP: M = 3.76; α = 0.88 UP: M = 3.63; α = 0.88	HP: M = 4.50; α = 0.81 UP: M = 3.24; α = 0.84
Negative emotions	– makes me feel bored, does not interest me – makes me feel guilty – makes me feel disgusted	HP: M = 2.66; α = 0.67 UP: M = 3.02; α = 0.70	HP: M = 1.59; α = 0.50 UP: M = 2.60; α = 0.69
Healthiness (Mai & Hoffmann, 2015)	The product is healthy. The product helps me stay fit.	HP: M = 4.51; α = 0.85 UP: M = 2.50; α = 0.92	HP: M = 5.61; α = 0.81 UP: M = 2.66; α = 0.90
Purchase intention (Mai & Hoffmann, 2015)	The product helps me stay slim. I will buy this product. Next time I am buying ready meals, I will choose this product. I prefer this product to other ready meals.	HP: M = 3.56; α = 0.91 UP: M = 3.22; α = 0.92	HP: M = 4.89; α = 0.91 UP: M = 3.00; α = 0.92
<i>Independent variables</i>			
FOP label	Interpretive summary indicator label (Heart Symbol) with nutrition claim present vs. not		
Health motivation (Roininen et al., 1999)	The healthiness of food has little impact on my food choices. R	M = 4.30; α = 0.84	M = 4.79; α = 0.85
	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. 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		
Pleasure motivation (adapt. Rozin et al., 1999)	Enjoying food is one of the most important pleasures in my life.	M = 4.82; α = 0.69	M = 5.50; α = 0.64
	I would rather eat my favourite meal than watch my favourite television show. I think about food in a positive anticipatory way. Money spent on food is money well spent. I have fond memories of family food occasions. If I could satisfy my nutritional needs safely, cheaply and without hunger by taking dietary supplements, I would do this. R **		
Sustainability motivation (Arbit et al., 2017; Van Loo et al., 2017)	When I eat food I think about where it came from. My food choices are an important way that I can affect the world. I care about the impact of my food choices on the world. I eat in a way that expresses care for the world. My food choices reflect my connection to nature. I compost food waste at home. I eat local products whenever possible. I eat seasonal products. I limit my meat consumption. I regularly eat organic food products. I limit the amount of food I waste. I regularly eat plant-based foods as an alternative to meat.	M = 4.13; α = 0.89	M = 5.00; α = 0.89

R = item was reversed for analysis; HP = healthy product; UP = unhealthy product. *In Study 1, the wording of the item was “I expect this product to contain a lot of salt/fat/energy”. **In Study 1, this item was removed due to poor reliability.

Appendix B. Servings of the sample products with a FOP label and nutrition claim in Study 2: vegetable lentil soup (left) and fried potatoes with sausage (right)



Appendix C. Illustration of the Heart Symbol materials, placements, and serving line layout (Junkkari et al., 2024)



Lines 1 & 2: soup and salads (same foods in the same order in both lines)
Lines 3a & 3b: main courses (same foods in the same order in both lines)
Table 1: drinks, bread and spreads
Table 2: spice counter, salt and ketchup
Table 3: coffee and desserts – not included in the data collection

Data availability

The data that has been used is confidential.

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