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Tasting and labeling meat substitute products can affect consumers' product evaluations and preferences

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ABSTRACT

Moving towards plant-based diets and reducing meat consumption is key to achieving the Paris climate targets. One option for reducing meat consumption is replacing meat products with substitutes. In two field experiments, we tested how labeling and tasting experiences with substitutes affected omnivores' evaluations of such products and investigated the latter's stated and revealed preferences regarding the consumption of meat substitutes and reduction of meat consumption. In our first experiment, we randomly labeled meat substitutes vegetarian or meat products, finding that this labeling resulted in more positive evaluations of the effects of the product on the environment, animal welfare, and health. However, labeling did not directly affect the assessment of the products' taste or participants' stated and revealed preferences regarding modifications to their food consumption. Nevertheless, we find evidence that vegetarian labeling indirectly affects the intention to consume more meat substitutes by enhancing climate and health-related product evaluations (i.e., significant mediation effects). Our second experiment shows that tasting meat substitutes results in a more positive assessment of the product's taste and texture than not tasting them. However, tasting did not directly affect the perceived effect of meat substitutes on health, the environment, and animal welfare, nor stated and revealed preferences. In contrast, we find strong indirect effects of the tasting experience on stated and revealed preferences regarding consuming more meat substitutes and plant-based dishes mediated by improvements in product taste and texture evaluations (i.e., significant mediation effects). The theoretical and policy implications of these findings are discussed.

1. Introduction

Our current food consumption choices are detrimentally affecting the environment. In particular, the consumption of meat products comes at a significant environmental cost (Godfray et al., 2018; Poore & Nemecek, 2018; Springmann et al., 2018). Without a substantial reduction in meat consumption, especially in high and upper-middle-income countries associated with high meat consumption, the Paris climate targets will be very difficult to achieve (Clark et al., 2020). Thus, encouraging more plant-based diets and reducing meat consumption is a promising route to mitigating climate change, operationalized largely by reducing the short-lived methane emissions that increase the risk of crossing climate tipping points in the near term (Fesenfeld et al., 2020; Godfray et al., 2018; Poore & Nemecek, 2018; Springmann et al., 2018). A dietary shift away from animal-based foods could also substantially reduce external costs related to human health and ecosystem damage, estimated to be US$7.3 trillion in 2018 alone (Lucas et al., 2023). However, although the negative consequences of meat consumption are well understood, meat production and consumption are still on the rise in many countries (FAO, 2020).

One way to encourage individuals to reduce their meat consumption is to replace meat products with plant-based substitutes. The new generation of plant-based meat substitutes, also referred to as meat replacements or meat alternatives, often look and taste similar to meat and can be used to replace meat products in regular meals (He et al., 2020). Entirely plant-based substitutes have a smaller ecological footprint than meat products as their creation emits less greenhouse gas emissions and requires less water and land usage (Jetzke et al., 2020; Kozicka et al.,

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2023; Smetana et al., 2015). For instance, the production of 100 g of soy-based meat substitute generates only about one-third of the greenhouse gas emissions of the production of 100 g of chicken (Jetzke et al., 2020).

Plant-based meat substitutes have been on the market for over 30 years, yet they have only recently experienced rapid growth rates, and their market share is still very small (Polaris Market Research, 2020; Sha & Xiong, 2020; Smetana et al., 2021). Nevertheless, over the last few years, more plant-based meat substitutes have become available that look and taste like meat (He et al., 2020; Smetana et al., 2021). Such substitutes can make it easier for omnivores to transition to more sustainable plant-based diets. However, it is unclear how to improve omnivores' evaluations of meat substitutes and increase their intention to consume more of these products. It is still debatable whether experiences with meat substitutes genuinely lead to the replacement of meat products or only additional protein intake (Cuffey et al., 2022; Neuhofer & Lusk, 2022; S. Zhao et al., 2022). Using two experiments conducted in a field setting in Dutch University cafeterias, the present research tests how labeling meat substitutes as vegetarian (Study I) and tasting experiences with meat substitutes (Study II) affect omnivores' evaluations of such products and their (stated and revealed) preferences regarding meat substitutes (see Fig. 1). We focus on omnivores because most consumers consume meat products, especially in high and upper-middle-income countries (Statista, 2023). Moreover, research has shown that many omnivores engage in motivated reasoning to rationalize their consumption choices and maintain internal consistency, i.e., omnivores often do not perceive vegetarian foods as more beneficial to human health, the environment, and animal welfare than meat products (Edenbrandt & Lagerkvist, 2022; Ginn & Lickel, 2020; Malek & Umberger, 2021; Michel, Hartmann, et al., 2021; Siegrist et al., 2015; Siegrist & Hartmann, 2019). However, these perceptions are starting to change, especially among higher educated and urban segments of the population (Bryant, 2019; Corrin & Papadopoulos, 2017; Michel, Knaapila, et al., 2021). This indicates the need for more causal evaluations of the effects of a vegetarian label and substitute-tasting experiences for omnivore segments of society who are potentially open to making dietary changes.

The Netherlands is a particularly interesting context in which to study these questions. The country has been a pioneer in the development of plant-based meat alternatives. In the 1990s, the Dutch government supported the development of new plant-based meat substitutes, and since then, the industry has expanded (Mylan et al., 2023; Tziva et al., 2020). Furthermore, the Netherlands is one of the world's fastest-growing markets for plant-based meat substitutes, and when we fielded our experiments, Dutch producers of plant-based meat substitutes offered some of the most innovative ones (Tziva et al., 2020). Moreover, the Netherlands is also a globally leading producer of meat and dairy products and is home to a strong lobby that favors the production of animal products (Bryant & van der Weele, 2021). Regular farmer protests in the Netherlands indicate how polarized the topic is in the Netherlands.

Our paper is structured as follows: First, we provide the theoretical argument and our hypotheses related to Study 1 concerning the effects of labeling the exact same products "meat" or "vegetarian meat substitute". Second, we outline our reasoning and hypotheses related to Study 2 on the effects of a product-tasting experience. Based on this theoretical section, we first discuss the research design and results of Study 1, followed by a discussion of the research design and results of Study 2. We conclude with a summary discussion of both studies' results, limitations, and implications for policymaking and future research.

2. Study I: Labeling effects

Labels on products aim to communicate information about the attributes and qualities of a product to the consumer. Labels may shape people's perceptions of a product, having implications for their evaluation of the latter and whether they are willing to consume it (Lee et al., 2006; Piqueras-Fiszman & Spence, 2015). In recent years, the labeling of meat and meat substitutes has been at the center of political debates (Demartini et al., 2022). For example, in many countries, meat and meat substitute producers have lobbied governments to allow or forbid the use of labeling that infers 'meaty' plant-based alternatives (Demartini et al., 2022; Domke, 2018).

Overall, research on the effects of plant-based and vegetarian labels on evaluations and consumption of meat substitutes has provided mixed evidence, rarely employed an experimental design, and infrequently measured revealed preferences in addition to stated preferences.

On the one hand, omnivores have been found to rate meat products to be better tasting, have a better texture, be cheaper, easier to prepare, and have less fat content and more protein than meat alternatives labeled vegetarian (Michel et al., 2021). At the same time, several studies point towards negative perceptions of plant-based and vegetarian food in general and the adverse effects of explicitly labeling products plant-based and/or vegetarian on the evaluations and consumption intentions of omnivores (Elzerman et al., 2011; Hartmann & Siegrist, 2017; Hielkema & Lund, 2022; Hoek et al., 2011; Michel, Knaapila, et al., 2021; Weinrich, 2018). For instance, omnivores perceive meat substitutes labeled as plant-based (Cordelle et al., 2022; Grasso et al., 2022; Hoek et al., 2011; Stubbs et al., 2018; Vural et al.,

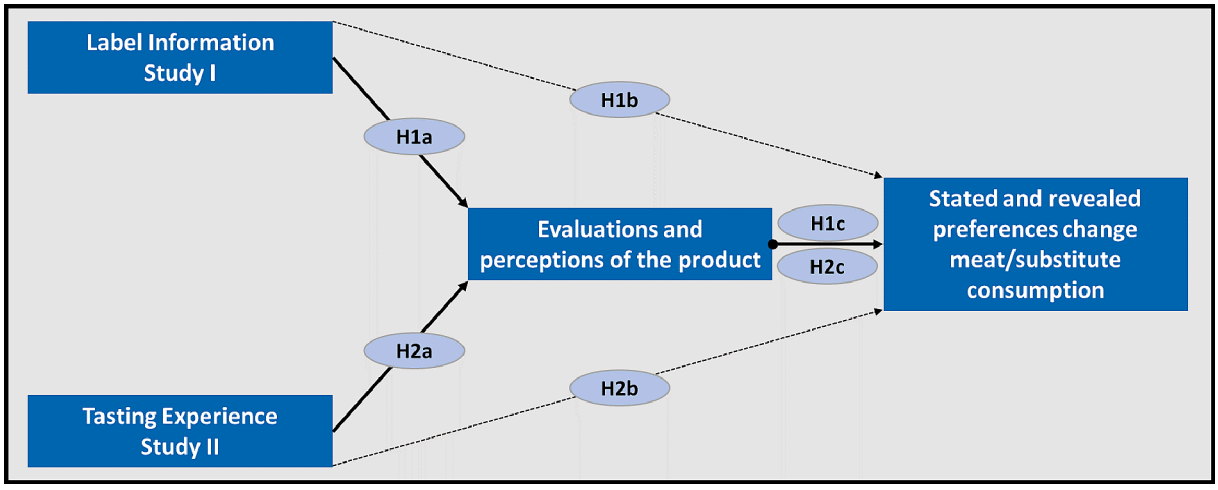

Fig. 1. Theoretical model on the effect of labeling and tasting experience on product perceptions, evaluations, and preferences related to Study I (Labeling) and Study II (Tasting Experience).

2023), as well as vegetarian (Michel, Hartmann, et al., 2021) to be less tasty, satiating, convenient, luxurious, and appropriate for meals than meat products. Further, studies find that omnivores perceive meat substitutes to be of lower quality and have a less satisfying texture than meat products (Cordelle et al., 2022; Grasso et al., 2022). Moreover, generally labeling products as vegetarian has been found to decrease consumers' perception of plant-based products' tastiness and healthiness, as well as their willingness to buy them (Demartini et al., 2022). In addition, vegetarian food is often associated with an unappealing texture, nutritional imbalance, and generally lower quality (Corrin & Papadopoulos, 2017; Hoek et al., 2011). Moreover, studies have identified negative stereotypes related to individuals who follow a vegetarian diet, including the perception of vegetarians as weak and less masculine (Corrin & Papadopoulos, 2017) and the perception that vegetarians are less tolerant of others (Hartmann et al., 2018). This negative perception of vegetarians and plant-based diets is explained, amongst other ways, by cognitive dissonance theory and motivated reasoning. In essence, to maintain internal consistency, omnivores seek to rationalize their consumption choices by highlighting the benefits of meat products compared to plant-based diets (Edenbrandt & Lagerkvist, 2022; Ginn & Lickel, 2020; Michel, Hartmann, et al., 2021; Siegrist et al., 2015; Siegrist & Hartmann, 2019). Moreover, vegetarianism may threaten social values and traditions (MacInnis & Hodson, 2017). In many countries, meat and meat products are of particular cultural significance, being perceived as an essential part of main dishes, especially on festive occasions (Hartmann & Siegrist, 2020). Further, in many cultures, vegetarian and vegan diets are associated with negative attributes (Funk, 2020; Ruby et al., 2016), while meat eating is perceived as 'natural, normal, necessary or nice' (Godfray et al., 2018; Piazza et al., 2015). Thus, negative product perceptions and evaluations of plant-based meat substitutes may also be due to omnivores' more general negative associations with plant-based diets and a vegetarian lifestyle. Therefore, the absence of vegetarian food labels may make plant-based food choices more likely (Demartini et al., 2022; Krpan & Houtsma, 2020). Overall, these perceived negative attributes of plant-based foods and a vegetarian lifestyle might hinder the widespread adoption of plant-based meat substitutes (Funk, 2020; Godfray et al., 2018; Lee et al., 2006; Piazza et al., 2015; Piqueras-Fiszman & Spence, 2015; Ruby et al., 2016; Weinsier, 2000).

On the other hand, in recent years, the negative perceptions of plant-based diets have started to change, and vegetarian and/or plant-based diets may be perceived as positive, especially concerning their sustainability and health impacts, and in the higher-educated and more urban segments of more affluent countries. Positive attributes associated with plant-based diets include virtuousness, thoughtfulness, ethics, and goodness for the environment (Bryant, 2019; Corrin & Papadopoulos, 2017; Michel, Knaapila, et al., 2021). Similarly, studies find that people who purchase meat substitutes labeled vegetarian and/or plant-based are increasingly perceived to be more health conscious, environmentally friendly, educated, and athletic than people who purchase meat products (Corrin & Papadopoulos, 2017; Hartmann et al., 2018; Hartmann & Siegrist, 2020; Hoek et al., 2011; MacInnis & Hodson, 2017; Michel, Hartmann, et al., 2021). Moreover, recent studies find that omnivores generally perceive meat substitutes labeled as plant-based to be healthier (Vural et al., 2023) and more environmentally friendly (Grasso et al., 2022) than meat products. These findings suggest that the presence of a vegetarian food label can also result in more favorable product evaluations.

However, we lack causal inferences about the effects of labeling on consumers' product evaluations and stated and revealed preferences. To the best of our knowledge, no field experimental research has studied the effects of labeling on different quality-, health- and sustainability-related product evaluations or stated and revealed preferences associated with the reduction of meat consumption and eating more meat substitutes. Further, prior research has primarily used correlational study designs to test the effects of labeling on product evaluations and consumption intentions. Such correlational evidence, however, does not allow causal inferences to be drawn and involves the risk of omitted variable bias. Moreover, given that meat and plant-based meat substitute products differ in many regards, it is still unclear if labeling the same product "meat" or "vegetarian meat substitute" changes consumers' evaluations and consumption intentions. It is also unclear to what extent the labeling of meat or substitute products affects product evaluations related to sustainability, health, and product quality (e.g., taste, texture, etc.). Based on the literature (as described above), we expect that labeling the same product meat (versus vegetarian) will affect omnivores' perceptions of product quality, health, and sustainability impacts, as well as their stated and revealed preferences associated with consuming these products. The current research aims to test this expectation experimentally and address the gaps in the literature by experimentally varying product labels and assessing the effects of this on people's product evaluations and stated as well as revealed preferences. Our first set of hypotheses (Study I) are thus as follows:

First set of hypotheses (H1, Study 1):

H1a: Omnivores rate plant-based meat substitutes labeled meat rather than vegetarian differently in terms of their general quality (e.g., taste and texture) and health and sustainability impacts.
H1b: Omnivores have stronger stated and revealed preferences for eating products labeled meat rather than vegetarian meat substitutes.
H1c: Omnivores' product evaluations mediate the relationship between labels and stated and revealed preferences (see Fig. 1).

3. Study II: Experience effects

Another reason for the negative evaluations of meat substitutes may be misperceptions about their characteristics driven by the fact that people are not yet familiar with such products. When consumers become more familiar with a new product, they often alter their evaluation of the specific product and, consequently, their behaviors (de Groot et al., 2009). This mere-exposure effect implies that people may change their beliefs, attitudes, product evaluations, and behaviors as they gain familiarity with new products, which can result in enduring behavioral changes (Fazio & Zanna, 1981). In the food context, several studies point towards the importance of tasting experiences and product familiarity for improving expectations of a food product's quality and sensory attributes, which may affect future willingness to consume these products, such as meat substitutes (Graça et al., 2019; Tan et al., 2017; Tuorila & Hartmann, 2020). It has been found that greater familiarity with a particular food product is related to more positive evaluations of the product (Raudenbush & Frank, 1999). Moreover, a survey-based study in China and the US suggests that experience with meat substitutes is one of the key predictors of individuals' intention to eat more substitutes and reduce meat consumption (Fesenfeld et al., 2023).

Only in the last few years has the meat substitute market started to grow exponentially, and consumers have had more tasting experience with such products (Polaris Market Research, 2020). However, in a recent US survey, around 69 percent of consumers still indicate that they have never or only very rarely tasted plant-based meat substitutes (Fesenfeld et al., 2023). Status quo biases and food neophobia – that is, the tendency to be reluctant to eat novel foods (Pliner & Hobden, 1992) – may explain this unfamiliarity, which may, in turn, be related to negative product evaluations. Indeed, food neophobia is linked to negative product evaluations and less willingness to consume meat substitutes (Hoek et al., 2011; Raudenbush & Frank, 1999). Thus, a lack of familiarity with a product can be a primary barrier to intentions to consume meat substitutes because initial product evaluations, especially of product quality (e.g., taste, texture), are negative.

We therefore propose that a tasting experience with meat substitute products may result in more positive evaluations of product quality (e.g., taste, texture) and stronger intentions to eat less meat and more meat substitutes. This is supported by the claim that with food preferences,

experiences are likely to have a more significant impact on behavior than mere information (Smith & DeCoster, 2000). Less frequent meat consumption and more experience with meat substitutes are especially associated with more positive meat substitute evaluations (Graça et al., 2019; Siegrist & Hartmann, 2019). Thus, we propose that becoming familiar with meat substitutes may improve affective product-quality perceptions, strengthening people's intentions to consume such products. There is initial evidence to support our reasoning. For example, correlational research has found that when participants were asked to cook with meat substitutes at home over a longer period, their liking of meat substitutes increased (Hoek et al., 2013). Other studies provide similar correlational evidence about the positive relationship between meat substitute consumption and the intention to consume more substitutes and less meat in the future (Fesenfeld et al., 2023; Hoek et al., 2013; Siegrist & Hartmann, 2019). However, such correlational evidence does not allow the making of causal inferences and is prone to reversed causality and omitted variable biases. For example, third variables like previous food-related attitudes, such as a higher level of environmental awareness, are likely to be related to meat substitute experience and intentions to change behaviors. Moreover, many studies focus on stated preferences (i.e., intentions), and no studies have revealed preferences. Thus, the question remains whether research designs that randomly vary the degree of experience with meat substitutes and measure revealed preferences can validate the expected meat substitute experience effects (Cuffey et al., 2022; Neuhofer & Lusk, 2022; S. Zhao et al., 2022). It is also not clear if tasting experiences with all types of meat substitutes lead to positive product evaluations and changes in behavioral preferences. Experiences with some types of meat substitutes, especially more novel and processed substitutes, might induce negative evaluations and thus might lead to "behavior backlash." Moreover, it is unclear how and to what extent meat substitute experience affects dimensions of product evaluations. Based on the literature, we expect the meat substitute experience to primarily affect affective evaluations of product quality in terms of taste, texture, and appearance. There is, however, less reason to presume that tasting experience also affects the sustainability- and health-related evaluations of meat substitutes. Arguably, these evaluative dimensions are linked more strongly to conscious reflections about the product than to affective evaluations made during the tasting experience. Last, it is unclear if experience merely affects product evaluations or directly or indirectly (i.e., mediated via product evaluations) affects consumers' stated and revealed preferences. The present research aims to extend previous research by experimentally examining to what extent tasting experience influences different types of evaluations of meat substitutes, stated and revealed preferences concerning the consumption of meat substitutes, and reductions in personal meat consumption (i.e., the expected substitution effect).

Our second set of hypotheses (H2, Study II) are thus:

H2a: Omnivores who taste a meat substitute compared to those who do not will rate such substitutes differently regarding their general product quality (e.g., taste and texture) but not in terms of their health- and sustainability impacts.

H2b: Omnivores who taste a meat substitute will have stronger stated and revealed preferences for eating less meat and more meat substitutes than those who do not.

H2c: Omnivores' product evaluations mediate the relationship between the tasting experience and preferences (see Fig. 1).

Fig. 1 provides an overview of the theoretical expectations tested in Study I and II.

We conducted two experimental studies among omnivores to test our hypotheses (see Fig. 1). Study I focuses on the effects of vegetarian labels (testing Hypotheses 1a-c), and Study II focuses on the effects of tasting experience (testing Hypotheses 2a-c). The following section presents both studies' research designs and findings and discusses the results.

4. Study I

4.1. Method

4.1.1. Participants

Participants were first-year psychology students who received course credits as compensation for their participation. This study was part of a more extensive one in which participants were first asked to complete a short online questionnaire[1] and subsequently invited to sign up to participate in our experimental study that would take place four weeks later. A total of 83 students participated in our experimental study (38 were male, 36 were female, and nine did not indicate their gender).[2] Their age ranged from 18 to 34 (median of 20). Given that this study aimed to examine factors related to the (reduction of the) consumption of meat, students could only participate in the study if they consumed meat.

4.1.2. Procedure

Upon entering the lab, participants were asked to participate in a product tasting and then to fill out a brief questionnaire (see Appendix A). To increase the credibility and external validity of our experiment, participants were informed that the purpose of the study was to taste and evaluate potential new products that might be offered at the university cafeterias. During our study, the faculty canteens at the university had recently changed caterers, and the assortment of products offered there was genuinely being changed. For the tasting, participants could choose between three small samples of typical sandwiches offered in the cafeterias, each with a different soy-based meat replacement on bread (for more information, see Appendix B). This study design mirrored a realistic choice situation in student cafeterias and allowed us to assess revealed and stated preferences. The three products were identical for each participant. However, the labels of the products differed across conditions. The three sandwiches were either labeled *vegetarian substitute sandwiches* (hereafter referred to as the 'vegetarian condition') or *meat sandwiches* (hereafter referred to as the 'meat-label condition'). Participants were randomly assigned to one of these two conditions. This enabled them to experience the products in a multidimensional and realistic way by seeing the offer and experiencing the products' taste and texture. Before tasting any of the products, participants were informed of any potential allergens and confirmed that it would be safe to taste them. After tasting one of the sandwiches, participants continued to fill out a short questionnaire on a laptop, including the following items of interest (see Appendix C for a detailed questionnaire).

4.1.2.1. Overall evaluation of the product quality. We asked participants to evaluate the product they had just tasted according to three dimensions. Specifically, participants were asked to indicate, on a Likert scale from 1 to 7, to what extent they evaluated the product to be *1 very distasteful* to *7 very tasty*; *1 very unappetizing* to *7 very appetizing*; and *1 of very unpleasant texture* to *7 of very pleasant texture*. Moreover, we asked participants what their general evaluation of the product they had just tasted was on a scale from *1 very negative* to *7 very positive*.

[1] Study 1 was part of a two-part study on food consumption. Participants who signed up for the first part of the study completed an online questionnaire about their food consumption preferences and choices. At the end of the online questionnaire, participants could sign up for our experimental study. As the online questionnaire is part of another study, the related measures and findings are not discussed further in this manuscript.

[2] We conducted power analyses using the two-tailed student's *t*-test (corrected for 1–5 comparisons) with an alpha of 0.05 and a power of 0.8–0.9. From these analyses, we found that our study was well-powered (i.e., the sample size was large enough to detect moderate to large effects – a Cohen's d of 0.5–0.8) but lacked the power to detect small effects (i.e., for the power of 0.8 a Cohen's d of 0.3 requires a minimum of 176 respondents per group).

4.1.2.2. Intention to consume the product in the future. Afterward, participants were asked to indicate how likely they would be to consume the tasted (meat-labeled or vegetarian-labeled) product in the future. Responses could vary from 1 *Do not intend to consume at all* to 7 *Definitely intend to consume*.

4.1.2.3. Intention to reduce meat consumption. Next, on a scale from 1 to 7, participants were also asked to indicate how likely they were to reduce their meat consumption in the future. Responses could vary from 1 *Do not intend to reduce at all* to 7 *Definitely intend to reduce*.

4.1.2.4. Willingness to replace meat consumption with meat substitutes. Participants indicated to what extent they were willing to replace their meat consumption with three different types of meat substitutes on a scale ranging from *1 Not at all willing* to *7 Extremely willing* (or *8 I don't know this alternative product*). The meat substitutes were synthetic meat alternatives: cell-cultured (in vitro) meat, plant-based meat alternatives, and meat alternatives based on insects.

4.1.2.5. Revealed preferences for a minimum share of vegetarian products in university canteens. We identified students' revealed preferences for diet shifts by asking them to express their desired minimum share of vegetarian products in the university canteens on a scale from 0 % to 100 %. Students were informed that their voting would influence actual canteen procurement and thus have real behavioral consequences. This information was credible, as the university caterer – during the study – was changing its product assortment, and students were informed about this.

4.1.2.6. Evaluation of product health- and sustainability-related attributes. Next, participants were asked to what extent they thought the product they had just tasted was healthy, animal-friendly, environmentally-friendly, and climate-friendly on a scale from 1 *Not at all* to 7 *Completely*.

The baseline questionnaire (see Appendix A) administered four weeks before the experiment contained several variables that could affect meat (substitute) product evaluations and consumption, including gender and spoken language (Koch et al., 2019), consumption habits (Graça et al., 2019), personal values (Steg et al., 2014), meat eater identity (Wolstenholme et al., 2021), and meat-related health perceptions (Michel, Hartmann, et al., 2021). We checked whether results were robust when (not) including these variables as covariates.

4.1.3. Statistical analysis

As some data were of non-normal distribution, we used non-parametric Kruskal-Wallis tests and ANOVA analysis to test Hypotheses 1a-b. Both tests yielded comparable results (see Appendix D for an overview table of means [with SE], F-value, and p-values). As a robustness check, we also conducted a multivariate analysis of variance (MANOVA) to control for the potential influence of covariates (i.e., language, gender, personal values, consumption habits, meat eater identity, meat-related health perceptions, sample type tasted), which again yielded similar results (See Appendix E – I). In the main results section below, we report the simple ANOVA results.

To test for mediation effects, we conducted a causal mediation analysis based on the R package mediation by Tingley et al. (2014) to determine the average causal mediation effects (ACME). The uncertainty estimates were calculated using the quasi-Bayesian Monte Carlo method based on normal approximation as the simulation type and by setting the number of simulations to 1,000 (Tingley et al., 2014). A significant total effect (significant relationship between the independent and dependent variables via the mediator) is not required for a mediation effect since the total effect and the direct effect (significant relationship between the independent and the dependent variable) may cancel each other out (Igartua & Hayes, 2021; Zhao et al., 2010). Hence, we interpret the presence of a mediation effect based on the indirect effect of the independent variables (meat label vs. vegetarian label condition) on the dependent preference variables (likelihood of consuming substitute products, likelihood of reducing meat consumption, desired minimum share of vegetarian products offered) through the mediators (i.e., product evaluations: taste, appetizing, texture, valence, environmental friendliness, climate friendliness, healthy and animal friendliness) – thus, based on the average causal mediation effect.

4.2. Results

In contrast to H1a, the product quality evaluation across the dimensions of taste, appetizing, texture, and general product evaluation (i.e., valence) was not significantly different between the meat and vegetarian label conditions (Fig. 2). Overall, participants in both conditions evaluated the products as markedly positive (average ratings in both conditions between 5 and 6 on a 7-point Likert scale). In the meat label condition, taste was rated highest ($M = 5.31 \pm SE = .17$) followed by appetizingness ($M = 5.26 \pm SE = .18$), overall product evaluation – i.e., valence ($M = 5.14 \pm SE = .19$) – and texture ($4.88 \pm .22$). In the vegetarian label condition valence was rated the highest ($M = 5.56 \pm SE = .19$) followed by taste ($M = 5.39 \pm SE = .20$), appetizingness ($M = 5.27 \pm SE = .23$), and texture ($M = 5.10 \pm SE = .21$).

However, in line with H1a, we find significant differences between the label groups in terms of consumers' perceptions of the product's health and sustainability impact. First, we found that participants in the vegetarian label condition rated the products as significantly healthier than the meat label condition ($p < .005$). Moreover, omnivores rated products labeled as vegetarian as more environmentally friendly ($p < .0005$), more animal-friendly ($p < .0005$), and more climate-friendly ($p < .0005$) than participants in the meat label condition (see Fig. 3 and Appendix D). These findings suggest that participants were conscious of the product labels and associated different product attributes with them depending on the label (Funk, 2020; Ruby et al., 2016).

In contrast to H1b, participants reported a relatively high likelihood (Fig. 4; see Appendix H and J) of consuming meat substitutes and

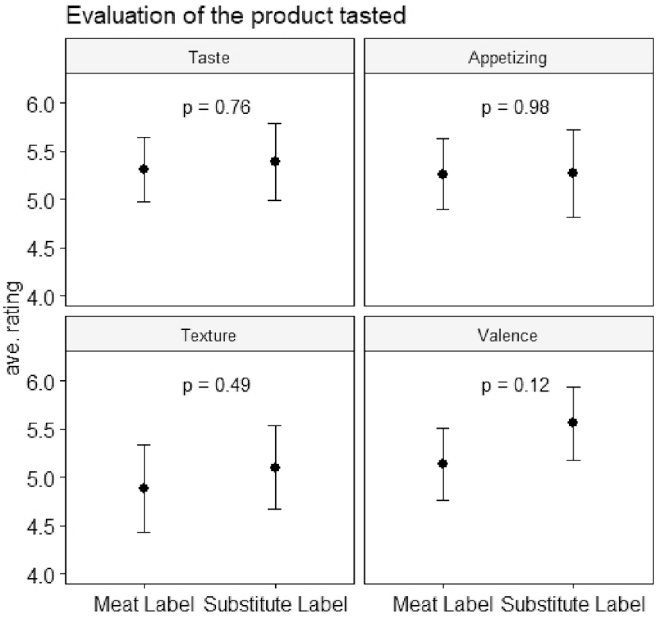

Fig. 2. Evaluation of the tasted product. Error plot of product evaluation variables (taste, appetizingness, texture, and valence) of meat label vs. vegetarian meat substitute label. Products were rated on a scale ranging from 1 to 7, with higher ratings representing more positive scores. Dots indicate estimated mean values and error bars are based on a 95 % CI interval with p-values based on ANOVA analysis of variance.

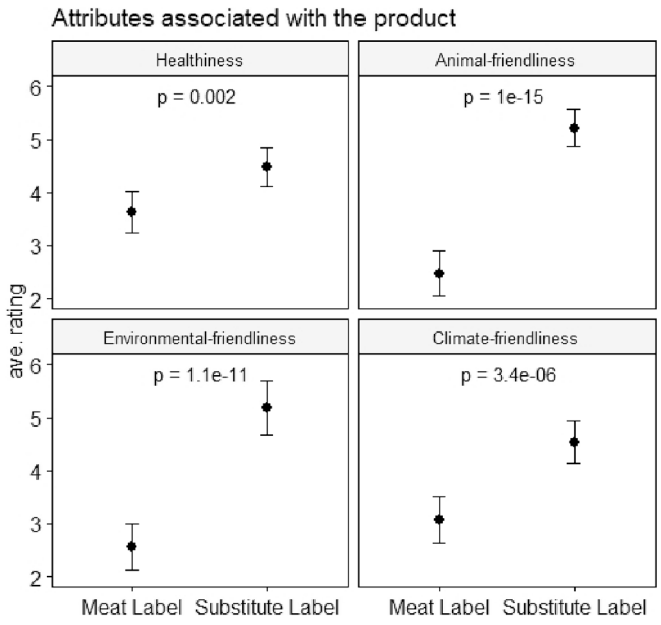

Fig. 3. Evaluation of attributes associated with meat and plant-based products. Error plot of product-associated attributes (healthiness, animal-friendliness, environmental-friendliness, climate-friendliness) of meat label vs. vegetarian meat substitute label group. Product attributes could be rated on a scale from 1 to 7. Dots indicate estimated mean values and error bars are based on a 95 % CI interval with p-values based on ANOVA analysis of variance.

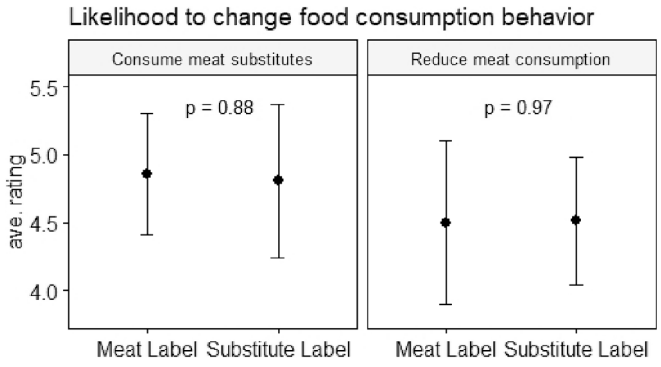

Fig. 4. Likelihood of changing food consumption behavior. Error plot of likelihood of changing meat consumption variables (likelihood of consuming plant-based meat substitutes and likelihood of reducing meat consumption) of meat label vs. vegetarian meat substitute group using a scale ranging from 1 to 7. Dots indicate estimated mean values and error bars are based on a 95 % CI interval with p-values based on ANOVA analysis of variance.

reducing meat consumption, no matter the label condition (meat label group: M = *4.86* ± *SE* = *.22*, vegetarian label: M = *4.80* ± *SE* = *.28*). Willingness to replace meat with plant-based meat substitutes was relatively strong (meat label group: M = *4.93* ± *SE* = *.30*, meat-substitute label: M = *5.32* ± *SE* = *.26*), while willingness to replace meat with insect-based meat was relatively weak (meat label group: M = *3.17* ± *SE* = *.33*, vegetarian label: M = *3.07* ± *SE* = *.33*), and willingness to replace meat with synthetic/cell-cultured meat was in between (meat label group: M = *4.14* ± *SE* = *.37*, vegetarian label: M = *4.29* ± *SE* = *.36*); here we also found no significant differences between the label conditions (see also Appendix G and K).

In contrast to H1b, we also found no significant differences in revealed preferences, as the desired minimum share of vegetarian products in the university's canteens did not differ significantly across the label conditions (Fig. 5). In both conditions, the desired minimum

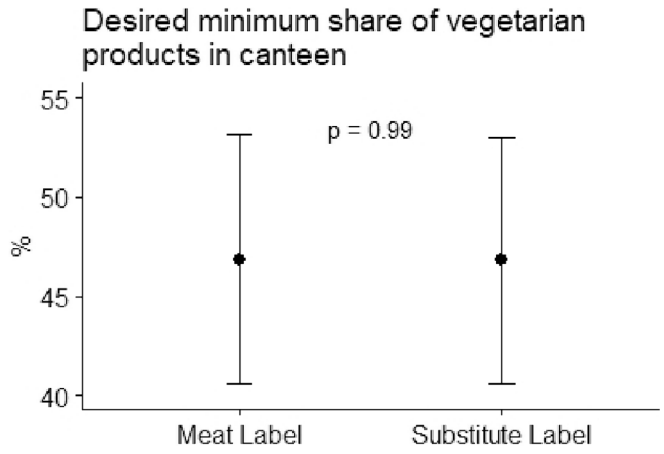

Fig. 5. Revealed preferences concerning the desired minimum share of vegetarian products in the canteen. Error plot of the canteen share variable (percentage from 1-100 % of plant-based meat substitutes desired to be served in the school canteen) of meat label vs. vegetarian meat substitute group. Dots indicate estimated mean values and error bars are based on a 95 % CI interval with p-values based on ANOVA analysis of variance.

share of vegetarian products in the University's canteens was around 47 percent (meat label group: M = *46.86 %* ± *SE* = *3.12*, meat-substitute label: M = *46.80 %* ± *SE* = *3.08*).

Finally, in line with H1c, we find significant and positive causal mediation effects of vegetarian labels on individuals' likelihood of consuming more plant-based meat substitutes via higher perceived product climate-friendliness and healthiness (see Table 1 and Appendix M). However, the labels did not affect individuals' consumption preferences via product quality evaluations, i.e., perceived taste, appetizingness, texture, and valence.

5. Study II

5.1. Method

5.1.1. Participants

A total of 142 participants took part in Study II. Participants were university students, 101 of whom were female (41 male). Their ages ranged from 19 to 36 (median 27.5 years old).[3] In compensation for their participation, participants received five euros. As with Study I, only students who consumed meat were invited to participate. Participants who took part in Study I were not allowed to participate in Study II.

5.1.2. Procedure

Study II was set up in two steps: first, participants were asked to fill out an online questionnaire (hereafter referred to as the 'pre-tasting questionnaire' measuring food consumption preferences). Subsequently, they could sign up for the product-tasting experiment. Participants were recruited by handing out flyers at the university library buildings. Along with general information about the study, the link to the pre-tasting questionnaire was given on the flyer (see Appendix N). In the pre-tasting questionnaire, participants were asked about their food consumption preferences. Specifically, we measured how participants evaluate meat replacement products and if they intend to eat more of the

[3] As with Study 1, we conducted power analyses using the two-tailed student's *t*-test (corrected for 1–5 comparisons) with an alpha of 0.05 and a power of 0.8–0.9. From these analyses, we found that Study 2 was also well powered (i.e., the sample size was large enough) to detect moderate to large effects (i.e., Cohen's d of 0.5–0.8) but lacked sufficient power to detect small effects (i.e., for power of 0.8 a Cohen's d of 0.3 requires min. 176 respondents per group).

Table 1
Overview Results, Mediation Analysis: The table shows the results of the causal mediation analyses of the effect of labels on different outcome variables via the mediators. The numbers indicate the average causal mediation effects estimate, which is the effect of the independent variables (meat label vs. vegetarian label condition) on the dependent variables (likelihood of consuming plant-based products, likelihood of reducing meat-based products and revealed preferences for a desired minimum share of vegetarian products in canteen) through the mediators (product evaluations: taste, appetizing, texture, valence, environmental friendliness, climate friendliness, healthy and animal friendliness, respectively) with the p-value in brackets. The average causal mediation effects, which are significant at the 5 % level, are highlighted in green (* = $p < 0.05$).

Mediators	Outcome Variables		
	Likelihood of consuming meat substitutes (Stated preferences)	Likelihood of reducing meat consumption (Stated preferences)	Desired min. share of vegetarian products in canteen (Revealed preferences)
Taste	-0.0171 (0.97)	-0.0008 (0.97)	-0.0728 (0.92)
Appetizing	-0.0886 (0.78)	-0.0140 (0.85)	-0.133 (0.91)
Texture	0.0747 (0.82)	0.0227 (0.81)	0.3455 (0.79)
Valence	0.3592 (0.28)	0.0562 (0.45)	0.4012 (0.60)
Environmental friendliness	0.7389 (0.086)	-0.3397 (0.31)	-5.173 (0.29)
Climate friendliness	0.5932 (0.02*)	-0.1467 (0.46)	-5.860 (0.06)
Healthy	0.4108 (0.014*)	0.0095 (0.98)	0.4331 (0.84)
Animal friendliness	0.6464 (0.10)	0.1518 (0.67)	-10.90 (0.018*)

latter and reduce their meat consumption in the future. Last, participants were asked to provide their email addresses so we could email them the sign-up sheet for the product tasting.

The product-tasting part of Study II took place in the lab four weeks after the pre-tasting questionnaire. Upon entering the lab, participants were randomly assigned to either the *tasting or control conditions*. All participants were informed that the purpose of the study was to provide input on potential new products that might be offered at the university cafeterias. This information was likely to be perceived as credible as the university cafeterias were changing their product assortment during the study period. Participants in the tasting condition were first asked to participate in a product tasting, then filled out a short questionnaire (hereafter referred to as the 'post-tasting survey'; see Appendix O). These participants could choose between three small samples of sandwiches typically offered at the university cafeterias (the same as in Study I). Each sandwich sample included one soy-based meat replacement, and all sandwiches were labeled as vegetarian (for more information about the meat-replacement products, see Appendix B). Before tasting any of the products, participants were informed of any potential allergens and reassured that it would be safe to taste such products. After tasting one of the products, participants in the tasting condition proceeded to fill out the post-tasting survey on a computer, including the same measures as in Study I. Using the same measures allowed us to compare results across Study I and II. Participants in the control condition also had to come to the lab but only filled out the same questionnaire and did not see nor taste any of the products.[4]

[4] The descriptions in questions that referred to the evaluation of vegetarian meat-replacement products differed slightly between the tasting and the control condition. In the tasting condition, the descriptions referred to the product that the participant had just tasted. In the control condition, the descriptions referred to vegetarian meat replacement products, and examples were given that were in line with the tasting options (see Appendix O for item descriptions across conditions).

5.1.3. Statistical analysis

As in Study I, most of the data in Study II was of non-normal distribution, thus we employed non-parametric Kruskal-Wallis tests in addition to one-way ANOVA analyses. Both types of analyses yield very similar results (see Appendix P). As a robustness check, in Study II, we also used multivariate analysis of variance (MANOVA), including relevant covariates (i.e., gender, personal values, grocery habits, meat consumption habits, meat eater identity, meat-related health perceptions, and sample type tasted), which again yielded similar results (See Appendix Q – U). In line with Study I, we thus present here the ANOVA findings in the main results; all additional robustness-check analyses can be found in the Appendix. To test for mediation effects, we conducted a causal mediation analysis based on the R package mediation by Tingley et al. (2014), similar to Study I. Again, we tested for the presence of a mediation effect based on the indirect effect of the independent variables (control vs. tasting condition) on the dependent variables (likelihood of consuming meat substitutes, likelihood of reducing meat consumption, desired minimum share of vegetarian products offered in the cafeteria) through the mediators (product evaluations: taste, appetizing, texture, valence, environmental friendliness, climate friendliness, healthy and animal friendliness).

5.2. Results

As expected in H2a, participants in the tasting condition evaluated products significantly more favorably in terms of product quality than participants in the control (non-tasting) group (see Appendix P for further details). This holds for all product evaluations: taste ($p < .0005$), texture ($p < .05$), appetizingness ($p < .0005$), and general valence ($p < .05$) (see Fig. 6).

However, in contrast to H2a, as shown in Fig. 7, those omnivores who tasted the vegetarian meat substitute evaluated the health benefits of meat substitutes less positively than respondents in the control group ($p < .05$; Fig. 7). However, in line with H2a, the tasting experience did not affect the evaluation of the animal-friendliness, environmental-friendliness, and climate-friendliness of plant-based meat substitutes.

In contrast to our expectation (H2b), tasting the product did not

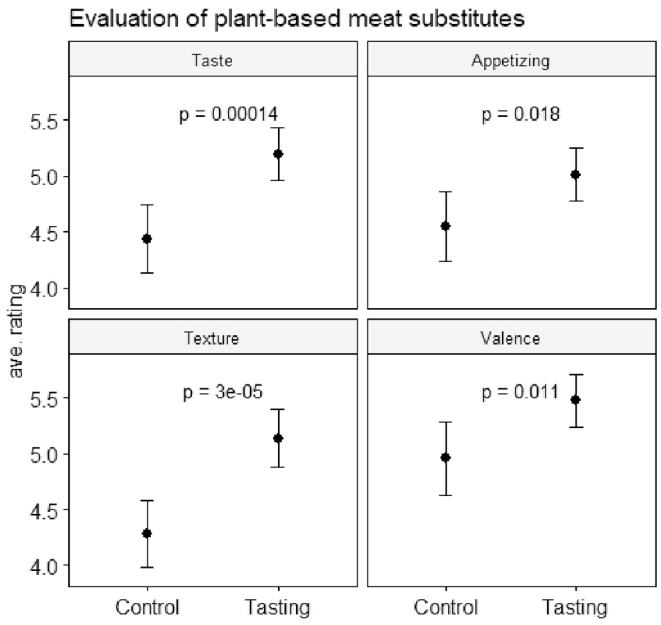

Fig. 6. Evaluation of plant-based meat substitutes. Error plot of product evaluation variables (taste, appetizing, texture, and valence) of the control (non-tasting) vs. vegetarian meat substitute tasting group. Products were rated on a scale from 1 to 7. Dots indicate estimated mean values and error bars are based on a 95 % CI interval with p-values based on ANOVA analysis of variance.

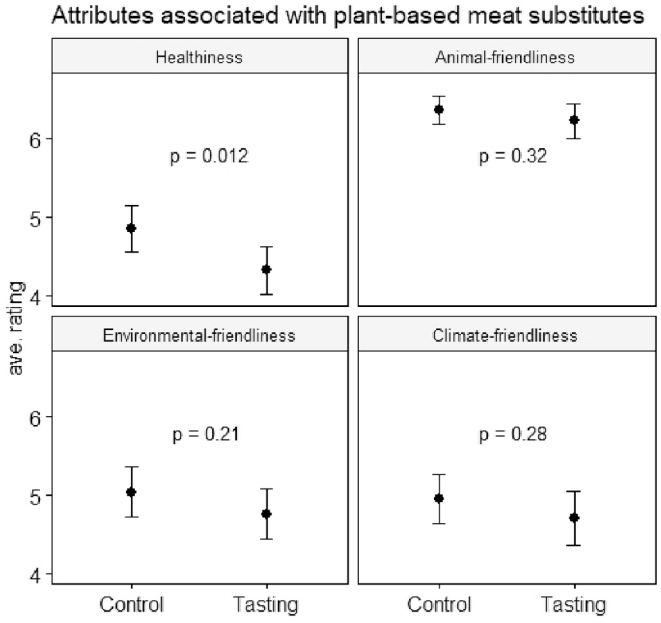

Fig. 7. Evaluation of attributes associated with plant-based meat substitutes. Error plot of product-associated attributes (healthiness, animal-friendliness, environmental-friendliness, climate-friendliness) of control (non-tasting) vs. vegetarian meat substitute tasting group. Product attributes could be rated on a scale from 1 to 7. Dots indicate estimated mean values and error bars are based on a 95 % CI interval with p-values based on ANOVA analysis of variance.

directly affect intentions to consume meat substitutes or reduce meat consumption (see Fig. 8). A similar non-significant result was found with respect to individuals' willingness to consume different types of meat replacements (see Appendix W). Furthermore, tasting the product did not affect revealed preferences for a desired minimum share of vegetarian products in university cafeterias (Fig. 9).

The mediation analyses (see Table 2) partially confirm H2c.

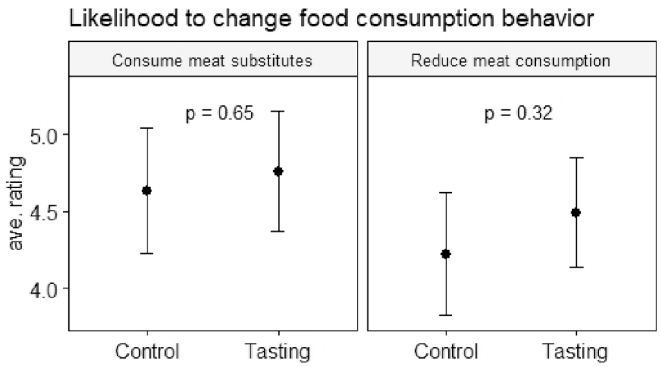

Fig. 8. Likelihood of changing food consumption behavior. Error plot of likelihood of changing meat consumption variables (likelihood of consuming meat substitutes and likelihood of reducing meat consumption) of the control (non-tasting) vs. vegetarian meat substitute tasting group given a scale of 1 to 7. Dots indicate estimated mean values and error bars are based on a 95 % CI interval with p-values based on ANOVA analysis of variance.

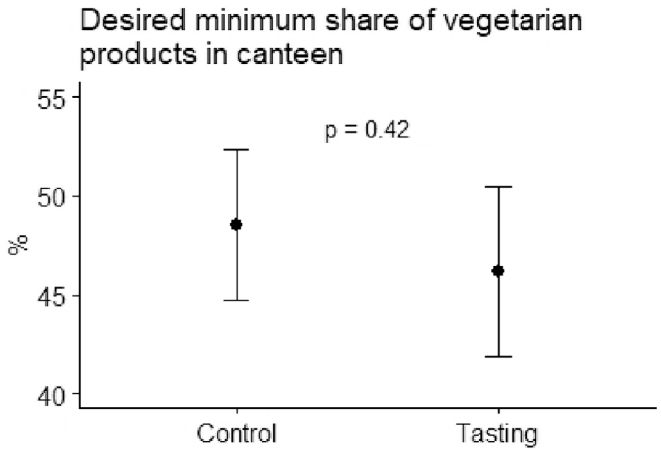

Fig. 9. Revealed preferences concerning the desired minimum share of vegetarian products in the canteen. Error plot (percentage from 1-100 % of plant-based meat substitutes desired to be served in the school canteen) of the control (non-tasting) vs. vegetarian meat substitute tasting group. Dots indicate estimated mean values and error bars are based on a 95 % CI interval with p-values based on ANOVA analysis of variance.

Specifically, we find that tasting vegetarian meat substitutes strengthens the intention to consume more plant-based meat substitutes and the desired minimum share of vegetarian products in canteens by improving respondents' product quality evaluations, especially of the products' taste, appetizingess, valence, and texture. In contrast to the labeling effect in Study I, the tasting experience did not affect respondents' stated and revealed consumption preferences via improved evaluations of products' sustainability- and health-related attributes.

6. Discussion

Study I tested the influence of vegetarian labeling on participants' product evaluations and behavioral intentions. Study II tested whether tasting vegetarian meat substitute products would change participants' product evaluations and their stated and revealed dietary preferences.

The results partially confirm our hypotheses. We found that labeling a product vegetarian and the tasting experience affected respondents' product evaluations in different ways. First, Study I partially confirmed H1a and showed that labeling a product as vegetarian primarily affected the evaluation of products' sustainability- and health-related attributes. In contrast, it did not affect the evaluations of the product quality (i.e.,

Table 2
Overview Results, Mediation Analysis: The table shows the results of the causal mediation analyses of the effect of vegetarian labels on different outcome variables via mediators. The numbers indicate the average causal mediation effects estimate, which is the effect of the independent variables (control vs. tasting condition) on the dependent variables (likelihood of consuming, likelihood of reducing, desired minimum share) through the mediators (taste, appetizing, texture, valence, environmental friendliness, climate friendliness, healthy and animal friendliness, respectively) with the p-value in brackets. The average causal mediation effects, which are significant at the 5 % level, are highlighted in green (* = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$).

Mediators	Outcome Variables		
	Likelihood of consuming meat substitutes (Stated preferences)	Likelihood of reducing meat consumption (Stated preferences)	Desired min. share of vegetarian products in the canteen (Revealed preferences)
Taste	0.6073 (0.00***)	0.0509 (0.52)	0.824 (0.43)
Appetizing	0.4108 (0.014*)	0.0665 (0.21)	0.712 (0.22)
Texture	0.4874 (0.00***)	0.1586 (0.11)	2.846 (0.04*)
Attitude	0.4576 (0.004**)	0.1175 (0.06)	1.551 (0.028*)
Environmental friendliness	-0.0211 (0.62)	-0.0190 (0.57)	-0.2774 (0.57)
Climate friendliness	-0.001 (0.81)	-0.0210 (0.61)	-0.1321 (0.73)
Healthy	-0.1565 (0.11)	-0.111 (0.11)	-0.610 (0.26)
Animal friendliness	-0.0097 (0.89)	-0.0184 (0.61)	-0.0152 (0.70)

taste, appetizingness, texture, and valence). In contrast, in Study II, we found that the tasting experience significantly affected product quality and health-related evaluations but not sustainability-related evaluations.

In contrast to H1b and H2b, however, we found that neither labeling nor tasting significantly affected participants' intention to reduce their meat consumption or eat more meat substitutes, nor their revealed preference for more plant-based products in cafeterias.

In line with H1c and H2c, we found partial support for the expected mediation effects: labeling a product vegetarian and the tasting experience strengthened consumers' intentions to eat more meat substitutes and their revealed preferences concerning the desired share of plant-based products in cafeterias via altering product evaluations. Interestingly, however, these mediation effects were insignificant for the intention to reduce personal meat consumption. Consistent with our main effects of labeling and tasting on product evaluations (see H1a and H2a), we found that the mediation effects of labeling and tasting differed for the different product evaluation dimensions. Specifically, while in Study I, we found significant mediation effects of labeling on stated and revealed product preferences via enhanced health- and sustainability-related evaluations, we did not find such positive and significant mediation effects via enhanced product-quality evaluations (i.e., taste, appetizingness, texture, and valence). In contrast, in Study II, we found the opposite: the tasting experience affected stated and revealed product preferences via enhanced product quality (i.e., taste, appetizingness, texture, and valence) but not via enhanced health- or sustainability-related product evaluations.

These findings indicate the potentially complementary effects of the labeling and tasting experience. In essence, while labeling seems to primarily change health- and sustainability-related product evaluations, tasting mainly alters product quality evaluations (i.e., taste, appetizingness, texture, and valence). Nevertheless, our results indicate that product labeling and a one-time tasting experience do not suffice to directly alter behavioral preferences, especially as concerns reducing personal meat consumption, but rather indirectly change stated and revealed preferences with altered product evaluations.

Our results have theoretical and empirical implications. The two studies offer novel field experimental support for the causal effects of labeling and meat substitute tasting experience on product evaluations and consumers' stated and revealed preferences, thereby extending the findings of previous studies that relied on correlational evidence and may be prone to potential endogeneity risks. The findings suggest that both the labeling and tasting experience can shift product evaluations, strengthening preferences for eating more plant-based products in different, complementary ways. This result is in line with previous correlational studies that point towards more positive evaluations of products labeled as vegetarian and plant-based (Bryant, 2019; Corrin & Papadopoulos, 2017; Hartmann et al., 2018; Lazzarini et al., 2016; Michel, Knaapila, et al., 2021). Moreover, our studies corroborate correlational evidence that a tasting experience results in more favorable product evaluations (Graça et al., 2019; Tan et al., 2017; Tuorila & Hartmann, 2020). However, we extend previous correlational work by distinguishing between different types of product evaluations, i.e., product quality (i.e., taste, appetizingness, texture, and valence) and health- and sustainability-related product attributes. In contrast to previous studies, we show that labeling and tasting affect these attributes differently, and differentiating product attributes matters. We also use a randomized field experimental design to make causal inferences and overcome the potential endogeneity risks associated with prior correlational studies. Moreover, we used the same items in both studies to measure product evaluations. Further, the findings may extend the results of other studies on the role of information in meat substitute consumption preferences (Fesenfeld et al., 2023; Martin et al., 2021), showing that a vegetarian label without any additional information on health or the environment can by itself impact consumers' health- and sustainability-related product evaluations. In essence, the key and robust contribution of our experimental studies is showing that labeling primarily affects health- and sustainability-related product evaluations, while a tasting experience primarily affects product quality evaluations and, via the latter, shapes stated and revealed consumer preferences.

Interestingly, even though we find that labeling and tasting affect consumer preferences via product evaluations, we cannot identify any direct effects of these on behavioral preference outcomes. This finding can be explained in two ways. First, it is possible that labeling and

tasting lead to both positive and negative effects on evaluative dimensions, not all of which were covered in our study. These unobserved effects might balance out the observed effects on product evaluations and thus lead to the finding of non-significant effects on behavioral preference outcomes. Second, it might be that the short-term treatment exposure and potential ceiling effects associated with our experiment (i.e., due to the high average ratings and minor variation in behavioral preference outcomes) resulted in non-significant direct effects of labeling and tasting on the preference outcomes. Future studies can examine why we did not observe any effects of labeling and the tasting experience on the preference outcomes and under what conditions consumers are likely to shift their meat consumption behavior.

Further, future research can examine factors that interact with labeling and the tasting experience to affect meat consumption. For instance, social norms (Carfora et al., 2022; Fesenfeld et al., 2023; Robinson et al., 2014; Sparkman et al., 2020, 2021; Sparkman & Walton, 2017), choice architecture (Garnett et al., 2019, 2020), and the cost of meat (substitute) products (Carlsson et al., 2022), as well as further developments in the quality of meat substitutes – e.g., regarding product formulations, (Grasso et al., 2022; He et al., 2020) – are also likely to influence any reduction in meat consumption. For instance, we predict that labeling and tasting experiences will better promote the adoption of plant-based substitutes and the reduction of meat consumption when social norms more strongly support plant-based diets and when alternatives are high quality and competitively priced.

Notably, we found particularly strong correlations between the product quality evaluations and the stated and revealed behavioral preference outcomes (see Appendix L and X), while correlations between sustainability-related and preference outcomes were weaker. Given that our tasting treatment affected evaluations of important product-quality-related features, like taste and texture, thereby affecting the preference outcomes, more substitute-tasting experiences of new-generation meat substitute products like the one used in our study may be a promising way to shift consumer behavior. Future longitudinal field-experimental studies could use robust behavioral outcome measures and repeatedly induce tasting experiences to identify the size of potential substitution effects and the mechanisms via which meat substitutes can reduce meat consumption.

6.1. Limitations and next steps

Our studies are associated with some limitations that suggest avenues for future research. First are the sample sizes and specific characteristics (e.g., urban, younger, and higher educated) from only one country, namely the Netherlands. While all participants regularly eat meat, the question remains whether similar results would be found in other countries and population segments. Specifically, liberals, women, those with a higher level of education, and those from urban areas typically more strongly support vegetarian diets and meat-substitute products (Corrin & Papadopoulos, 2017; de Boer et al., 2013; Graça et al., 2019). Our sample represents this type of group, which may explain the relatively strong intention to use plant-based products. Due to these high average ratings, however, the study may have failed to detect treatment effects from product labeling and the tasting experience (i.e., risk of ceiling effects). Future research should thus repeat similar experiments with different segments of society and larger samples representative of different populations. Comparing studies across countries, cultures, and sample types would further allow the generalizability of our results to be tested.

Second, our field experiment only treated individuals at one point and one type of substitute (soy-based cold cuts), which may have induced relatively small treatment effects. Moreover, our one-time measures of stated and revealed consumer preferences do not allow us to thoroughly test consumers' real-world behavior change, especially over longer periods. The lack of behavioral panel data also does not allow us to assess how the treatments might change product evaluations and later affect consumer preferences and actual behavior. Future studies would ideally embed experiments in longitudinal field settings, using various types of substitute products to increase generalizability and gather panel data on changes in evaluations and behavior over time. Repeated exposure to product labels and tasting experiences with different products over time would allow testing for temporally varying treatment effects. Moreover, measuring real-world behavior in different ways, such as using daily cafeteria and supermarket shopping data over a more extended period, would be appropriate. Generally, food choices are habitual, and it is presumed that it takes time to form new habits (Siegrist & Hartmann, 2020). Longitudinal experiments would also allow us to make causal inferences about the size of potential meat substitution effects caused by more experience with different types of meat substitutes. Moreover, treatment effects in social settings such as cafeterias might become stronger over time because consumers not only encounter repeated personal tasting experiences but interact with other consumers, thereby learning and potentially modifying social norms over time (Robinson et al., 2014). Thus, future longitudinal and comparative field experiments in a variety of settings (e.g., restaurants, supermarkets, and cafeterias) could study if the effects of labeling and tasting also influence those who were not directly exposed to labeling or tasting via social norm diffusion and social contagion.

Third, our experimental design allows us to independently test for the effects of the labeling and tasting experience. However, the two studies' sampling and design differences mean that we cannot thoroughly compare the labeling and tasting effects in Studies 1 and 2. Furthermore, we cannot test for the potential interactions between the labeling and tasting experience with the current designs. Given our finding that labeling affected the sustainability-related product evaluations and tasting experience (primarily the product quality evaluations), it would be valuable to increase the understanding of potential synergetic and interactive effects between both factors. This would require a 2x2 treatment design that compares the effects of labeling and tasting on their own to those of a combined labeling and tasting treatment and the baseline control group. Moreover, future studies could combine tasting and labeling experiments and test whether differences emerge when products are variously labeled ("meat alternative," "meat substitute," and/or "vegetarian," "plant-based," "vegan," etc.).

Fourth, future (experimental) studies could analyze different types of product labels (e.g., climate or animal welfare labels), combine labeling and the tasting experience with financial incentives and different nudging interventions, and vary the type of dependent variable(s) (e.g., measure labeling and tasting effects on perceived social norms and public support for food policies). For example, such experiments could test how the interaction of information and tasting experience potentially enable social and political feedback dynamics in food system transformation by diffusing social norms in favor of more plant-based diets and shifting public support in favor of policies aimed at reducing meat consumption (Fesenfeld et al., 2023).

7. Concluding remarks and policy implications

In conclusion, our experimental studies add to an emerging strand of literature that investigates how to promote the adoption of meat substitutes, reduce meat consumption, and transform the food system. Our results have important policy implications. First, product labeling and enabling tasting experiences with meat substitutes can shift consumers' product evaluations and preferences, promoting the uptake of meat substitutes. This is particularly important in the context of the increasingly polarized public debate on meat and meat substitutes. Simple nudging interventions in supermarkets and restaurants (e.g., side-by-side placement of meat and meat substitutes on the same shelves) might be a cost-effective way to increase consumers' tasting experiences and change product perceptions (Garnett et al., 2019). Moreover, research suggests that more such tasting experiences could increase public acceptance of policies that target a reduction in meat

consumption (e.g., higher meat taxes), reduce public backlash, and create social and political feedback beyond direct consumer behavior shifts (Fesenfeld et al., 2023). Second, our findings are relevant to the current discussions about the governmental regulation of meat substitute labeling (e.g., in the EU) and programs that support plant-based food (e.g., the recent Danish fund on plant-based food). Labeling substitutes as vegetarian can affect consumers' sustainability- and health-related evaluations while tasting experiences primarily affect product quality perceptions. Removing the present barriers to the uptake of plant-based diets and substitutes is critical for making shifts in diets. Besides improving alternative product quality, availability, and price, our study shows that targeted labeling and positive tasting experiences are promising pathways for encouraging more plant-based diets.

8. Ethics statement

The present study was reviewed and approved by the Ethics Committee of the Department of Psychology at the University of Groningen. All participants gave informed consent before taking part in the study.

9. Data availability statement

The datasets generated during and/or analyzed during the current study and relevant study documentation are available in the Harvard Dataverse public repository: https://doi.org/10.7910/DVN/V4WVYK.

10. Code availability statement

The R code used to analyze the datasets during the current study is available in the Harvard Dataverse public repository: https://doi.org/10.7910/DVN/V4WVYK.

Author contributions

L.F. and L.S. acquired the grant-based funding for data collection. L.F., N.Z., and L.S. led the conceptualization of the study design and the development of the theoretical argument. L.F. and N.Z. designed the survey and embedded the survey experiment. E.vdW. and L.S. provided feedback. N.Z. took the lead in gathering the data. M.G. and L.F. led the preparation of the data for analysis. M.G., L.F., and M.M. jointly analyzed the data. L.F. and M.M. jointly led the writing of the paper, to which all other authors contributed.

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CRediT authorship contribution statement

Lukas Paul Fesenfeld: Writing – review & editing, Writing – original draft, Project administration, Methodology, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Nadja Zeiske:** Writing – review & editing, Project administration, Methodology, Conceptualization. **Maiken Maier:** Writing – review & editing, Writing – original draft, Data curation. **Maria Rachelle Gallmann:** Visualization, Data curation. **Ellen Van der Werff:** Writing – review & editing, Methodology. **Linda Steg:** Writing – review & editing, Funding acquisition, Conceptualization.

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Lukas Fesenfeld reports financial support was provided by Swiss Network for International Studies (SNIS).

Data availability

Data will be made available on request.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.foodqual.2024.105184.

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