Food Quality and Preference 140 (2026) 105869

Contents lists available at ScienceDirect

Food Quality and Preference

journal homepage: www.elsevier.com/locate/foodqual

Drivers, barriers, and intentions related to substituting meat with pulses: a comparative study in at-home and out-of-home settings in Germany

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ARTICLE INFO

Keywords:
Pulse consumption
Meat substitution
Public catering
Sustainable dietary transitions

ABSTRACT

Pulses and pulse-based products are a promising alternative to meat since they have nutritional and environmental benefits. However, their consumption in Germany remains low. In this study, we investigate the factors influencing German consumers' intention to substitute meat with pulses, comparing at-home and out-of-home settings. Based on a nationwide online survey (n = 964), hierarchical regression models were used to analyze person-related, nutritional–psychological, and product-related predictors. The results indicate that meat attachment, age, and an omnivorous diet are significant negative predictors of substitution intention in both settings. Attitudes toward pulses as (ingredients in) food negatively predict substitution intention, potentially indicating moral licensing or an attitude–behavior gap. Contrastingly, subjective norms are significant positive predictors—particularly in out-of-home settings. Taste- and texture-related motives for consuming pulses are relevant only in at-home contexts. These findings emphasize the need for context-sensitive strategies: Efforts to overcome sensory and practical barriers are required in at-home settings, while efforts to make out-of-home settings leverage points through norm-based interventions and professional meal preparation are required. Ensuring product availability and implementing tailored communication are also essential for transitioning toward more plant-based diets.

1. Introduction

The consumption of animal-based products contributes greatly to global environmental issues, such as climate change, biodiversity loss, and land use pressure (Bryant, 2022; UNEP, 2023). With the expectation of the global population increasing to 9.7 billion by 2050 (United Nations, 2024) and the resulting increase in demand for protein sources (Semba et al., 2021), plant-based meat alternatives are becoming popular solutions (FAO, 2022; Frezal et al., 2022). Accordingly, reducing meat consumption and fostering plant-based alternative consumption are considered key measures in promoting more sustainable food systems and achieving the goals outlined in the 2030 Agenda, particularly the Sustainable Development Goals (Chen et al., 2022; United Nations, 2017).

Pulses—as dried seeds from the *Leguminosae* family—are regarded as highly promising substitutes for meat since they are nutritionally dense and rich in plant-based proteins, complex carbohydrates, vitamins, minerals, and dietary fiber. They include, among others, beans, lentils, peas, and lupins (Maphosa & Jideani, 2017; Serrano-Sandoval et al., 2023).

In addition to their nutritional value, pulses are environmentally beneficial due to their low ecological footprint (e.g., 9.2 kg CO_2 eq for a 1 kg beef burger patty and 1.2 kg CO_2 eq for a 1 kg pea-based burger patty) and their restoration of atmospheric nitrogen (Henn, Zhang, et al., 2022; Hueppe & Zander, 2025; Reinhardt et al., 2020). However, despite increasing awareness and policy support, the consumption of pulses in Germany remains low in a global comparison (Federal Office for Agriculture and Food, 2022; Henn, Goddyn, et al., 2022; Melendrez-Ruiz et al., 2019). Whereas per capita pulse consumption exceeded 20 kg per year in the mid-19th century, this has decreased to only 2.5 kg in modern times, while meat consumption in Germany has increased slightly from 52.8 kg per capita in 2022 to 52.9 kg per capita in 2023, then to 53.2 kg in 2024 (Federal Office for Agriculture and Food, 2022; Statista, 2025).

Numerous consumer studies have mentioned several barriers to pulse consumption, such as their lengthy preparation time, potential

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https://doi.org/10.1016/j.foodqual.2026.105869
Received 14 August 2025; Received in revised form 18 December 2025; Accepted 22 January 2026
Available online 29 January 2026

digestive discomfort, and absence from everyday cooking routines (Hueppe & Zander, 2025; Michel et al., 2021). Social norms, taste expectations, and the image of pulses as "a poor man's food" or "vegetarian food" further hinder their broader acceptance (Lemken et al., 2019; Vainio et al., 2016). Pulses as meat substitutes also have a mostly negative image since they are perceived as less natural than animal-based products (Hartmann et al., 2022). Simultaneously, recent research has shown a growing interest in pulse-based dishes, particularly when they are professionally prepared and served in institutional food settings such as canteens or university cafeterias (Faber et al., 2022).

Out-of-home settings are promising leverage points for promoting sustainable dietary choices since approximately 40% of meat products are consumed outside the home (Christoph-Schulz et al., 2018; Speck et al., 2022). A prior study also noted the higher consumption of pulses in out-of-home settings than at-home settings, discovering that consumers often prefer meals they consider to be difficult to prepare themselves when eating out-of-home (Melendrez-Ruiz et al., 2019).

Despite their nutritional and ecological advantages as meat alternatives, pulses and pulse-based products remain underused as meat substitutes in Germany (BLE, 2022; Statista, 2025). While previous studies have explored general barriers to pulse consumption (e.g., Hemler et al., 2022; Marette & Roosen, 2022; Röös et al., 2022; Tidåker et al., 2021), there is almost no research that compares at-home and out-of-home settings in Germany. Consequently, little is known about person- and product-related factors among at-home and out-of-home consumers in Germany, even though these factors may affect the intention to increase pulse consumption as a meat substitute.

2. The aim of our study

The overall objective of this study is to advance our understanding of the factors that influence German consumers' intention to substitute meat with pulses or pulse-based products—an essential yet underused component of sustainable diets. Additionally, by comparing at-home and out-of-home consumption contexts, we examine the impact of person-related, nutritional–psychological, and product-related factors influencing the intention to substitute meat with pulses (see Fig. 1). This comparison is crucial since both settings have contextual differences (e.g., location of consumption; responsibility for planning, grocery, and preparing). According to Pfefferle et al. (2021), in this study, out-of-home settings include communal catering, such as business catering as well as catering in schools and universities but not restaurants. We hope to offer empirical insights into how behavioral drivers vary by setting, thereby providing a differentiated foundation for context-specific interventions, policy recommendations, and communication strategies promoting pulse consumption in Germany.

3. Theoretical background

To establish a structured foundation for understanding consumers' intention to substitute meat with pulses, in this section, we outline the key variables of our study. Drawing on established frameworks in nutritional psychology, we distinguish three overarching categories of influencing factors: (1) person-related factors, (2) nutritional–psychological factors, and (3) product-related factors (Giacalone et al., 2022; Hoek et al., 2011). These categories inspired the structure of our theoretical background and model, as presented in Fig. 1. To follow, each category is discussed in more detail.

3.1. The intention to substitute meat with pulses

In nutritional psychology, the theory of planned behavior is commonly used to explain environmentally friendly and sustainable (dietary) behavior (Ajzen, 2015; Mancha & Yoder, 2015; McDermott et al., 2015; Povey et al., 2000; Stranieri et al., 2016; Weber et al., 2020). Within the theory of planned behavior, behavioral intention refers to the motivational factors that influence a person's decision to perform (or not perform) a behavior and is a measure of how much effort the person is willing to invest therein (Ajzen, 1991).

In general, people are open to trying pulse-based meat substitutes, although opinions vary considerably (Röös et al., 2022). While the overall consumption of pulses (e.g., lightly processed pulses and pulse-based meat substitutes) is less popular than the consumption of meat (Röös et al., 2022), the intention to consume soybeans, peas, lentils, and chickpeas is stronger than for other alternative proteins such as algae,

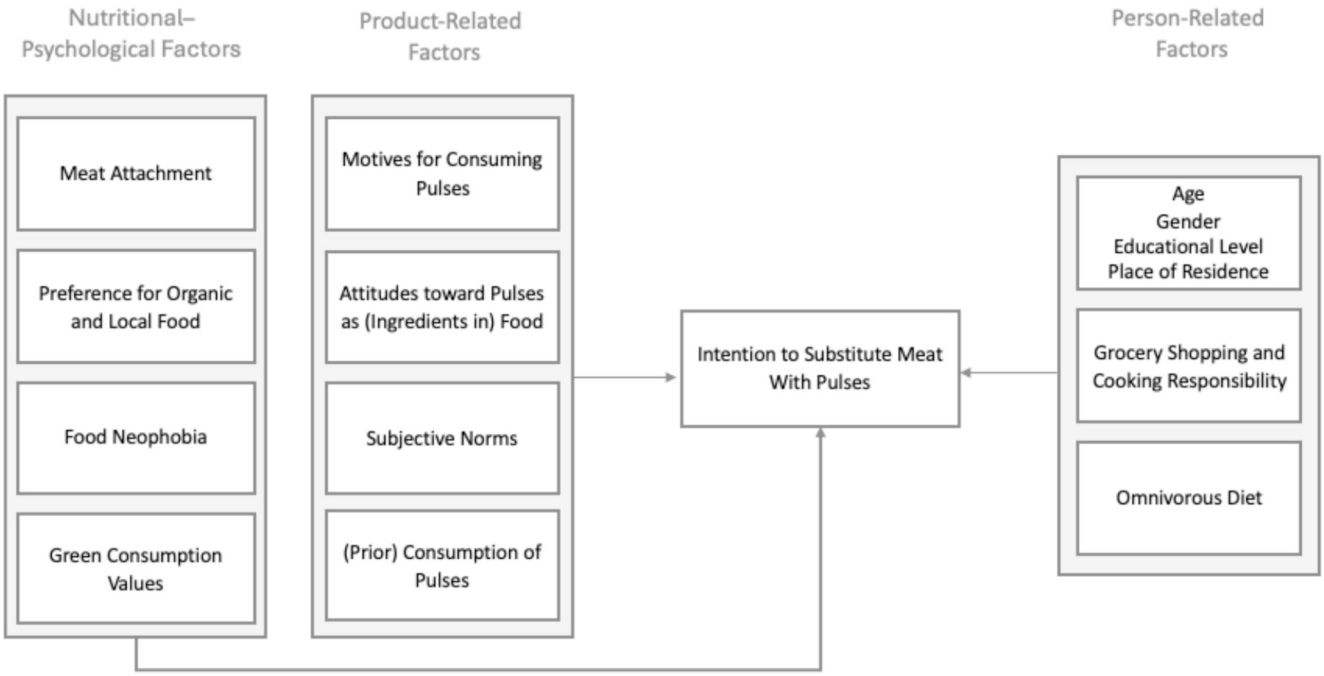

Fig. 1. Overview of the variables and relationships examined in our study.

insects, or cultivated meat, but it remains weaker than for conventional meat such as chicken, beef, or pork (Etter et al., 2024; Faber et al., 2022; Onwezen et al., 2021; Possidónio et al., 2021).

A Europe-wide study found that consumers prefer the taste of a meat burger than that of a pea-based burger, although the latter is rated as healthier and more sustainable (Michel et al., 2021). Another study reported a growing interest in pulse-based meat substitutes, especially when such products are not designed to imitate meat in taste and texture (Faber et al., 2022). This is supported by a review indicating that acceptance of pulse-based meat substitutes increases when these products are not marketed as direct meat alternatives (Lemken et al., 2019). Furthermore, both Henn, Goddyn, et al. (2022) and Faber et al. (2022) observed a significant consumer preference for minimally processed pulses over meat-like products. However, preferences for pulse consumption vary depending on the sample, product, and type of preparation (Laureati et al., 2024; Rabitti et al., 2024).

Pulses are also primarily used to replace beef and pork, mainly for health and sustainability motives, whereas their substitution of fish, cheese, or eggs is less common (Henn, Bøye Olsen, et al., 2022). Despite these trends, most omnivorous German consumers are not prepared to reduce their meat consumption—either now or in future—and reject the idea of replacing meat with pulse-based meat alternatives (Lemken et al., 2019).

3.2. Person-related factors

Several sociodemographic variables—such as gender, age, and educational level—have been shown to influence pulse consumption and the intention to substitute meat with pulses. Regarding gender, studies have shown that women in Europe are more willing to consume pulses than men (Duarte et al., 2020; Henn, Zhang, et al., 2022; Lemken et al., 2019; Reuzé et al., 2022; Röös et al., 2022). However, other studies have reported no significant gender differences in the willingness to consume pulses (Etter et al., 2024). A Finnish study found that women tend to have more taste- and texture-related barriers to pulse consumption than men, though (Kuosmanen et al., 2023).

Most studies have shown a negative correlation between age and the intention to substitute meat with pulses—that is, the younger the individuals, the more they are likely to adopt pulses as a substitute for meat (Gholami Karim Abad et al., 2023; Henn, Bøye Olsen, et al., 2022; Jallinoja et al., 2016; Lemken et al., 2019; Reuzé et al., 2022; Röös et al., 2022). Duarte et al. (2020) found that participants older than 28 years have a strong intention to increase their pulse consumption.

Studies have found a correlation between higher educational levels and the increased and more diversified consumption of pulses (Henn, Goddyn, et al., 2022; Reuzé et al., 2022). Educational levels also correlate with a greater awareness of the health benefits of pulses, which may, in turn, promote their use as meat substitutes (Henn, Zhang, et al., 2022). In cross-national studies, consumers with higher educational levels (e.g., $\geq$13 years of schooling) in Germany, France, Finland, and Portugal were found to be more likely to reduce their meat consumption in favor of pulse consumption (Duarte et al., 2020; Gholami Karim Abad et al., 2023; Lemken et al., 2019; Melendrez-Ruiz et al., 2019). However, some data have indicated that young and less-educated consumers are also among the more frequent consumers of pulse-based meat substitutes (Röös et al., 2022), suggesting the presence of interactions between age, educational level, and substitution intention.

Moreover, food-related decisions in at-home settings are largely shaped by individuals' responsibilities for grocery shopping and meal preparation. The degree to which an individuum is autonomous in food selection and meal preparation is a factor that has been shown to influence dietary behavior and openness toward new foods. Individuals who regularly engage in grocery shopping or cooking are more strongly involved in decision-making processes, tend to possess higher food competence, and are generally more sensitive to practical barriers such as preparation effort or product availability (Hoek et al., 2011; Vainio et al., 2016).

Only individuals who consume meat face the actual decision of whether to reduce or replace it with pulses. Thus, previous studies have consistently shown that omnivorous dietary habits are associated with a lower intention to reduce meat consumption as well as to consume plant-based substitutes such as pulses (Graça et al., 2015; Lemken et al., 2019).

3.3. Nutritional–psychological factors

Among others, Etter et al. (2024) identified nutritional–psychological barriers to pulse consumption. For example, food neophobia—defined as an aversion to trying unfamiliar foods (Pliner & Hobden, 1992)—has been shown to reduce pulse consumption among children and adults (Etter et al., 2024; Rocha et al., 2021). Moreover, a high level of food neophobia negatively influences expectations of the taste, healthiness, and sustainability of a pulse-based product such as a pea-based burger (Michel et al., 2021).

Another relevant factor is green consumption values, which refer to the extent to which ecological and environmental considerations influence individuals' consumption and purchasing decisions (Haws et al., 2014; Kusch & Fiebelkorn, 2019). It has been found that strong green consumption values contribute to sustainable food choices (Gorissen & Weijters, 2016).

Another nutritional–psychological factor that underlies sustainable consumer behavior is the preference for organic and/or local food since this reflects pro-environmental consumption values. Regular consumers of organic food have a higher consumption ratio of plant to animal foods, with a strong relationship between vegetarianism or veganism and organic food consumption (Baudry et al., 2017; Hueppe & Zander, 2025). Concerning meat substitutes, Profeta et al. (2021) identified that organic food consumers in Germany evaluate meat substitutes more negatively than non-organic food consumers. Other studies have found that individuals with strong preferences for organic foods tend to engage more frequently in environmentally conscious dietary behaviors, such as reducing meat consumption and incorporating plant-based alternatives like pulses into their diets (Duarte et al., 2020; Gorissen & Weijters, 2016; Lemken et al., 2019). Additionally, Hueppe and Zander (2021) revealed that organic food consumers are more skeptical of a product when it is more processed. A preference for local food has also been associated with environmentally friendly consumption practices and higher levels of trust in food quality and traceability (Andersen et al., 2022; Faber et al., 2022).

Meat attachment has also emerged as a key barrier to meat alternative consumption (Etter et al., 2024). Consumers with a strong emotional attachment to meat are less likely to view pulses as tasty, healthy, or environmentally beneficial (Michel et al., 2021). However, some evidence has been found to suggest that the rejection of meat alternatives may be influenced by negative attitudes toward meat substitutes more than they are by meat attachment (Etter et al., 2024).

3.4. Product-related factors

Product-related factors include attitudes toward, motives for, and subjective norms related to pulse consumption. *Attitudes* are defined as overall evaluations of objects, people, or concepts based on beliefs, emotions, and prior experiences (American Psychological Association, 2024). In this study, attitudes refer to the perception of the general favorability or unfavourability of pulses as (ingredients in) food. According to the theory of planned behavior, attitudes are among the core predictors of behavioral intention (Ajzen, 1991). However, studies have shown that negative attitudes toward vegetarian and vegan lifestyles can reduce expectations of the taste, healthiness, and environmental benefits of pulses (Michel et al., 2021).

Despite the generally low consumption of pulses among Germans, research has shown that German consumers display a general preference

for lentils produced locally and/or organically, with local origins often valued more highly than organic certification, particularly for less processed products (Hueppe & Zander, 2025). According to a Polish study, consumers most frequently select products containing soybeans (e.g., soya milk, grains, tofu cottage cheese), followed by products containing peas (various frozen foods and canned vegetables) and beans (e.g., ready meals in jars, frozen and dry products). The most infrequently selected products are chickpeas and broad beans due to the seasonality of this plant in Polish cuisine (Śmiglak-Krajewska & Wojciechowska-Solis, 2021). When asked about their expectations for future pulse-based products and preferences for pulse-based alternatives, European respondents with a low willingness to consume pulses mentioned preferring plain pulses over processed pulse-based products. Respondents who had already replaced animal-based foods with pulses stated preferring processed products over products in a meat-resembling form (Henn, Bøye Olsen, et al., 2022).

According to *motives* to consume pulses, research has indicated that consumers who perceive pulses as healthy are more likely to consume them (Appleton, 2024). For example, the perceived health benefits of hybrid products containing pulses significantly increase the likelihood of choosing such products over conventional meat (Appleton, 2024). On the other hand, concerns about anti-nutrition–compounds in pulses that may cause bloating or discomfort—act as barriers to pulse consumption (Henn, Goddyn, et al., 2022; Lemken et al., 2017; Śmiglak-Krajewska & Wojciechowska-Solis, 2021). Additional negative perceptions include associations with animal feed or the image of pulses as "simple" and "rustic" food (Erbersdobler et al., 2017). Moreover, while meat-free products are generally considered healthy, pulse-based meat substitutes are perceived as unhealthy due to their high processing level (Kerslake et al., 2022).

Sustainability and environmental friendliness are widely recognized attributes of pulses, especially among vegetarians and vegans (Faber et al., 2022). Consumers are more likely to purchase pulse-based products when sustainability claims are made or when information about their origin is provided (Andersen et al., 2022).

While vegan, vegetarian, or flexitarian consumers often mention taste and texture as important motives for consumption (Faber et al., 2022), other individuals view unpleasant sensory properties as a key barrier to consumption (Appleton, 2024; Henn et al., 2023; Kuosmanen et al., 2023; Melendrez-Ruiz et al., 2019; Śmiglak-Krajewska & Wojciechowska-Solis, 2021; Tuccillo et al., 2024). This dual factor underscores the subjective and context-dependent nature of taste and texture for pulse consumption.

Although pulses are generally considered affordable and good value for money (Weng, 2019), their preparation time and perceived effort remain major barriers to their consumption (Vainio et al., 2016). Some studies have suggested that price is not a decisive factor for pulse consumption, while others have shown that the higher prices of processed pulse products weaken purchase intention (Lemken et al., 2017; Marette & Roosen, 2022; Śmiglak-Krajewska & Wojciechowska-Solis, 2021).

Subjective norms include the expectations, obligations, and sanctions of social groups concerning a behavior (e.g., a family member's or friend's expectation to consume pulses) (Schwartz, 1977) and thus define what is considered appropriate within a group. Within the theory of planned behavior (Ajzen, 1991), subjective norms reflect the perceived expectations of relevant others (such as family, friends, or colleagues). Studies have shown that social environments and peer behavior can either encourage or discourage the substitution of meat with pulses (Vainio et al., 2016). Further, positive social cues can encourage consumption, while negative social perceptions—e.g., pulses being seen as "food for the poor," unstylish food, or food consumed exclusively by organic shoppers—act as barriers to consumption (Duarte et al., 2020; Lemken et al., 2017). Dynamic social norms—when people perceive that others have already started changing their behavior (e.g., consuming more pulses)—can foster the intention to substitute meat (Carfora & Catellani, 2023). The feeling of being part of a "social trend" can also promote a shift toward a more plant-based diet (Duarte et al., 2020; Lemken et al., 2017). Despite social norms being potential drivers of pulse consumption, modern lifestyles, cultural changes, increased purchasing power, and the resulting increase in meat consumption are considered contributing factors for reduced pulse consumption (Duarte et al., 2020).

Building on the theoretical framework and variables presented in Fig. 1, the following research questions (RQs) were formulated to guide our empirical analysis and identify key differences between at-home and out-of-home consumption settings:

RQ 1: What attitudes and preferences do German consumers hold toward pulses as (ingredients in) food, and how do they differ between at-home and out-of-home settings?

RQ 2: What are the motives for consuming pulses among German consumers, and how do they differ between at-home and out-of-home settings?

RQ 3: Which person-related, nutritional–psychological, and product-related factors influence the intention to substitute meat with pulses, and how do they differ between at-home and out-of-home settings?

4. Material and methods

4.1. Data collection and sample

To answer our RQs, we collected data from throughout Germany. We administered a questionnaire online during January 2025 through the panel provider Bilendi GmbH. Participants were informed about the reasons for the research and how their data would be used. They gave their informed consent and were told that they could withdraw from the survey at any time without giving a reason.

Quotas for age, gender, educational level, and federal state were applied to ensure representativeness according to official German population statistics (German Federal Statistical Office, 2024). The sample included individuals who were at minimum 16 years old and at maximum 69 years old.

In total, 1471 participants completed the questionnaire, followed by a multi-step data cleaning process. First, incomplete responses were excluded (Schendera, 2007). Second, the responses of participants who failed the attention check item ("Please click on 'Totally disagree' to show that you are reading the questionnaire attentively") were removed. Third, responses with extreme outliers in response time were eliminated to minimize careless or disengaged responding. Finally, participants with uniform or non-differentiated response patterns (e.g., straight-lining) were excluded (Meade & Craig, 2012). The final sample size was $n = 964$.

The final sample included 52% women and 48% men, with a mean age of 44.54 years ($SD = 13.46$) for out-of-home consumers (having meals in company, university, or public canteens at least once a week) and 43.45 years ($SD = 15.85$) for at-home consumers (having meals in company, university, or public canteens less than once a week). Gender distribution was comparable to national figures, with minor deviations (Germany: 51% female; 49% male) due to data cleaning (German Federal Statistical Office, 2024). Quotas for educational level and federal state were met. A total of 47% of participants reported regular out-of-home meal consumption, primarily in company canteens (59%), followed by public (24%) and university canteens (17%). Among at-home consumers (53%), most were always responsible for cooking (45%), 40% were mostly responsible, 13% were rarely responsible, and 1% were not at all responsible. An overview of the sample is provided in Table 1 and in Supplementary Material 1.

4.2. Instruments

The online questionnaire comprised three main parts: (1) person-related variables (see Chapter 4.2.1), (2) nutritional–psychological variables (see Chapter 4.2.2), and (3) product-related variables (see

Table 1
Sociodemographic and dietary characteristics of the consumer groups, with frequencies and χ^2 test results.

Variable and response format	At-home consumers		Out-of-home consumers		χ^2	p	V
	n	%	*n*	%			
Gender							
Male	185	35.9	278	61.9			
Female	329	63.9	171	38.1	65.40	< 0.001	0.26
Non-binary	1	0.1	1	0.1			
Age							
16–29 years	147	28.6	78	17.3			
30–39 years	73	12.8	95	21.1			
40–49 years	83	16.3	80	21.7	31.47	< 0.001	0.18
50–59 years	106	20.6	130	29.0			
60–69 years	106	20.4	66	14.7			
Frequency of out-of-home consumption							
Never	360	37.3					
Rarely (max. three times per month)	155	16.1					
Approx. once per week			301	31.2			
Several times per week			148	15.4			
Dietary habits							
Omnivorous	283	55.0	241	53.7			
Flexitarian	173	33.6	169	37.6			
Pescetarian	10	1.9	10	2.2	4.07	0.397	0.07
Vegetarian	38	7.4	22	4.9			
Vegan	11	2.1	7	1.6			

Note. $n = 964$. Indication of absolute (*n*) and relative (%) frequency of participants for the sample, as well as results of χ^2 tests and Cramer's V for sociodemographic and dietary variables.

Chapter 4.2.3).

4.2.1. Person-related factors

Person-related factors included age, gender, educational level, place of residence, cooking and grocery shopping responsibilities, and dietary habits. Participants reported their frequency of out-of-home consumption with the question, "How often do you eat in a canteen?" Responses included 1 = *never*, 2 = *rarely (max. Three times per month)*, 3 = *about once a week*, and 4 = *usually several times a week*. Those indicating weekly or more frequent out-of-home consumption were then asked about their preferred canteen type (company, public, or university).

Dietary habits were assessed by asking participants to choose the category that best described their current diet: 1 = *omnivorous (I do not exclude any foods)*, 2 = *flexitarian (I consciously limit my meat consumption)*, 3 = *pescetarian (I eat fish but not meat)*, 4 = *vegetarian*, 5 = *vegan*, or 6 = *other diet, namely: [open response field]*. Those who consumed meat were also asked whether they intended to reduce their meat consumption within the next 3 months (1 = *yes*, 2 = *no*).

4.2.2. Nutritional–psychological factors

Preferences for organic food were measured using the Witzenhäuser Food Inventory for Organic Food (WFI–OeL) developed by Kühn, Krikser, et al. (2023). The scale comprises a set of five items (e.g., "When buying food, I prefer organic products.") measuring consumers' attitudes toward and preferences for organic food, scored on a scale ranging from 1 to 5 (1 = *strongly disagree*, 2 = *disagree*, 3 = *neither agree nor disagree*, 4 = *agree*, and 5 = *strongly agree*).

Preferences for local food were measured using the Witzenhäuser Food Inventory for Local Food (WFI–LF) developed by Kühn, Profeta, et al. (2023). It comprises five items (e.g., "I spend a little more money on products that are proven to come from my region.") measuring consumers' attitudes toward and preferences for local food, scored on a scale ranging from 1 to 5 (1 = *strongly disagree*, 2 = *disagree*, 3 = *neither agree nor disagree*, 4 = *agree*, and 5 = *strongly agree*).

For measuring meat attachment, participants answered the 5-point Meat Attachment Scale (MEAS) developed by Graça et al. (2015) (1 = *strongly disagree*, 2 = *disagree*, 3 = *neither agree nor disagree*, 4 = *agree*, and 5 = *strongly agree*). We selected four out of the 16 items of the scale developed by Graça et al. (2015) to reduce respondent burden and avoid redundancy. The selected items (e.g., "I love meals with meat.") showed high item-total correlations and factor loadings in prior studies, thereby preserving the scale's reliability while shortening the questionnaire (Kühn, Profeta, et al., 2023).

Green consumption values were measured using six items from the Green Scale developed by Haws et al. (2014). The German version and the response format were adopted from the work of Kusch and Fiebelkorn (2019). The items, an example of which is, "I am concerned about wasting the resources of our planet," were answered on a 5-point Likert scale ranging from 1 = *strongly disagree* to 5 = *strongly agree*. High scores indicate a high degree of green consumer values.

Food neophobia was assessed using the scale created by Pliner and Hobden (1992) and the German translation by Dupont and Fiebelkorn (2020). An example item is, "I do not trust new foods." The 10 items are scored on a 5-point Likert scale ranging from 1 = *strongly disagree* to 5 = *strongly agree*.

4.2.3. Product-related factors

Attitudes toward pulses as (ingredients in) food were assessed using a 7-point semantic differential. The scale comprised four opposing adjective pairs, an example of which is, "Imagine you consume pulses. What is your personal attitude toward pulses as food or as an ingredient in food?" Responses ranged from, 1 = e.g., *disgusting* to 7 = e.g., *delicious*.

Before answering the scale on attitudes, participants were provided with a standardized definition and examples of pulses: "In the questionnaire, we use the term 'pulses' for food such as peas, (kidney) beans, chickpeas, lentils, soy (beans), peanuts, and field beans. Pulses are ripe, edible seeds from plants that form fruit pods. They are characterized by high vegetable protein, fiber, vitamin, and mineral content. Unripe harvested pulses from beans and peas are sold fresh, frozen, or canned and are classified as vegetables." Participants had to confirm that they had read and understood this information before proceeding.

Subjective norms were measured using four items. Participants were asked to indicate their level of agreement with each statement on a 7-point Likert scale ranging from 1 = *strongly disagree* to 7 = *strongly agree*. An example item is, "I can imagine that my friends and family would use pulses as an alternative to meat."

(Prior) pulse consumption was measured with one item adapted from the Food Frequency Questionnaire developed by Feltz et al. (2023). Participants were asked to indicate their frequency of pulse consumption in various forms of preparation (e.g., as patties, raw) on the following scale: 1 = *less often than every 2–3 months*, 2 = *about every 2–3 months*, 3 = *about once a month*, 4 = *about every 2 weeks*, 5 = *about once a week*, and 6 = *more often than once a week*. Moreover, participants were asked about the types of consumed pulses. Specifically, at-home consumers who regularly eat pulses were asked, "You indicated that you consume pulses in various forms at least every 2 weeks. How often did you consume the following pulses at home during the past month?" Out-of-home consumers had to answer the same item, but it was adapted to out-of-home settings: "How often did you consume the following pulses in the canteen during the past month?" Participants rated their frequency of consumption as follows: 1 = *never*, 2 = *rarely (less than once a week)*, 3 = *often (at least once a week)*, or 4 = *I don't know*.

Motives for consuming pulses were assessed using 21 items on a 7-point Likert scale (1 = *strongly disagree* to 7 = *strongly agree*) based on the work of Henn, Goddyn, et al. (2022) and Kuosmanen et al. (2023). Participants were asked "You have indicated to already consume pulses regularly. Why do you eat them?". Principal component analysis (PCA) revealed four components of motives for pulse consumption, indicating convenience- and accessibility-related motives (six items; e.g., "I eat

pulses because they are easy to prepare."), health-related motives (seven items; e.g., "I eat pulses because they are low in fat."), sustainability-related motives (four items; e.g., "I eat pulses because they are environmentally friendly."), and taste- and texture-related motives (four items; e.g., "I eat pulses because I like the texture.").

The intention to substitute meat with pulses was assessed using five items that were adapted for both at-home and out-of-home settings, scored on a 5-point Likert scale ranging from 1 = *strongly disagree* to 5 = *strongly agree*. As per Lemken et al. (2019), participants who regularly eat in canteens were given a scale with the context of meat substitution when eating out of-home (e.g., "I will replace meat with pulses at my next meal" or "I will replace meat with pulses at my next meal in the canteen"). To ensure the relevance of the intention scale, only participants who identified as omnivorous or flexitarian received items for the intention to substitute meat with pulses. Participants who reported following vegetarian, vegan, or pescetarian diets were excluded from this scale, as they do not consume meat.

4.3. Data analysis

All statistical analyses were conducted using IBM SPSS Statistics (version 29.0), with the significance level set at 5%. First, PCA with oblique rotation was performed to examine the dimensionality of the scales. This approach allowed for the differentiated yet correlated representation of conceptually related components and facilitated the empirical examination of their internal structure (Field, 2018). For the reliability analysis, Cronbach's alpha (α) was calculated for all scales and subscales. All Cronbach's α values ranged from 0.73 to 0.90, indicating acceptable to excellent internal consistency (Table 2).

The normal distribution of all variables was checked using Q-Q plots and histograms. Since there was a normal distribution, parametric tests were conducted. To answer RQ 1 and RQ 2, independent sample *t*-tests were performed to compare attitudes, reported consumption, and motives for pulse consumption between at-home and out-of-home consumers. For further group comparisons, a one-way analysis of variance (ANOVA) with Bonferroni post hoc tests were used. Prior to conducting the ANOVA, the assumption of homogeneity of variances was tested using Levene's test, which yielded non-significant ($p > 0.05$) results, confirming that the assumption was met (Field, 2018). To assess the strength of significant mean differences, the partial eta squared (η^2) was calculated as an effect size (Cohen, 1988).

To answer RQ 3, multiple hierarchical regression analyses were conducted to identify predictors of the intention to substitute meat with pulses (Table 5). Prior to these analyses, all assumptions for multiple regression were tested. Variables were included in the regression models in three steps: (1) person-related factors, (2) nutritional–psychological factors, and (3) product-related factors.

5. Results

Both consumer groups differed significantly in their sociodemographic variables, including their gender, $\chi^2(2) = 65.40$, $p < .001$; age, $\chi^2(4) = 31.47$, $p < .001$; federal state, $\chi^2(15) = 60.54$, $p < .001$; and household situation, $\chi^2(2) = 43.36$, $p \leq 0.001$. The largest effect sizes were identified for household situation and gender ($V = 0.26$), federal state ($V = 0.25$), and the highest educational level ($V = 0.21$), while for age ($V = 0.18$), dietary habits ($V = 0.07$), and place of residence ($V = 0.06$), small effect sizes were found (Cohen, 1988). All these results are presented in Table 1.

5.1. Research question 1

RQ 1 was aimed at examining participants' attitudes toward pulses as (ingredients in) food and their reported consumption of specific pulse types, as well as how these differ between at-home and out-of-home consumers.

5.1.1. A comparison of attitudes toward pulses as (ingredients in) food

A *t*-test was conducted to assess differences in attitudes toward pulses as (ingredients in) food between individuals who regularly consume food in out-of-home settings and those who do not. Levene's test confirmed homogeneity of variance, $F(1, 962) = 0.206$, $p = .650$. The *t*-test revealed no statistically significant difference in attitudes between the two groups, $t(962) = 0.186$, $p = .853$. The mean scores were nearly identical (out-of-home consumers: $M = 6.09$, $SD = 0.83$; at-home consumers: $M = 6.10$, $SD = 0.82$), while the effect size was negligible (Cohen's $d = 0.013$), indicating that consumption context did not have a meaningful impact on general attitudes toward pulses.

A one-way ANOVA was performed across four groups based on the frequency of out-of-home consumption *(never; rarely (*max. *Three times per month); about once a week; usually several times a week.)* Levene's test indicated homogeneity of variance, $F(3, 960) = 0.184$, $p = .907$. The ANOVA results revealed no statistically significant difference in attitudes between the groups, $F(3, 960) = 0.660$, $p = .577$. The effect size, as measured using the η^2, was minimal ($\eta^2 = 0.002$), indicating that group affiliation explained only 0.2% of the variance in attitudes.

5.1.2. A comparison of reported pulse consumption

Table 3 shows the reported pulse consumption among participants from at-home and out-of-home settings. Overall, reported pulse consumption was higher in out-of-home settings. In both settings, though, peas were the most frequently consumed pulses, while lupins and fava beans were among the least consumed, with a high proportion of participants reporting that they had never consumed them.

Regarding the product forms that participants consumed, most

Table 2
Means and Standard Deviations of the Scores of At-Home and Out-of-Home Consumers ($n = 964$).

Scale	At-home consumers		Out-of-home consumers		Min.	Max.	α	No. of items
	M	*SD*	*M*	*SD*				
Meat reduction	1.68	0.47	1.57	0.47	1	2	–	1
Preference for organic food (WFI–OeL)	3.05	0.86	3.65	0.73	1	5	0.80	5
Preference for local food (WFI–LF)	3.13	0.76	3.43	0.64	1	5	0.73	5
Meat attachment	3.26	0.99	3.30	0.89	1	5	0.79	4
Green consumption values	3.06	0.84	3.47	0.78	1	5	0.90	6
Food neophobia	2.53	0.76	2.49	0.63	1	5	0.85	10
Attitudes	6.30	0.80	5.93	0.90	1	7	0.74	4
Subjective norms	4.15	1.36	4.70	1.18	1	7	0.88	4
Convenience-related motives	5.00	0.88	5.34	0.84	1	7	0.76	6
Health-related motives	5.48	0.94	5.71	0.86	1	7	0.86	7
Sustainability-related motives	5.05	1.12	5.51	0.94	1	7	0.83	4
Taste- and texture-related motives	5.38	1.16	5.68	0.96	1	7	0.80	4
Intention (at-home consumers)	2.24	0.85	–	–	1	5	0.86	5
Intention (out-of-home consumers)	–	–	2.91	0.81	1	5	0.76	5

Note. Min. = Minimum, Max. = Maximum, *SD* = standard deviation.

Table 3
Reported pulse consumption among at-home ($n = 515$) and out-of-home ($n = 449$) consumers.

	At-home consumers				Out-of-home consumers			
	n (%)							
	Never	*Rarely*	*Often*	*I don't know*	*Never*	*Rarely*	*Often*	*I don't know*
Green beans	58 (11.3)	171 (33.2)	58 (11.3)	3 (0.6)	37 (8.2)	155 (34.5)	129 (28.7)	10 (2.2)
Kidney beans	39 (7.6)	181 (35.1)	69 (13.4)	1 (0.2)	60 (13.4)	143 (31.8)	120 (26.7)	8 (1.8)
Fava beans	199 (38.6)	70 (13.6)	16 (3.1)	5 (1.0)	127 (28.3)	134 (29.8)	49 (10.9)	21 (4.7)
Lupins	232 (45.0)	42 (8.2)	8 (1.6)	8 (1.6)	189 (42.1)	83 (18.5)	33 (7.3)	26 (5.8)
Chickpeas	86 (16.7)	106 (20.6)	94 (18.3)	4 (0.8)	64 (14.3)	144 (32.1)	114 (25.4)	9 (2.0)
Peas	18 (3.5)	122 (23.7)	149 (28.9)	1 (0.2)	15 (2.3)	127 (28.3)	185 (41.2)	4 (0.9)
Red lentils	76 (14.8)	139 (27.0)	73 (14.2)	2 (0.4)	71 (15.8)	139 (31.0)	115 (25.6)	6 (1.3)
Soybeans	142 (27.6)	97 (18.8)	46 (8.9)	5 (1.0)	114 (25.4)	116 (25.8)	86 (19.2)	15 (3.3)
Other pulses	85 (16.5)	133 (25.8)	61 (11.8)	11 (2.1)	78 (17.4)	156 (34.7)	76 (16.9)	21 (4.7)

Note. Rarely = Participants consume pulses less than once per week; Often = Participants consume pulses at least once per week. Even if peanuts are botanically considered pulses, they were excluded from analyses since their preparation differs from that of other pulses. Moreover, peanuts are primarily used as a source of fatty acids, not as a source of protein or as a meat substitute.

participants (43%) reported consuming canned pulses (e.g., lentils, peas, or chickpeas in tins or jars), followed by fresh or frozen legumes (39%) and pulses (25%). Processed products (e.g., tofu, hummus, or patties) were consumed by 17% of participants, plant-based spreads by 12%, and ready-to-eat alternatives (e.g., plant-based sausages or nuggets) by 10%.

5.2. Research question 2

RQ 2 was aimed at examining motives for pulse consumption and the differences between at-home and out-of-home consumers. An overview is presented in Table 4. Independent samples *t*-tests were conducted to examine whether convenience- and accessibility-related, health-related, sustainability-related, and taste- and texture-related motives for pulse consumption differed between individuals who ate in out-of-home settings and those who did not. The results showed significant differences for all four motives. In summary, out-of-home consumers consistently reported stronger motives for pulse consumption. Notably, the largest differences were found for sustainability-, taste-, and texture-related motives. An overview is presented in Table 4.

For convenience- and accessibility-related motives (e.g., affordable, available, easy to prepare), Levene's test indicated equal variances ($p = .465$). There was a statistically significant difference, with $M = 5.34$, $SD = 0.84$ for out-of-home consumers and $M = 5.00$, $SD = 0.88$; 95% CI [−0.47, −0.20] for at-home consumers, $t(619) = -4.87$, $p < .001$. There was also a statistically significant difference between health-related motives among at-home and out-of-home consumers (e.g., source of protein, low fat), with out-of-home consumers scoring significantly higher ($M = 5.71$, $SD = 0.86$) than at-home consumers ($M = 5.48$, $SD = 0.94$; 95% CI[−0.37, −0.09]), $t(619) = -3.15$, $p = .002$.

For sustainability-related motives (e.g., environmentally friendly, plant-based), the assumption of equal variances was violated ($p = .005$). Therefore, Welch's t-test was used. The results indicated significantly higher values among out-of-home consumers ($M = 5.51$, $SD = 0.94$) than among private consumers ($M = 5.05$, $SD = 1.12$), $t(567.57) = -5.56$, $p < .001$, 95% CI[−0.62, −0.30].

Similarly, for taste- and texture-related motives (e.g., delicious, good texture), variances were unequal ($p = .004$), although out-of-home consumers scored higher ($M = 5.68$, $SD = 0.96$) than private consumers ($M = 5.38$, $SD = 1.16$), $t(565.18) = -3.58$, $p < .001$, 95% CI [−0.48, −0.14].

5.3. Research question 3

RQ 3 was aimed at identifying person-related, nutritional–psychological, and product-related factors that may impact the intention to substitute meat with pulses and the differences therein between at-home and out-of-home consumers. Separate multiple linear regression analyses were conducted for each setting. Both models included product-, nutritional–psychological, and person-related predictors. Overall, seven of the 20 predictors for at-home consumers and five of the 20 predictors for out-of-home consumers had a statistically significant influence on the intention to substitute meat with pulses (Table 5).

For at-home consumers, the model explained 63.5% of the variance in the intention to substitute meat with pulses ($R^2 = 0.669$, $\Delta R^2 = 0.635$). Significant negative predictors included an omnivorous diet ($\beta = -0.21$, $p < .001$), meat attachment ($\beta = -0.38$, $p < .001$), age ($\beta = -0.14$, $p = .003$), and attitudes toward pulses as (ingredients in) food ($\beta = -0.12$, $p = .009$). Taste- and texture-related motives were positively

Table 4
Overview of consumers' motives for pulse consumption between at-home ($n = 515$) and out-of-home ($n = 449$) settings.

	At-home consumers	Out-of-home consumers	*df*	*t*	*p*	Cohen's *d*
	M (SD)	*M (SD)*				
Health-related motives	5.48 (0.94)	5.71 (0.86)	619	−3.15	< 0.001	0.90
Taste- and texture-related motives [a]	5.38 (1.16)	5.67 (0.96)	565	−3.58	< 0.001	1.06
Sustainability-related motives [a]	5.05 (1.12)	5.51 (0.94)	577	−5.50	< 0.001	1.03
Convenience-related motives	5.00 (0.88)	5.34 (0.84)	619	−4.87	< 0.001	0.86

Note. Participants who stated that they consumed pulses at least every 2 weeks and up to more than once a week were asked about the motives behind their consumption of pulses. *M* = mean; *SD* = standard deviation. [a] = No homogeneity of variance, and *t*-test values were Welch-corrected.

Table 5
Results of the multiple regression analyses for the intention to substitute meat with pulses in at-home (n = 515) and out-of-home (n = 449) settings.

Variable	At-home consumers					Out-of-home consumers				
	B	*SE B*	β	*t*	*p*	*B*	*SE B*	β	*t*	*p*
Person-related factors										
Age	−0.01	0.00	−0.14	−2.99	** (0.003)	−0.01	0.00	−0.10	−2.03	* (0.043)
Gender	0.05	0.08	0.03	0.56	–	−0.04	0.08	−0.03	−0.51	–
University qualification	−0.10	0.31	−0.05	−0.28	–	−0.03	0.36	−0.02	−0.07	–
No school-leaving certificate or still in school	0.16	0.44	0.02	0.36	–	−1.01	0.57	−0.11	−1.78	–
(Intermediate) secondary school certificate	−0.18	0.31	−0.10	−0.56	–	−0.10	0.37	−0.06	−0.28	–
Place of residence	0.00	0.07	−0.00	−0.05	–	0.08	0.08	0.05	1.07	–
Grocery shopping responsibilities	0.12	0.32	0.02	0.38	–	−0.54	0.61	−0.04	−0.88	–
Cooking responsibilities	0.01	0.11	0.01	0.13	–	−0.10	0.11	0.04	0.86	–
Meat reduction	−0.12	0.09	−0.07	−1.40	–	−0.12	0.08	−0.08	−1.57	–
Omnivorous diet	−0.36	0.09	−0.21	−4.03	*** (< 0.001)	−0.20	0.08	−0.13	−2.46	* (0.015)
Nutritional–psychological factors										
Preference for organic food (WFI–OeL)	−0.00	0.05	−0.01	−0.10	–	0.05	0.06	0.04	0.73	–
Preference for local food (WFI–LF)	0.02	0.06	0.02	0.38	–	−0.00	0.07	−0.00	−0.01	–
Green consumption values	0.12	0.07	0.11	1.73	–	−0.07	0.06	0.07	1.18	–
Food neophobia	−0.02	0.05	−0.02	−0.35	–	−0.03	0.06	−0.03	−0.54	–
Meat attachment	−0.40	0.06	−0.38	−6.32	*** (< 0.001)	−0.30	0.06	−0.29	−5.46	*** (< 0.001)
Product-related factors										
Subjective norms	0.07	0.04	0.10	2.04	* (0.042)	0.10	0.04	0.15	2.51	* (0.013)
Convenience- and accessibility-related motives	−0.08	0.06	−0.08	−1.32	–	−0.03	0.08	−0.03	−0.42	–
Health-related motives	−0.00	0.06	−0.00	−0.01	–	0.11	0.07	0.12	1.43	–
Sustainability-related motives	0.09	0.06	0.12	1.70	–	0.11	0.06	0.13	1.70	–
Taste- and texture-related motives	0.09	0.04	0.12	2.10	* (0.037)	0.04	0.06	0.05	0.65	–
Attitudes	−0.16	0.06	−0.12	−2.65	** (0.009)	−0.13	0.06	−0.11	−2.05	* (0.041)
Prior pulse consumption	0.15	0.05	0.12	2.74	** (0.007)	0.03	0.05	0.03	0.61	–
R^2 (ΔR^2)	0.669 (0.635)					0.477 (0.435)				

Note. University qualifications comprise advanced technical college entrance qualifications or general university qualifications; WFI–OeL = Witzenhäuser Food Inventory for Organic Food; WFI–LF = Witzenhäuser Food Inventory for Local Food; ΔR^2 = adjusted R^2; – = not significant; *** = $p \leq .001$; ** = $p \leq .01$; * = $p \leq .05$.

associated with the intention to substitute meat with pulses (β = 0.12, p = .037), while subjective norms showed a marginally significant effect (β = 0.10, p = .042).

For out-of-home consumers, the regression model explained 43.5% of the variance in the intention to substitute meat with pulses (R^2 = 0.475, ΔR^2 = 0.435). Both an omnivorous diet (β = −0.13, p = .015) and meat attachment (β = −0.29, p < .001) were identified as significant negative predictors here. Moreover, age (β = −0.10, p = .043) and attitudes toward pulses as (ingredients in) food (β = −0.13, p = .041) emerged as slightly significant negative predictors. Contrastingly, subjective norms (β = 0.15, p = .013) proved to be a positive predictor. Taste- and texture-related, convenience- and accessibility-related, and health-related motives did not have any significant impact on the intention to substitute meat with pulses for out-of-home consumers.

6. Discussion

In this study, we examined person-related, nutritional–psychological, and product-related factors influencing German consumers' intention to substitute meat with pulses, comparing at-home and out-of-home settings. Our results contribute to the growing body of literature on sustainable dietary transitions (Poore & Nemecek, 2018) by revealing context-specific structural and motivational differences between consumer groups.

6.1. Attitudes and preferences in different consumption contexts

Our findings confirm that attitudes toward pulses as (ingredients in) food are generally highly positive in both at-home and out-of-home contexts, aligning with previous findings in Germany (Lemken et al., 2019; Michel et al., 2021). Similarly high mean attitude scores ($M \approx 6.1$ on a 7-point scale) and no significant differences were found between the two groups. Additionally, out-of-home consumers mentioned consuming pulses at home, making them at-home consumers, as well. In terms of prior consumption, both groups reported favoring commonly known pulses such as peas and chickpeas, whereas fava beans and lupins were rarely consumed. Although out-of-home consumers reported a higher overall frequency of pulse consumption, they did not report consuming unfamiliar pulses more frequently than at-home consumers. This suggests that the higher overall intake among out-of-home consumers may primarily reflect increased consumption of already familiar pulse varieties, potentially facilitated by greater availability, professional preparation, and menu diversity in out-of-home settings. While previous studies indicate that unfamiliar or less commonly consumed pulses, such as lupins or fava beans, are more likely to be consumed when offered in out-of-home settings due to the reduced preparation barriers and the greater variety of pulse-based dishes (Henn, Goddyn, et al., 2022; Melendrez-Ruiz et al., 2019), our findings suggest that increased availability alone may not be sufficient to promote the uptake of unfamiliar pulses. Instead, it may mainly reinforce the consumption of well-known pulses, highlighting persistent familiarity-related barriers even in out-of-home settings.

6.2. Motives for pulse consumption and contextual differences

The four motive dimensions capture conceptually distinct drivers of pulse consumption. *Convenience and accessibility motives* refer to the perceived ease of preparing, accessing, or integrating pulses into meals. *Health-related motives* reflect the nutritional qualities attributed to pulses, such as protein content or the low amount of fat. *Sustainability-related motives* include environmental and ethical considerations, such as the lower ecological footprint of pulses. *Taste- and texture-related motives* capture the sensory evaluation of pulses and pulse-based dishes. These motives align with established food-choice frameworks that highlight practical, hedonic, normative, and health-oriented drivers of dietary decisions (Renner et al., 2012).

Across all four motive dimensions—convenience and accessibility, health, sustainability, as well as taste- and texture—out-of-home consumers consistently reported higher mean scores than at-home consumers, suggesting that these settings not only facilitate pulse consumption but also enhance the underlying motives. This indicates that out-of-home settings may systematically amplify both practical drivers (e.g., preparation effort and access) and perceptual drivers (e.g., the evaluation of food in terms of their sensory, health-related, or sustainability attributes) of food choice.

For convenience-related motives, out-of-home settings substantially reduce the perceived effort and uncertainty associated with preparing pulses, as professional meal provision removes typical barriers faced at home, such as long cooking times or the need for culinary knowledge. Health-related motives appear to be reinforced through menu design and nutritional labeling, which make health attributes more visible and credible than at home. Sustainability-related and taste- and texture-related motives showed the largest effect sizes, indicating that out-of-home settings particularly strengthen environmental considerations and sensory acceptance—both central determinants of dietary transitions toward plant-based foods.

These findings suggest that out-of-home settings may not only reduce practical barriers to pulse consumption but also foster positive perceptions and experiences through repeated exposure (e.g., Henn, Bøye Olsen, et al., 2022; Kuosmanen et al., 2023), which can enhance familiarity and reduce neophobia. Taste concerns—a known deterrent in private households (Rabitti et al., 2024)—may be overcome when meals are professionally prepared. The significance of sustainability-related motives among out-of-home consumers also aligns with the findings of previous studies showing that environmental messaging in out-of-home settings can increase the awareness and acceptance of pulses as (ingredients in) food (Andersen et al., 2022; Carfora & Catellani, 2023).

At-home consumers face more pronounced challenges related to preparation and taste—barriers frequently cited in earlier studies (Vainio et al., 2016). These may stem from a lack of culinary routines involving pulses, limited knowledge of preparation methods, or concerns about family acceptance, all of which can dampen motivation. This emphasizes the importance of treating out-of-home settings not merely as distribution points but as high-leverage points for dietary transitions (Speck et al., 2022) by introducing consumers to pulse-based dishes in a low-effort, low-risk manner. Setting-specific framing of pulses (e.g., as sustainable and flavorful in canteens, as convenient and simple to prepare at home) could be a promising strategy to tailor communication and reduce perceived barriers—either through ease of access or by lowering the psychological cost of experimenting with pulses, that is, by counteracting the subjectively perceived mental effort, hesitation, or uncertainty associated with trying pulse-based meals. Such tailored framing can also enhance perceived self-efficacy at home and reinforce normative signals in out-of-home environments.

It is plausible that the higher motive scores reported by out-of-home consumers partly reflect their greater familiarity with pulse-based dishes, as higher consumption frequency can reinforce positive perceptions through repeated exposure. This aligns with earlier findings showing that familiarity and experience enhance sensory liking and the perceived sustainability of pulses (Henn, Bøye Olsen, et al., 2022; Kuosmanen et al., 2023).

However, the observed differences are likely not solely attributable to consumption frequency. They may also reflect contextual factors inherent to out-of-home settings—such as professional preparation, social dining situations, or menu framing—that can strengthen taste-, convenience-, and sustainability-related motives. Understanding the differential relevance of these four motives is crucial as each of them requires distinct interventions: convenience barriers call for infrastructural support, health motives relate to nutritional framing, sustainability motives require communicative cues, and taste-related motives call for culinary innovations.

6.3. Predictors of substitution intention in at-home and out-of-home settings

Across both at-home and out-of-home contexts, meat attachment emerged as the strongest negative predictor, consistent with previous research (Etter et al., 2024; Graça et al., 2015). This indicates that individuals who attribute high emotional value to meat are less inclined to consider meat alternatives, including pulses, as viable meat substitutes. Moreover, it shows that for many consumers, meat is not merely a food product but has become part of a broader identity structure, preventing its substitution (Etter et al., 2024; Graça et al., 2015). This result aligns with those of previous studies showing that the moralization of meat—often framed around tradition, identity, or perceived naturalness—can act as a barrier to dietary change, especially when alternative protein sources are framed as ideological or identity-threatening (Graça et al., 2015; Possidónio et al., 2021). From a behavioral interventionist perspective, this suggests that communication strategies emphasizing moral superiority or guilt might be counterproductive and may even provoke resistance to substitution among individuals with strong meat attachments. Consequently, interventions targeting meat reduction should avoid identity-threatening messages and instead focus on the low entry points and non-threatening framing of pulses as complementary meal options, as Onwezen et al. (2021) suggested.

Another noteworthy finding was that an omnivorous diet significantly weakens substitution intention among both at-home and out-of-home consumers. This supports the assumption that existing dietary patterns exert a stabilizing effect on food choices. That is, the habitual nature of meat consumption—reinforced by personal cooking routines and cultural expectations—may be more resistant to change in private contexts (Onwezen et al., 2021; Ruby et al., 2015). In at-home settings, individuals also have greater autonomy and habitual reinforcement compared to the more constrained and standardized environment of out-of-home settings. However, in this study we defined omnivorous diet as "I do not exclude any foods." In line with a reviewer's comment, the definition of omnivores should be adjusted in future studies, since some consumers might not like particular animal foods such as offal or mussels, but would still be considered omnivores.

We identified age as a negative predictor of the intention to substitute meat with pulses. Specifically, younger consumers had a stronger intention to substitute meat across both groups. This result is consistent with those of other studies (e.g.,Gholami Karim Abad et al., 2023; Henn, Bøye Olsen, et al., 2022; Jallinoja et al., 2016; Lemken et al., 2019; Reuzé et al., 2022; Röös et al., 2022), which showed that the older the participant, the weaker their intention to substitute meat with pulses and vice versa (Gholami Karim Abad et al., 2023; Henn, Bøye Olsen, et al., 2022; Jallinoja et al., 2016; Lemken et al., 2019; Reuzé et al., 2022; Röös et al., 2022).

The negative impact of age on the intention to substitute meat with pulses may reflect generational differences in dietary habits, openness to change, and health-related perceptions. Older individuals often exhibit more stable eating patterns and may be less receptive to incorporating new foods, such as pulse-based meat alternatives, into their diets since they know pulses as a traditional ingredient from earlier times. In addition, meat tends to hold higher cultural value among older generations, while pulses are sometimes perceived as less satisfying or associated with a lower social status. Health concerns, such as digestive discomfort, may also contribute to decreased acceptance within this age group (Henn, Goddyn, et al., 2022; Lemken et al., 2019; Śmiglak-Krajewska & Wojciechowska-Solis, 2021). Finally, younger individuals may be more readily influenced by sustainability-related motives, which could explain their greater willingness to adopt plant-based alternatives (BMEL, 2024).

The significant positive impact of subjective norms—particularly in out-of-home settings—that we found reinforces the findings of Hartmann and Siegrist (2017), who emphasized the power of perceived social expectations over sustainable consumption behavior. These findings

align with the theory of planned behavior (Ajzen, 1991) and support recent research on the impact of dynamic social norms in dietary behavior (Carfora & Catellani, 2023), as well. In out-of-home settings, food choices are public, visible, and socially embedded—making normative cues more effective. This was supported by Makov et al. (2023), who emphasized the powerful effect of an individual's immediate social and physical context on their food choices. Therefore, intervention strategies that leverage social modeling (e.g., promoting popular choices) may be especially effective in out-of-home settings, where peer presence and behavioral visibility are high.

Taste- and texture-related motives were found to be significant only for at-home consumers, where personal taste expectations and meal preparation control are more prominent. Contrastingly, taste is externally shaped and less controllable in out-of-home settings. Therefore, out-of-home consumers have limited control over preparation methods or product selection, making taste- and texture-related concerns less impactful.

Contrary to our expectations, health- and convenience-related motives and accessibility-related motives did not emerge as significant predictors in either context. While these attributes have been cited frequently as facilitators in consumer surveys (Apostolidis & McLeay, 2016), their actual impact on behavioral intention appears to be less significant when stronger emotional or normative drivers are present.

Although attitudes toward pulses as (ingredients in) food were found to be positive and did not differ significantly between at-home and out-of-home consumers, they were inversely related to substitution intention. This finding contradicts well-established findings in behavioral research on pulses that showed attitudes to be a positive predictor of intention (e.g., Hemler et al., 2022; Melendrez-Ruiz et al., 2023). Several explanations may account for this pattern.

First, theoretical and psychological explanation may play a role. One possibility is a moral licensing effect, where individuals with favorable attitudes toward pulses might perceive themselves as already doing "enough" and thus feel less urgency to act further, resulting in weaker substitution intentions. Similarly, consumers with more positive attitudes toward pulses may already consume pulses more frequently, which could naturally limit their intention to further increase consumption.

Second, contextual factors may reduce the relevance of attitudes toward pulses as (ingredients in) food for substitution intentions. When eating out-of-home, consumers may be less self-determined and more constraint by menu availability, social settings, or convenience, which may weaken the influence of general attitudes on specific substitution decisions.

Third, methodological explanations should be considered. The intention scale framed substitution specifically, while individuals might consume pulses for reasons unrelated to meat replacement. Thus, positive attitudes toward pulses may not translate into intentions to consume them as a meat substitute. This mismatch reflects a broader attitude–behavior gap (Kollmuss & Agyeman, 2002; Sheeran & Webb, 2016; Vermeir & Verbeke, 2006), whereby positive attitudes fail to translate into intentions due to habitual, social, or practical barriers. The use of different attitude objects (general pulses) and intention objects (pulses as meat substitutes) may have further contributed to this discrepancy.

Lastly, shared variance with other predictors–such as meat attachment or subjective norms–may have suppressed the effect of attitudes within the regression model. Future research could apply alternative modeling approaches (e.g., structural equation modeling) to clarify overlapping variance structures and improve model specification.

Overall, our findings illustrate that the intention to substitute meat with pulses is driven by an interplay between personal dispositions, social influences, and setting-specific constraints. However, this study also has some methodological considerations. Although the inclusion of a large set of predictors can be viewed critically with respect to model complexity and potential multicollinearity, all statistical assumptions were tested and fulfilled. Moreover, each variable was retained based on theoretical and empirical justification. Nevertheless, the considerably higher explanatory power of the regression model for at-home consumption compared to out-of-home consumption suggests that psychological variables are more influential in autonomous settings, while in out-of-home settings, structural and contextual factors (e.g., limited menu options, menu composition, availability, peer group effects, placement in menu plans, price cues) may matter more but were not fully explored in our study.

6.4. *Implications for policy, marketing, and further research*

The findings of this study have practical implications for stakeholders in policymaking, food marketing, and out-of-home catering. They emphasize the important role of out-of-home settings as effective leverage points for promoting the consumption of pulses and contributing to dietary change.

Institutional food environments not only provide physical access to pulse-based meals but also reinforce positive motivational structures, particularly in relation to sustainability and sensory experience. Therefore, pulse-based dishes should not be treated as niche or vegetarian-specific alternatives but should rather be integrated into mainstream menu offerings. Professional preparation, attractive presentation, and repeated exposure can also help normalize pulse consumption and reduce perceived barriers to pulse consumption—especially when dishes are offered as standard options rather than labeled as alternatives (Cosson et al., 2025).

Our results underline the potential application of social norms and peer dynamics in public food settings. Promoting what others are choosing—with messages stating, for example, "Many students chose a pulse dish last week"—can be more effective than relying solely on nutritional or environmental claims. These approaches may also strengthen the intention to consume pulses through social modeling and reduce psychological resistance by shifting perceived norms.

For at-home consumers, knowledge about how to prepare pulse-based meals is key. Even the most favorable attitudes or subjective norms cannot translate into behavior if people are lacking knowledge about what and how to easily prepare pulse-rich dishes (Amoah et al., 2023; Figueira et al., 2019; Henn, Goddyn, et al., 2022; Lombardo et al., 2023). Therefore, communication formats emphasizing taste, texture, and preparation convenience, such as easy-to-follow recipes or cooking tutorials, may also offer low-threshold entry points to increase pulse consumption at home.

Concerning public policy, interventions should be setting-specific and evidence-based. In schools, universities, and public institutions, procurement guidelines and menu policies could explicitly promote the inclusion of pulses. In the private sphere, subsidies for pulse products or public campaigns focused on flavor and convenience may prove more effective than purely informational efforts. Furthermore, to reach more meat-attached consumer segments, policy communication should avoid moralizing narratives that could provoke resistance and instead frame pulses as enriching additions to one's diet.

While we provide some meaningful insights into pulse consumption, further research is needed. The strong context-dependence of subjective norms calls for a more nuanced investigation into how visibility, group identity, and peer presence shape food decisions—especially in out-of-home settings. Experimental studies in real-life canteens could test the effect of norm-based prompts and menu designs on actual meal choices. Moreover, longitudinal research could assess whether stated intentions to substitute meat with pulses translate into actual behavioral change over time and how this may differ across settings. On the other hand, how encouraging out-of-home consumption increases the consumption of pulses in at-home settings should also be explored. Further research should also explore interaction effects between predictors, such as how subjective norms moderate the impact of attitudes or meat attachment. Expanding the analysis to include intervention-based designs could aid in testing the causality of observed relationships. For example, it would

be valuable to investigate how subjective norms moderate the influence of meat attachment or how social exposure in canteens alters sensory expectations.

We underscore the relevance of context in our study. The same individual may behave differently depending on whether they eat at home or in a public setting. Therefore, successful interventions must be sensitive to setting-specific dynamics—aligning environmental design, messaging, and behavioral prompting in a targeted and evidence-based manner. Our findings also suggest that the promotion of pulse consumption should not be limited to isolated interventions but should rather be embedded within overarching sustainability and nutrition strategies. Public procurement policies, university meal standards, and regional campaigns can also be used to help frame pulses as meaningful contributors to climate-friendly and health-conscious eating since out-of-home settings reach a broad and often habitual audience (e.g., students, employees). Interventions here can have systemic effects, first by shaping both immediate choices and longer-term food habits that may carry over into at-home settings, and second by canteens not only serving as distribution points but also as experiential learning spaces that can foster familiarity and sensory acceptance (Faber et al., 2022; Hueppe & Zander, 2025).

7. Conclusion

This study demonstrates that the intention to substitute meat with pulses is shaped by a combination of person-related, nutritional—-psychological, and product-related factors. It highlights that meat attachment, an omnivorous diet, and higher age emerged as key barriers to substituting meat with pulses in both at-home and out-of-home contexts, while subjective norms played a particularly important role in out-of-home settings. Out-of-home consumers reported stronger sustainability-, taste-, and health-related motives, highlighting the potential of institutional food environments for promoting pulse consumption. These results underscore the need for setting-specific strategies—addressing sensory and practical barriers in at-home contexts and harnessing social norm effects in public catering—to promote a broader transition toward more plant-based diets in Germany.

CRediT authorship contribution statement

Alina Weber: Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Conceptualization. **Florian Fiebelkorn:** Writing – review & editing, Funding acquisition. **Thomas Krikser:** Writing – review & editing, Funding acquisition, Formal analysis. **Ulrich Enneking:** Writing – review & editing, Supervision, Project administration, Methodology, Funding acquisition, Formal analysis, Conceptualization.

Ethical statement

The study was conducted in accordance with the Declaration of Helsinki and relevant national guidelines for research involving human participants. Data were collected in Germany in January 2025 via the panel provider Bilendi GmbH. Participants were fully informed about the purpose of the research, the study requirements, and how their data would be used. They were assured that participation was voluntary, that they could withdraw from the survey at any time without providing a reason, and that all responses would be kept confidential, de-identified, and reported only in aggregate form. No personally identifying information was collected, and no data were released without participants' knowledge.

Before starting the questionnaire, participants were required to read and agree to the informed consent statement: “I am aware that my responses are confidential, and I agree to participate in this survey.” An affirmative reply was required to proceed. The survey did not involve vulnerable populations, and no photographs or identifying materials of participants were collected. Participants completed the questionnaire on their personal devices and received incentives of between €0.75 and €1.20.

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

During the preparation of this work the authors used ChatGPT Version 1.2025.210 in order to improve wording and language clarity. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgments

This research was supported by the Federal Office for Agriculture and Food under the LINSE-project (“Leguminosen für eine suffiziente Ernährung”) (No. 2822EPS009) and did not receive any other grants from funding agencies in the commercial or not-for-profit sectors. We would like to thank the participants for their time and willingness in participating in this study and L. Kyriacou for proofreading the manuscript. We would also like to thank the working group “Socioeconomics in Household and Businesses”, led by Prof. Dr. Melanie Speck, for their valuable discussions and advice, as well as all other project collaborators for their critical questions and constructive exchange.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.foodqual.2026.105869.

Data availability

Data will be made available on request.

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