CUES

CONSUMERS' UNDERSTANDING OF EATING SUSTAINABLY

D2.1

Report on the social, economic and environmental factors that influence sustainable food choices

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Executive Summary

Despite emerging consumer trends and an increasing number of policies promoting sustainable food consumption, the transition toward societal tipping points for sustainable food systems remains slow and uneven. The transition is slow and uneven due to a complex intertwining of factors, including consumer misconceptions, social and economic inequalities across the food value chain, and fragmented policy landscapes. Overcoming these challenges requires more than isolated interventions; it calls for a system-wide, actor-inclusive approach that importantly considers consumers' knowledge, perceptions, and motivations shaping their food choices.

This report presents the findings of Task 2.2 of the Horizon Europe CUES project, which investigates the social, cultural, economic, and contextual factors that influence sustainable food consumption across Europe. Drawing on a rich mixed-methods approach combining qualitative and quantitative research, the report provides insights into how individuals perceive, define, and respond to sustainable food in different cultural and socioeconomic settings.

The qualitative strand of the research consists of three focus group research lines. The first line explores how consumers across various countries understand the concept of sustainable food and how they perceive individual, sociocultural, economic, and contextual factors to adopt more sustainable food behaviours. This line also sheds light on the perceptions of the value chain stakeholders, policy and uptake of food labelling. The second research line focuses on the sense-making and resistance of anti-vegans - consumers who strongly oppose veganism, an established sustainable food diet, and subsequent lifestyle. It examines how cultural and informational influences potentially shape their views and sense-making processes. The third line investigates consumer reactions to plant-based fish and seafood alternatives, revealing how participants make sense of these novel products and the extent to which they view them as viable and authentic options.

Refining the insights from both the literature reviews conducted under Task 2.1 and the abovementioned focus groups, three survey research lines were developed. The first survey examines how individual, socio-cultural, media-related, and contextual factors shape sustainable food consumption patterns across various European countries. The second survey investigates which product attributes, such as nutritional information, price, sustainability certification, brand familiarity, texture, and packaging, strongly influence purchasing preferences for plant-based meat products in point-of-sale settings. This line also explores how individual and contextual factors interact to inform consumer intentions and ethical judgments. The third survey focuses on consumers' willingness to reduce dairy consumption and consumers' acceptance of plant-based milk and dairy alternatives.

In addition to these three lines, two targeted surveys were developed for vulnerable populations: specifically, low-income individuals and older adults. These instruments adapted key constructs, in specific frequency of sustainable food consumption and food waste behavior, as indicators from the broader surveys to address these groups' specific drivers, barriers, and needs. An overview of the research lines, countries, methodologies and thematic foci can be found in the Appendix.

By synthesizing these findings, this report serves as a foundation for evidence-based intervention design, guiding future research efforts and contributing to the transition toward a more sustainable food system. The empirical insights generated here provide a grounded understanding of sustainable consumer

behavior and serve as a critical input for developing inclusive, culturally relevant, and effective strategies across the CUES project.

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Table 1: Terms and Definitions

Acronyms	Meaning
M	Mean
SD	Standard Deviation
fsQCA	Fuzzy-set Qualitative Comparative Analysis
IV	Independent Variable
SEM	Structural equation modeling

1. Focus Group Discussions

1.1 Dimensions of Sustainable Food Choices and Influencing Factors

1.1.1 Aims

The first line of focus group research within Task 2.2 explores how consumers across diverse European contexts define, perceive, and engage with the concept of sustainable food. The primary objective is to gain an in-depth understanding of the individual, socio-cultural, economic, and contextual factors that act as either enablers or barriers to the uptake of sustainable food behaviours and choices.

Unlike previous approaches primarily focusing on environmental sustainability or emphasizing individual-level variables in isolation, the present approach adopts a holistic view. It explicitly integrates the three core dimensions of sustainability, namely social, economic, and environmental, into its research design. This comprehensive perspective is essential to also uncover how consumers interpret trade-offs between the sustainability dimensions, and to explore the value tensions that often shape real-world food choices. Prior research has highlighted the dominant focus on environmental aspects (e.g. Vermeir & Verbeke, 2006), while food choices' social and economic implications, including fair labour conditions, and local economic support, are often overlooked. By addressing all three dimensions, this research line contributes to a more complete and inclusive understanding of sustainable consumption, aligning with the ‘Consumer and Cultural Change’ dimension of the *Triple Change* strategy that is a core element of the CUES project, as put forward by Polyportis et al. (2024a). The theoretical framework guiding this line draws on the findings of task T2.1, and on the Theory of Planned Behavior (Ajzen, 1991) and its extension through values and norms-based models, recognizing that sustainable food consumption involves both rational decision-making and identity-driven, affectively charged responses, together with macro-environmental factors.

An overview of this and the other research lines, including countries studied, methodology, and thematic foci, is provided in Table 8 in the Appendix. All studies reported herein were approved by the relevant institutional ethics board, and the corresponding research protocols were submitted as part of the ethics application process.

1.1.1.1 Country Selection

To ensure a diverse and representative cross-section of consumer perspectives, focus groups were conducted across eight European countries: the Netherlands, Belgium, and Germany representing Western and Northern Europe; Italy, Spain, and Portugal representing Southern Europe; and Greece and Hungary representing Southeastern and Eastern Europe respectively. These countries were selected to capture variation in food cultures, sustainability discourses, socio-economic conditions, and policy exposure. By engaging participants from this geographical spread, the findings aim to provide a rich empirical basis for informing the design of tailored interventions in subsequent Work Packages.

1.1.2 Methods

The focus groups were conducted between October and December 2024 across eight European countries (Belgium, the Netherlands, Germany, Spain, Portugal, Italy, Greece, and Hungary) facilitated by local CUES partners who are associated with T2.2 and assisted with recruitment and moderation. These countries were selected to reflect cultural, economic, and policy diversity across Western, Northern, Southern, and Eastern Europe, offering a robust comparative lens on sustainable food consumption. Partners followed a protocol that was finalized after their input, while maintaining flexibility for culturally adapted moderation, ensuring consistency.

The development of the focus group protocol was grounded in an extended behavioural framework. Drawing primarily from the Theory of Planned Behavior (Ajzen, 1991) and its augmentation by Aertsens et al. (2009), the protocol incorporated constructs such as emotions, personal moral norms, subjective norms, culture, policy. These constructs were chosen to capture the individual, psychological, socio-economic and contextual processes that shape food-related choices and behaviours. The focus group protocol was carefully designed to give equal weight to the three dimensions of sustainable food consumption, namely environmental, social, and economic, rather than focusing disproportionately on environmental issues, as is common in existing research. In specific, to explore consumer expectations and informational needs related to sustainable food choices, the focus group protocol included a dedicated set of questions for each of the three dimensions of sustainability: environmental, social, and economic. These questions were carefully developed to uncover how informed consumers feel in each area, what sources they rely on, and what kind of labelling or information they expect to guide their choices. By prompting participants to reflect not only on their knowledge but also on their expectations more broadly, the discussion was designed to elicit in-depth insights into perceived gaps, and desired improvements in sustainability communication and labelling. This structure enabled the identification of overlooked areas, especially in the social and economic domains, where consumer awareness and expectations may be underdeveloped, yet potentially actionable.

Afterwards, this balanced approach enabled the exploration of a broader set of influencing factors, categorized into the following domains. Individual-level factors included participants' values, emotions, food-related knowledge, and perceived moral norms. Social influences were explored through questions related to family and social pressures. Economic considerations were probed through discussions on perceptions of pricing and availability, as intrinsic elements of perceived behavioural control. Finally, contextual factors were examined through questions on awareness of local policies and regulations, for instance, regarding labelling sustainable food products, together with perceptiomns of the value chain.

The focus group format was intentionally selected to foster interaction and dynamic co-construction of meaning. Compared to individual interviews, group discussions allow researchers to observe how collective understandings emerge in real-time (Farnsworth & Boon, 2010). This was particularly valuable for investigating how participants interpret trade-offs across sustainability dimensions and negotiate value tensions in everyday food decisions. Also, emotion-based dynamic prompts were used to elicit affective responses that are often underrepresented in standard consumer research.

The focus group data were analysed using standard qualitative research practices, involving anonymization of responses, systematic interpretation of participant responses to identify meaningful patterns and insights across countries, aligned with the study's guiding aims.

1.1.3 Findings

Insights from the focus groups suggest that a rich and complex configuration of individual motivations, social influencers, economic constraints, and contextual conditions often influences consumer engagement with sustainable food. These findings reveal the multidimensional nature of consumer reasoning and the need for more integrated systemic approaches to promoting sustainable food consumption, which go beyond environmental impact and explicitly incorporate social and economic sustainability dimensions.

From an individual perspective, participants often showed increased awareness of all three dimensions of sustainability, with the environmental dimension often being more prevalent and thus less susceptible to trade-offs. Participants often expressed clearer expectations and needs with regards to the environmental dimension. Participants frequently expressed alignment with expected values and moral norms, such as environmental responsibility, and health. However, the strength of these values did not always translate into consumer expectations or behavior, especially when sometimes challenged by economic considerations such as limited availability, or price concerns. Emotions, extracted through participants' interactions on Plutchik's Wheel, often played a significant role, with noted feelings of pride, or guilt that influence sustainable choices, aligned with previous literature (e.g. Mahasuweerachai et al., 2023).

Socio-cultural dynamics also emerged as influential. Participants often reported that their food choices were shaped, either positively or negatively, by family traditions, peer opinions, and prevailing cultural norms and practices. In some cases, participants described social resistance to change. Informational (i.e. from labelling, media and peers) and economic (i.e. pricing) influences were highlighted and often acted as a significant antecedent of sustainable food expectations, needs and choices. In relation to food labelling specifically, in some cases, participants expressed concerns about current labelling schemes. Participants often emphasized the importance of transparency, clarity, and trusted third-party certification as attributes of sustainable labelling. Selected focus groups called for more comprehensive labelling schemes that include not just environmental indicators, but also social (e.g. working conditions) and economic dimensions.

Contextual and systemic factors, including policies and labelling practices, together with perceptions of the food value chain stakeholders, were also central to the discussions. Participants sometimes voiced skepticism toward larger food corporations, while local producers were viewed as more authentic but often less accessible. Retailers were often seen as playing an influential role in shaping choices as an external economic force, yet not always using their power to prioritize sustainability. Across focus groups, a lack of consistent and strong policy support, national guidance, and labelling standards was sometimes noted, citing a lack of optimal efforts to make sustainable food options visible, affordable (as an aspect of economic sustainability), or easy to choose, although there was also an acknowledgement that efforts have been made in recent years. Participants expressed the need for more government-

backed subsidies, certification and stronger regulation measures to make sustainable options more visible and affordable.

Overall, the focus groups suggest that sustainable food consumption is not a singular behavior but rather a dynamic, often ambivalent process shaped by the interaction of individual factors such as personal values, social influence, structural constraints, informational clarity through optimisation of attributes for uptake of sustainable labelling, contextual and systemic factors. Importantly, these early findings underscore the relevance of addressing all three sustainability dimensions - environmental, social, and economic - within future interventions and policy frameworks. The findings also affirm the importance of considering not just individual attitudes or knowledge gaps, but also the broader cultural and systemic conditions that shape what is perceived as available, desirable, and socially acceptable in consumers' everyday lives.

1.2 Sensemaking and Resistance of Anti-Vegans

1.2.1 Aims

The second line of focus group research within Task 2.2 explores the sense-making processes and resistance of individuals who actively oppose veganism, commonly referred to as anti-vegans (Gregson et al., 2022). Studying anti-vegans is crucial for understanding resistance to plant-based diets, which are a key component of the sustainable food transition (Verain et al., 2020). Their perspectives represent a significant challenge to policies and interventions promoting plant-based consumption, as their opposition is often rooted in deeply held cultural, moral, and social convictions. Hence, gaining insight into these opposing viewpoints supports the broader goal of identifying socio-cultural barriers to sustainable food choices, and forming culturally and socially optimized strategies for sustainable food transitions.

This research line contributes to the 'Consumer and Cultural Change' dimension of the Triple Change strategy, which is the core element of the CUES project, recognizing that behavioural shifts toward sustainability are unlikely to succeed without addressing consumer resistance and identity-related tensions (Polyportis et al., 2024a, 2024b). The existing literature largely focuses on identity conflicts between vegans and anti-vegans, especially within online contexts (Gregson et al., 2022). However, less attention has been paid to the in-depth cultural and informational dimensions that shape anti-vegan perspectives and sense-making processes through qualitative research. Theoretically, the study is guided by Psychological Reactance Theory (Brehm & Brehm, 2013), which explains opposition as a response to perceived moral imposition, and Moral Disengagement Theory (Bandura, 1996; Moore, 2015), which accounts for how individuals rationalize choices that conflict with internal ethical norms through justification, displacement, or denial of responsibility.

The present research extends this literature by situating anti-vegan perspectives within the broader socio-cultural context, while exploring perceived asymmetries in moral flexibility, trust in plant-based food products and labelling, and (mis)information, which are within the scope of T2.2.

1.2.1.1 Country Selection

Focus groups were conducted in two countries: Greece and the Netherlands. These countries were selected for their contrasting cultural orientations toward food and dietary norms; in particular, Greece represents a Mediterranean meat-centric culture with strong food traditions, and the Netherlands represents a Northern European context where plant-based diets have gained greater institutional and consumer-level traction. This cross-cultural design offers an opportunity to explore how different cultural narratives, informational influences, and policy environments shape resistance to veganism. The findings contribute empirical insights for tailoring future interventions to both culturally established and progressively shifting food systems.

1.2.2 Methods

Two focus groups were conducted in October 2024, one in Greece and one in the Netherlands, with six participants in each group. While this study includes two focus groups, such sample is consistent with accepted qualitative research practices (e.g., Mancini et al., 2017), where in-depth insights rather than generalizability are prioritized. Participants were selected using a combination of purposive and snowball sampling to ensure that all group members explicitly self-identified as anti-vegan and demonstrated strong resistance to veganism and plant-based diets. The Dutch focus group included six self-identifying anti-vegan participants reflecting diverse urban backgrounds and varied educational levels. The Greek group comprised six participants, also from mixed urban, educational, and occupational backgrounds. Efforts were made to ensure representation of diverse demographic characteristics to augment the depth and range of discussions. Each group was moderated by a member of the research team to optimize authentic, context-rich discussion.

The semi-structured protocol was designed to elicit how participants construct their resistance to veganism considering product labelling, cultural values, emotional responses, and social interactions. Drawing on the lenses of Psychological Reactance Theory and Moral Disengagement Theory, the protocol included prompts designed to explore perceived moral imposition, emotional discomfort, and rationalizations used to justify or normalize anti-vegan perspectives. Participants were shown examples of vegan labels and packaging. Further questions explored their reactions in social contexts, such as accommodating vegan guests, and probed their sense of agency, perceived judgment, and alignment with broader political, cultural, and economic narratives.

Discussions were transcribed and interpreted using standard qualitative research practices allowing for systematic identification of how anti-vegan positions are constructed, emotionally expressed, and socially defended. Particular attention was paid to language that reflected either reactance (e.g., rejection of moral norms, expressions of autonomy) or disengagement (e.g., minimization of harm, displacement of responsibility). Responses were anonymized. Manual coding was applied for richer and promising insights in terms of interpretive flexibility. Analysis was conducted separately for each cultural context and then synthesized through a comparative thematic analysis (Braun & Clarke, 2006) to explore similarities and differences. This cross-cultural synthesis resulted in overarching thematic clusters that consistently emerged across both contexts, such as rationalizing resistance to veganism, emotional responses, cultural influences, informational influences, and social resistance.

1.2.3 Findings

The data reveal that anti-vegan positions are often sustained through a combination of psychological reactance, emotional reasoning, cultural attachment, and mechanisms of moral disengagement. Specifically, across both countries, participants expressed a sense of resistance to veganism not merely as a dietary choice but as a moral narrative imposed upon them, which threatened their autonomy. This was more evident in the Greek context, where meat consumption was strongly linked to identity, religious practices, and family customs. In both settings, participants described veganism as something preached or pushed, eliciting frustration or defensiveness, which are key hallmarks of psychological reactance.

Moral disengagement was also evident in how participants rationalized their choices. Several distanced themselves from potential harm by questioning the integrity of vegan food production. Others framed veganism as a corporate trend designed for profit rather than a genuine ethical movement, thereby neutralizing its moral appeal. Rationalization processes often included claims that their dietary choices were natural in terms of human history or evolution, or that labelling was manipulative and untrustworthy. These justifications allowed participants to uphold their opposition to veganism while preserving a positive self-image. A recurrent theme was a **perceived asymmetry in moral flexibility**: anti-vegans described themselves as willing to accommodate vegan guests but doubted that vegans would reciprocate with non-vegan food, which they interpreted as social rigidity. Importantly, anti-vegans in both countries noted that they often feel equally or even more stigmatized by society, compared to their vegan counterparts.

Finally, contextual influences such as media exposure and national discourse shaped the narratives expressed in both countries. Dutch participants sometimes described a more tolerant and pluralistic environment, in contract with their Greek counterparts. Taken together, these findings highlight that anti-veganism is not simply about opposition to plant-based diets, but rather a **cultural and emotional stance defended through reactance and disengagement**. Addressing such resistance requires communication strategies that avoid triggering moral imposition and instead acknowledge cultural identity, social norms, and emotional concerns.

1.3 Plant-Based Fish and Seafood

1.3.1 Aims

The third line of focus group research within Task 2.2 explores consumers' attitudes, perceptions and behaviours toward plant-based fish and seafood alternatives. These novel products are more sustainable substitutes for natural fish and seafood resources, offering a pathway to more sustainable food transitions (Kazir & Livney, 2021). While consumer attitudes, perceptions and behaviors toward plant-based meat have been studied extensively (for a review see Onwezen et al., 2021), comparable academic literature focusing on plant-based fish and seafood as plant-based protein alternatives currently remains scarce (Appiani et al., 2023; Gorman et al., 2023; Kazir & Livney, 2021, Kim, Caputo, & Kliders, 2023; Lanz et al., 2024; Tripathi & Agarwal, 2023). Therefore, this research aims to gain a deeper understanding of the meaning of plant-based fish and seafood alternatives for sustainable food transitions while attempting to overcome methodological limitations of previous research.

1.3.1.1 Country Selection

We conducted this research in Germany and the Netherlands due to their leading role in the plant-based market (Good Food Institute Europe, n.d.) and for being among the first European countries offering a selected range of PBFSAs. Therefore, It is assumed that consumers in these countries have access to respective products and an extent of familiarity with plant-based substitutes. To provide a contrasting perspective, further focus groups were conducted in Belgium, where plant-based alternatives are less popular and less marketed compared to Germany and the Netherlands (Good Food Institute Europe, n.d.) while still being culturally comparable (Schwartz, 2006). Belgium and The Netherlands are further contrasting Germany by having a cost with the sea, which may impact fish and seafood consumption as well as consumers perception thereof. This cross-country approach facilitated an exploration of consumer attitudes, perceptions, and behaviors across different levels of market maturity of plant-based (fish and seafood) alternatives.

1.3.2 Methods

Six in-person focus groups were conducted with omnivores, flexitarians, and pescatarians in Germany, The Netherlands, and Belgium between September 2024 and February 2025. Participants were recruited through convenience and snow-ball sampling while considering the sampling requirements of those above 18 years of age, local citizens speaking the national language, consuming fish and/or seafood, and not having any food allergy.

This research is grounded in the Theory of Planned Behavior (Ajzen, 1991), which explores general attitudes, social norms, perceived behavioral control, behavioral intentions and behaviors toward plant-based fish and seafood alternatives. Further, to explore both internal (appearance, taste, etc.) of plant-based fish and seafood products as well as external cues (packaging) and how they shape consumer attitudes, this research also follows Cue Utilization Theory (Olsen, 1972). In the context of this research, consumers tested plant-based breaded fish fillets from a private brand and plant-based shrimp from a supermarket brand.

Under consideration of previous research following these two frameworks in related fields, a semi-structured interview guide was developed which aided native researchers in moderating the focus groups. The collected focus group data was then transcribed and any personal data collected was anonymized post-transcription by censoring personal identifiers and assigning pseudonyms. The data was then analysed across focus groups and countries by thematic analysis under consideration of the Theory of Planned Behaviour and Cue Utilization Theory. Codes were manually applied and relevant themes were identified.

1.3.3 Findings

Consumers had either no familiarity or limited experience with plant-based fish and seafood products and expressed both curiosity and scepticism toward these novel products. Omnivore and older participants especially criticized the adoption of names referring to animal products for plant-based

alternatives and questioned the meaning and necessity of plant-based alternatives imitating a natural product.

Awareness of environmental, health, or animal welfare issues related to fish and seafood consumption and therefore the recognition of the potential advantages remained limited. Many participants shared health concerns about plant-based fish and seafood alternatives, considering the nutritional value of such replacements, especially when comparing them with natural fish and seafood products. Specific emphasis was placed on the importance of omega-3 and sufficient protein content.

While most participants did not anticipate any difficulties in preparing plant-based fish and seafood alternatives, product availability and affordability concerns were raised. When asked about the social acceptance of plant-based fish and seafood alternatives, many assumed negative reactions from their social environments. Although consumers perceived the freedom to consume these products themselves, they expected disapproval from others in their social circles, especially older generations.

When exploring the two products, participants used the respective natural products as reference point and drew parallels to other meat alternatives they were familiar with. While the plant-based breaded fish fillet was predominantly compared to chicken schnitzel with a fried or lumpia-like smell, the plant-based shrimp were often described as artificial, with a sour scent and gummi texture.

When evaluating the packaging of the two products, some derived positive associations and familiarity from the private brand image. Several participants criticized the products for lacking health benefits, not being gluten-free, and having unsustainable packaging. These evaluations may be partially explained by the halo effect surrounding the term “vegan” which can lead to higher expectations regarding health and sustainability traits.

Consumers perceived the plant-based fish and seafood alternatives as unhealthy based on the nutritional information provided. Several were unsure how to interpret the Nutri-Score label and stated that they lack the skills to understand listed ingredients. The design of the respective packaging was further often perceived as misleading or deceiving.

With regards to behavioural intentions and behaviour, the majority of consumers indicated that they were not willing to purchase or consume the tested products in the future. However, some stated that they will remain curious about future developments of this market segment and expressed openness to explore new alternatives further.

Overall, across the three lines of focus group research, several overarching insights emerge that inform our understanding of sustainable food consumption. Consumers conceptualize sustainability as a multidimensional construct encompassing environmental, social, and economic dimensions, with environmental considerations often being most salient. Participants actively reflected on what constitutes sustainable food, and articulated their expectations and informational needs across the dimensions of sustainability. Individual motivations were shaped by personal values, emotions, and perceived knowledge, but were deeply intertwined with social influences, cultural norms, and systemic or contextual enablers and constraints. Persuasive cues such as attributes of sustainable labelling and packaging were discussed as critical factors influencing expectations and decision-making. Participants emphasized the need for clear, transparent, and comprehensive food labels that reflect all three

sustainability dimensions, not only environmental impact. Moreover, participants shared perceptions of key food system stakeholders. Large food corporations were often viewed with skepticism, while local producers were associated with authenticity and ethical integrity but perceived as less accessible. Retailers were seen as having a strong influence on consumer choices, but not always prioritizing sustainability. Policy contexts were often perceived as fragmented, with inconsistent guidance and insufficient support for sustainable options, although some participants acknowledged recent improvements. Taken together, these findings provide a rich and multi-level understanding of how consumers define, engage with, and respond to sustainable food. They confirm the importance of addressing informational needs, structural limitations, and cultural dynamics in shaping behavior. As such, they serve as a foundation for the evidence-based design of tailored interventions in WP3 and WP5 and highlight the value of culturally sensitive and systemically grounded approaches to support sustainable food transitions across Europe.

2. Surveys From Representative Samples

2.1 Main representative survey

2.1.1 Aims

The first survey research line under Task 2.2 of the CUES project investigates how individual, socio-cultural, contextual, and other factors shape sustainable food consumption across diverse European settings. The central research question guiding this study is: *How do individual, sociocultural, and other factors influence consumers' sustainable food consumption, and how do these influences vary across different cultural contexts?*

The rationale for this research line lies in the need to move beyond narrow, individualistic explanations of consumer behavior and account for the broader constellation of psychological, cultural, and systemic influences that either support or constrain (i.e., drivers or barriers) the adoption of sustainable food practices. In this regard, it compliments and extends the findings of the focus groups. While earlier research has emphasized consumer knowledge and attitudes, limited attention has been paid to how norms, media influences, political orientation, and cultural background affect sustainable food consumption and choices. This study adopts a comprehensive and comparative approach to identifying how these factors operate in different countries and cultural contexts.

The survey design builds on insights from T2.1 and the focus groups under T2.2, integrating a wide range of theoretically and empirically grounded constructs. These include attitudinal, normative, behavioural variables derived from established research, as well as cultural, psychological and demographic factors.

2.1.1.1 Country selection

Data collection was conducted in ten European countries, representing a balanced geographical and cultural spread: the Netherlands, Belgium, Greece, Italy, Portugal, Bulgaria, Hungary, Ireland, Iceland, and Sweden. These countries were selected to capture meaningful variation in food cultures, sustainability awareness, media environments, and political attitudes across Western, Southern, Eastern, and Northern Europe. By covering this diverse range of contexts, the survey allows for rich

comparative insights into how sustainable food behaviours and their determinants vary across regions. A pilot study was first conducted in Greece with 200 respondents to test question clarity, scale functioning, and overall usability. Following successful validation, the final survey was launched across the remaining countries using stratified sampling.

2.1.2 Methods

The survey instrument was developed in close collaboration with all associated project partners, whose feedback helped refine the question wording, scale balance, and cross-cultural suitability. The survey was distributed online through the panel provider Bilendi, subcontracted via the KU Leuven team. Data collection took place between February and March 2025, and yielded 4,222 completed responses, with an intended sample size of 450 participants per country, balancing feasibility and cost-efficiency within the project's available resources. Representativeness across countries was ensured in two main ways: the panel provider applied age and gender quotas to approximate a balanced and healthy cross-section of each national population. Second, by adhering to the principle of statistical representativeness as defined by Krejcie and Morgan (1970), which establishes that a sample of 384 respondents is sufficient for populations of one million or more. Accordingly, each country sample was set to exceed this threshold to ensure robust population-level inference. The intended sample size was achieved for all countries, except from Iceland, due to panel provider constraint.

The survey protocol first focuses on sustainable food patterns and related psychological factors. It includes measures of subjective knowledge (Verain et al., 2015), attitudes (White & Simpson, 2013), frequency of sustainable food consumption (including categories such as organic, local, fair trade, and plant-based products; sourced from Verain et al., 2015, 2021), food waste frequency (Stancu et al., 2016). It also included questions related to personal and injunctive social norms (Koklic et al., 2019) and the influence of media and advertising cues (self-developed). Afterwards, the survey protocol includes a set of deeper individual difference variables, including consumer ethnocentrism (Sharma, 2010), religiosity (Martin & Bateman, 2014), and political orientation (Imhoff et al., 2022). These constructs were included to explore how sociocultural and ideological beliefs shape consumers' perceptions and actions toward sustainable food options. The next section covers a broad set of sociodemographic and contextual variables, such as age, gender, education. By triangulating these data points, this research line aims to provides an in-depth view of what drives and inhibits sustainable food behavior. It enables the project team to identify target groups, cultural patterns, and barriers central to designing evidence-based, culturally sensitive interventions in Work Packages.

2.1.3 Findings

Below are the notable findings of the representative survey. First, we illustrate the overview of the sample (4,222 participants) in Table 2 below. The mean age of respondents was 48.46 years (SD = 15.72), with relatively balanced gender distribution (54.5% female, 45.4% male). The majority of participants identified as omnivores (72.5%), followed by flexitarians (21.6%), while smaller proportions identified as pescatarians (2.2%), vegetarians (2.6%), or vegans (1.1%). National patterns varied considerably; for instance, flexitarianism was most prominent in Italy (35.8%) and the Netherlands (22.2%), while Iceland displayed the lowest rate of omnivores (21.0%) and the highest proportion of pescatarians (14.5%) and

vegetarians (12.3%). These variations underscore the importance of considering cultural and contextual diversity when designing interventions for sustainable food consumption:

Table 2: Overview of Sample Characteristics by Country.

Country	Sample size	Mean Age	SDAge	Female %	Male %	Omnivore %	Flexitarian %	Pescetarian %	Vegetarian %	Vegan %
Portugal	468	49.67	14.48	61.1	38.9	80.8	14.1	2.4	1.3	1.5
Italy	444	50.95	14.57	54.5	45.3	59.2	35.8	1.8	2.5	0.7
Greece	430	48.79	12.52	57.4	42.3	54.0	43.3	0.9	1.4	0.5
Bulgaria	454	45.24	12.76	55.1	44.9	81.9	16.3	0.2	1.3	0.2
Hungary	500	43.62	14.52	61.0	39.0	84.0	11.8	0.8	1.8	1.6
Ireland	422	46.18	14.58	58.5	41.5	78.7	13.0	2.6	4.5	1.2
Sweden	482	50.23	16.86	51.0	48.8	76.8	13.9	4.1	2.7	2.5
Iceland	138	38.76	9.85	27.5	72.5	21.0	49.3	14.5	12.3	2.9
Netherlands	436	53.86	16.49	47.7	52.1	72.7	22.2	0.7	3.7	0.7
Belgium	448	51.02	17.34	52.2	47.8	77.9	17.9	2.7	1.3	0.2
Total	4222	48.46	15.27	54.5	45.4	72.5	21.6	2.2	2.6	1.1

Based on the figure below (Figure 1), participants rated environmental aspects as most important on average (lower mean rank), followed by social, health, and economic dimensions. Note: Rankings range from 1 (most important) to 4 (least important). The visible error bars represent the standard deviations.

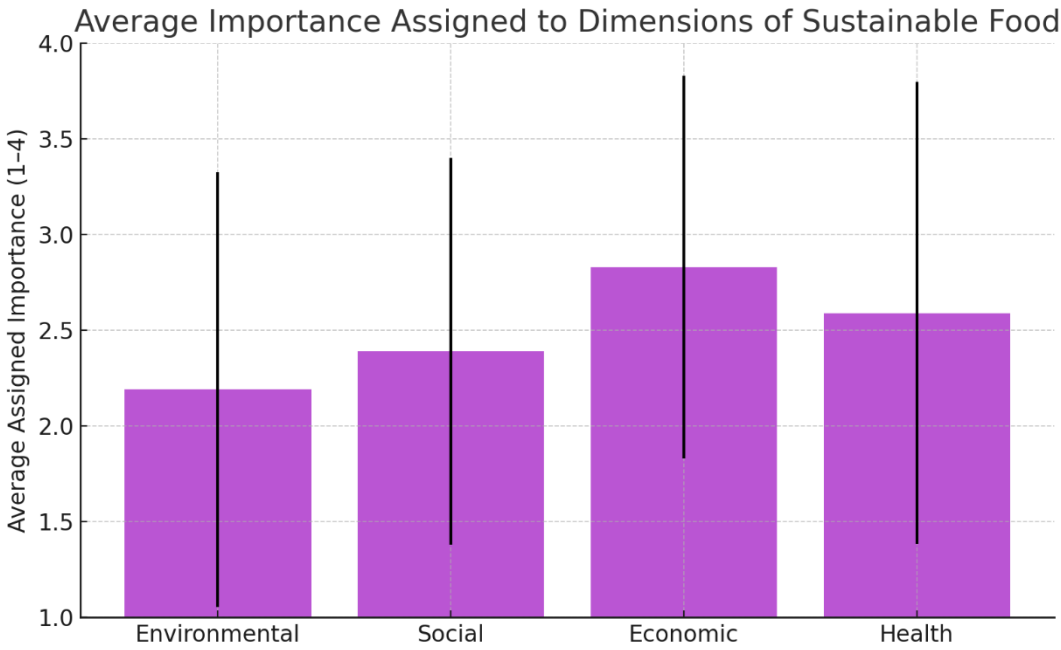


Figure 1 Average importance assigned to four dimensions of sustainable food.

Figure 2 presents the mean scores (± standard deviation) for four key variables measured on a 1–5 scale. For Dietary Preferences, 1 = Omnivore and 5 = Vegan. For Sustainable Food Consumption Frequency, 1 = Never and 5 = One or more times per day. For Subjective Knowledge, 1 = Much less informed than the average citizen and 5 = Much more informed. Error bars indicate standard deviation. Respondents reported relatively **high attitudes** for sustainable food consumption (M = 3.88), suggesting a generally favourable mindset toward sustainability. However, **actual behavioural frequency** of consuming sustainable food was markedly lower (M = 2.43), indicating a possible intention–behavior gap. The **average dietary preference** score was low (M = 1.38), reflecting the predominance of omnivorous diets in the sample, with relatively few respondents identifying as vegetarian or vegan. **Subjective knowledge** about sustainable food consumption fell around the midpoint (M = 3.12), suggesting that participants consider themselves moderately informed compared to the average citizen.

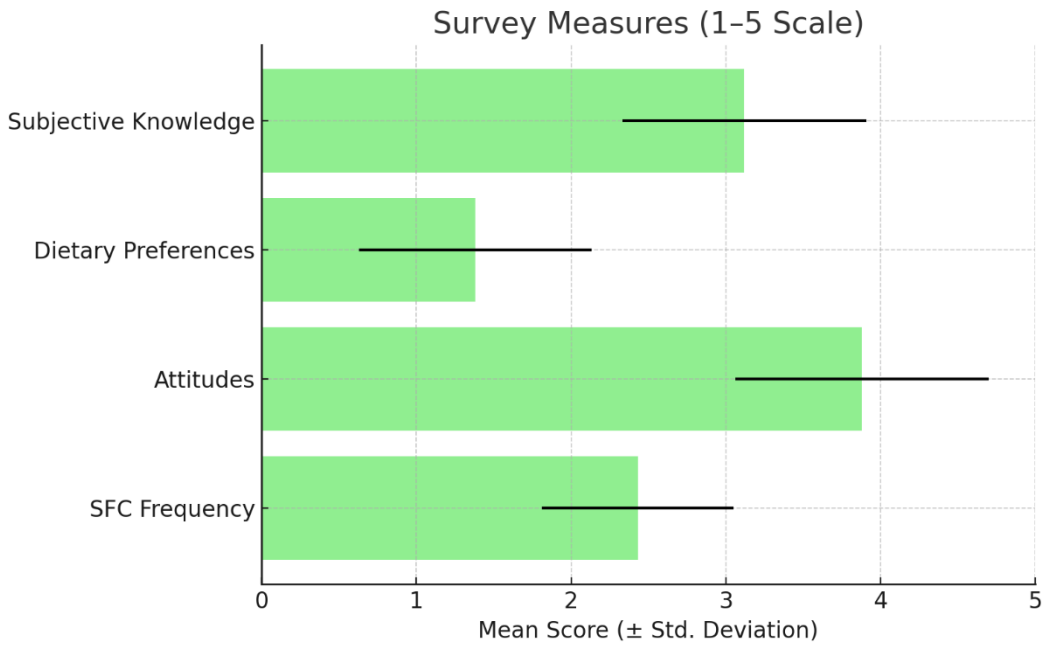


Figure 2 Mean scores for key indicators related to sustainable food consumption (N = 4,222).

Food waste frequency measured on a 1–7 scale, where 1 = never waste food (i.e. never throw away food) and 7 = always waste food, was also measured as a variable (see Figure 3 below). The low mean score suggests that, on average, participants admit to relatively rarely waste food.

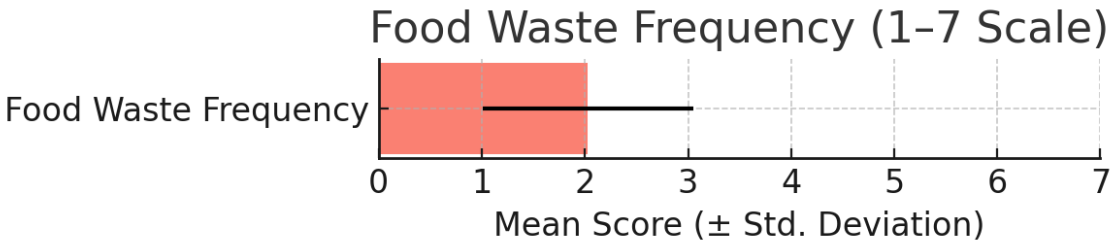


Figure 3 Self-reported food waste frequency among participants (N = 4,222).

Figure 4 (items are based on participants' level of agreement, with 1 = Strongly disagree and 7 = Strongly agree, error bars represent standard deviation) visualizes potential normative, social, media and environmental antecedents of sustainable food consumption—namely, personal and social norms, the perceived influence of (social media) influencers, traditional media (TV and press), advertisements and promotional materials, point-of-sale promotions, and environmentally friendly packaging (e.g. recyclable or biodegratable), along with their corresponding mean scores and standard deviations.

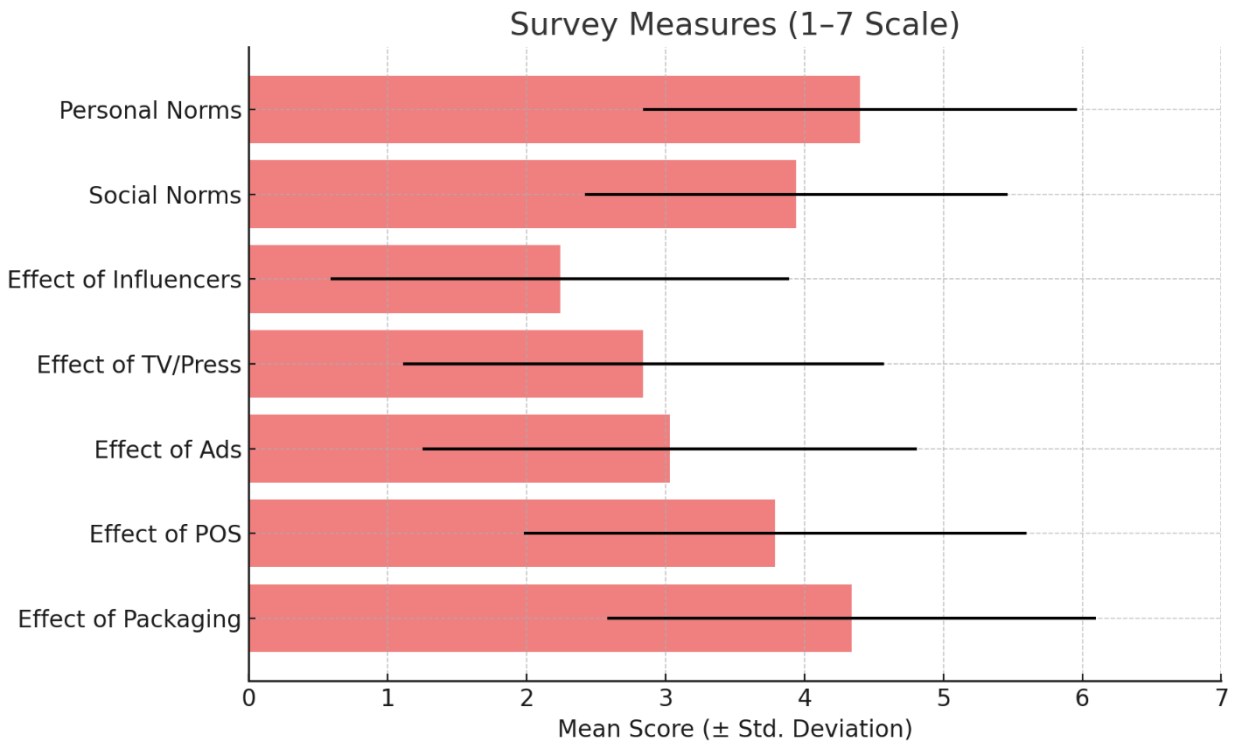


Figure 4 Mean scores for survey variables that are explored as antecedents of sustainable food consumption (N = 4,222).

The above figure visualizes the potential antecedents of sustainable food consumption. The results indicate that **personal norms** (M = 4.40) and **social norms** (M = 3.94) were relatively strong predictors of sustainable food intentions, suggesting that both individual moral commitment and perceived social expectations play an important role in shaping consumer behavior. Among media and communication influences, environmentally friendly **packaging (**e.g. recyclable or biodegrable; **M = 4.34)** and **point-of-sale cues (M = 3.79)** were rated as the most influential factors, highlighting the importance of visual and in-context cues in guiding consumer decisions. In contrast, **traditional media channels** such as **TV and press** (M = 2.84) and **influencers** (M = 2.24) were rated significantly lower in their perceived impact. These findings suggest that interventions targeting **product presentation and immediate shopping environments** may be more effective than broad awareness campaigns.

2.1.3.1. Regression Findings: Normative, media and environmental predictors of Attitudes Toward Sustainable Food consumption

To examine which factors significantly predict consumers' attitudes toward sustainable food consumption, **multivariate analyses** were applied. In specific, a multiple regression analysis was selected because it allows for the simultaneous assessment of the relative contribution of multiple independent variables, helping to identify which predictors have the strongest influence on consumer attitudes. A multiple linear regression was conducted with personal norms, social norms, media-related influences (influencers, TV/press, advertisements), point-of-sale (POS) promotions, and packaging that is environmentally friendly (e.g. recyclable or biodegratable) as predictors. The overall model was statistically significant, **$F(7, 4214) = 280.07$, $p < .001$**, indicating that the combination of predictors

reliably explains variation in attitudes. The model accounted for **31.6% of the variance** in attitudes (Adjusted R^2 = .316, R^2 = .318).

Among the predictors, personal norms emerged as the strongest and most significant contributor (β = .454, p < .001), suggesting that individual moral commitment plays a central role in shaping favourable attitudes toward sustainable food. Packaging cues also had a meaningful impact (β = .165, p < .001), indicating that environmentally friendly packaging positively affects how consumers perceive sustainable food. Influencer impact showed a paradoxically negative effect on attitudes (β = –.110, p < .001), implying that greater perceived influence from social media personalities such as content creators is associated with less favourable attitudes, possibly reflecting scepticism. Similarly, social norms showed a small but significant negative relationship (β = –.045, p = .016), perhaps pointing to perceived peer pressure or value misalignment.

Other statistically significant predictors included TV/press influence (β = .059, p = .005) and point-of-sale promotions (β = .042, p = .018), both showing small positive effects on attitudes. In contrast, the effect of advertisements was not significant (β = –.006, p = .773), indicating that traditional advertising may have limited persuasive power in this context.

2.1.3.2 Regression results: Normative, media and environmental predictors of Sustainable Food Consumption frequency

A multiple linear regression was conducted to examine which factors significantly predict the frequency with which consumers engage in sustainable food consumption behaviours (i.e. SFC frequency). The model included personal norms, social norms, the influence of media and advertising (influencers, TV/press, ads), point-of-sale (POS) promotions, and packaging cues as predictors, as in the previous regression model.

The regression model was statistically significant, **$F(7, 4214) = 352.61$, $p < .001$**, indicating that the set of predictors reliably accounts for variance in sustainable food consumption frequency. The model explained **36.8% of the variance** in the outcome (Adjusted R^2 = .368), suggesting a strong and stable model.

Among the predictors, personal norms again emerged as the strongest positive predictor (β = .248, p < .001), closely followed by social norms (β = .210, p < .001), confirming the importance of internalized moral standards and perceived social expectations in influencing sustainable food behavior. Influencers also showed a significant and meaningful positive effect (β = .160, p < .001), contrasting with their negative effect on attitudes, and suggesting that social media figures may help drive action even if they do not necessarily enhance attitudes.

Packaging cues were also positively associated with behavior (β = .113, p < .001), further highlighting the importance of visible, credible sustainability signals in the shopping context. Meanwhile, the effects of TV/press, ads, and POS promotions were statistically non-significant, indicating limited influence of these more traditional or commercial communication channels on actual consumer behavior.

The regression findings for attitudes and SFC frequency, with a focus on predictor coefficients, are visualized in Figure 5 below:

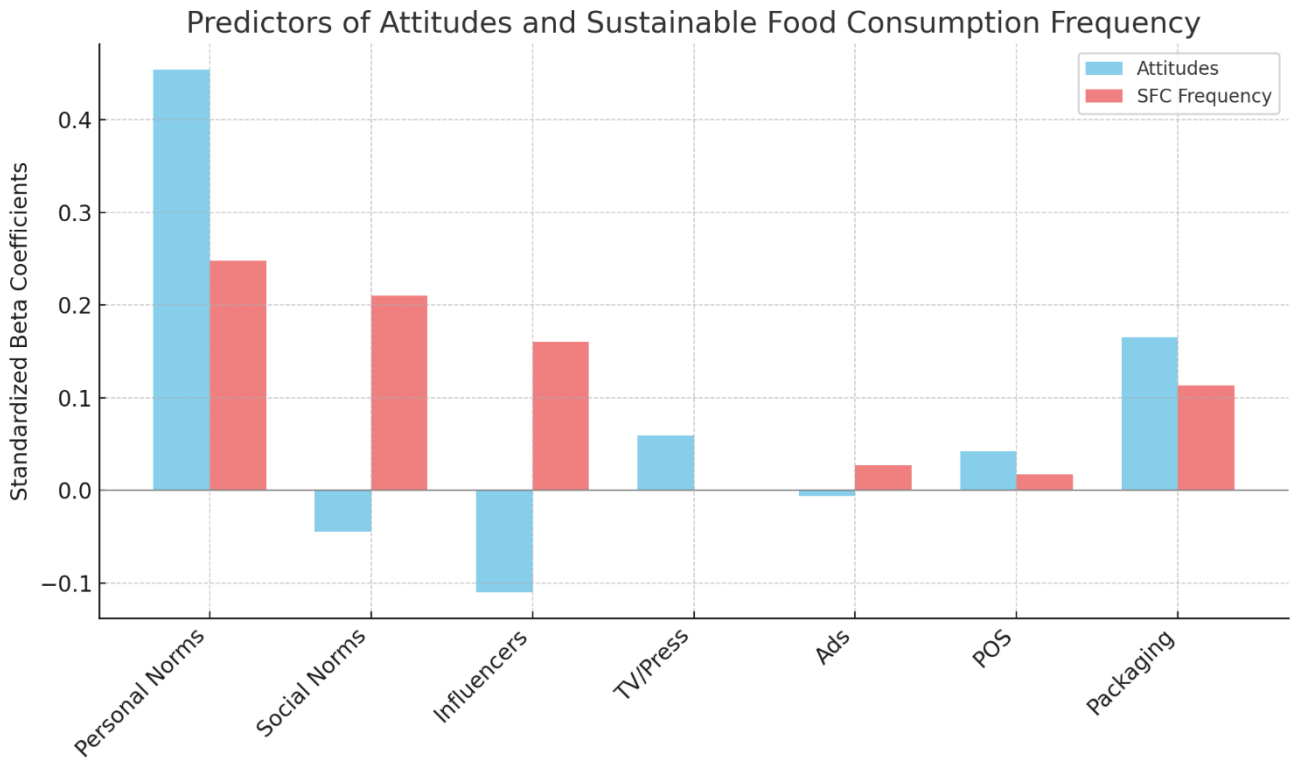


Figure 5 Comparative bar chart visualizing the standardized beta coefficients from the two regression models: Blue bars represent the effect of each predictor on attitudes toward sustainable food consumption. Red bars represent their effect on sustainable food consumption frequency (SFC Frequency).

2.1.3.3 Regression Results: Cultural, psychological, and demographic predictors of Attitudes toward Sustainable Food consumption

To investigate the role of cultural orientations, personal beliefs, and demographics in shaping attitudes toward sustainable food consumption, a multiple linear regression was performed with **religiosity, ethnocentrism, political orientation, environmental concern, trust in companies commercializing sustainable food products, age, gender, and education** as predictors.

The model was statistically significant, $F(8, 4206) = 182.40$, $p < .001$, and explained 25.6% of the variance in attitudes (Adjusted $R^2 = .256$).

Environmental concern (EC) was by far the strongest positive predictor of sustainable food attitudes ($\beta = .390$, $p < .001$), showing that individuals with greater concern for environmental issues are more likely to support sustainable food choices. Trust in companies commercializing these products also had a robust and significant positive effect ($\beta = .190$, $p < .001$), indicating that corporate credibility and perceived alignment with sustainability principles enhance consumer receptivity.

Education level was a meaningful positive predictor (β = .106, p < .001), confirming previous research linking higher education to more pro-environmental attitudes. In contrast, religiosity (β = –.047, p = .001) and ethnocentrism (β = –.049, p < .001) had small but significant negative effects, suggesting that stronger attachment to religious or national values may dampen attitudes. Conservative political orientation also negatively predicted sustainable attitudes (β = –.041, p = .003), with more conservative participants showing slightly less support for sustainable food. Similarly, gender showed a negative effect (β = –.046, p < .001), indicating that men were slightly less supportive of sustainable food consumption than women. Age was not a significant predictor in this model (β = .013, p = .314), suggesting that sustainable attitudes are more consistently shaped by values and belief systems than by age-related differences.

2.1.3.4. Regression Results: Cultural, psychological, and demographic predictors of Sustainable Food Consumption frequency

A multiple linear regression was conducted to examine how individual-level cultural beliefs, trust, values, and sociodemographic characteristics relate to the frequency with which consumers engage in sustainable food consumption. The model included religiosity, ethnocentrism, political orientation, environmental concern, trust in companies, and education, gender, and age as predictors.

The model was statistically significant, **F(8, 4206) = 196.06, p < .001**, and explained **27.0% of the variance** in SFC Frequency (**Adjusted R^2 = .270**).

Among the predictors, environmental concern once again emerged as the strongest driver (β = .283, p < .001), reinforcing the idea that concern for environmental issues motivates sustainable food behavior. Trust in companies that commercialize sustainable products was also a substantial positive predictor (β = .173, p < .001), pointing to the importance of perceived corporate credibility and transparency in facilitating actual behavior. Interestingly, religiosity (β = .159, p < .001) and ethnocentrism (β = .086, p < .001) were also positive predictors of sustainable behavior—an opposite direction from their effects on attitudes in the previous model. This may reflect that certain cultural or identity-based orientations, while perhaps sceptical of the broader sustainability discourse, still support frequent sustainable practices (e.g., for reasons of purity, frugality, or moral discipline). Education showed a significant and moderate positive effect (β = .158, p < .001), while age had a small but statistically significant negative relationship (β = –.043, p < .001), suggesting that younger participants tend to consume sustainable food more frequently. Political orientation and gender were non-significant in this model, indicating that behavioural frequency is less ideologically and gender-driven than attitudes.

The comparative figure below (Figure 6) summarizes the effects (coefficients) of cultural, psychological and demographic predictors.

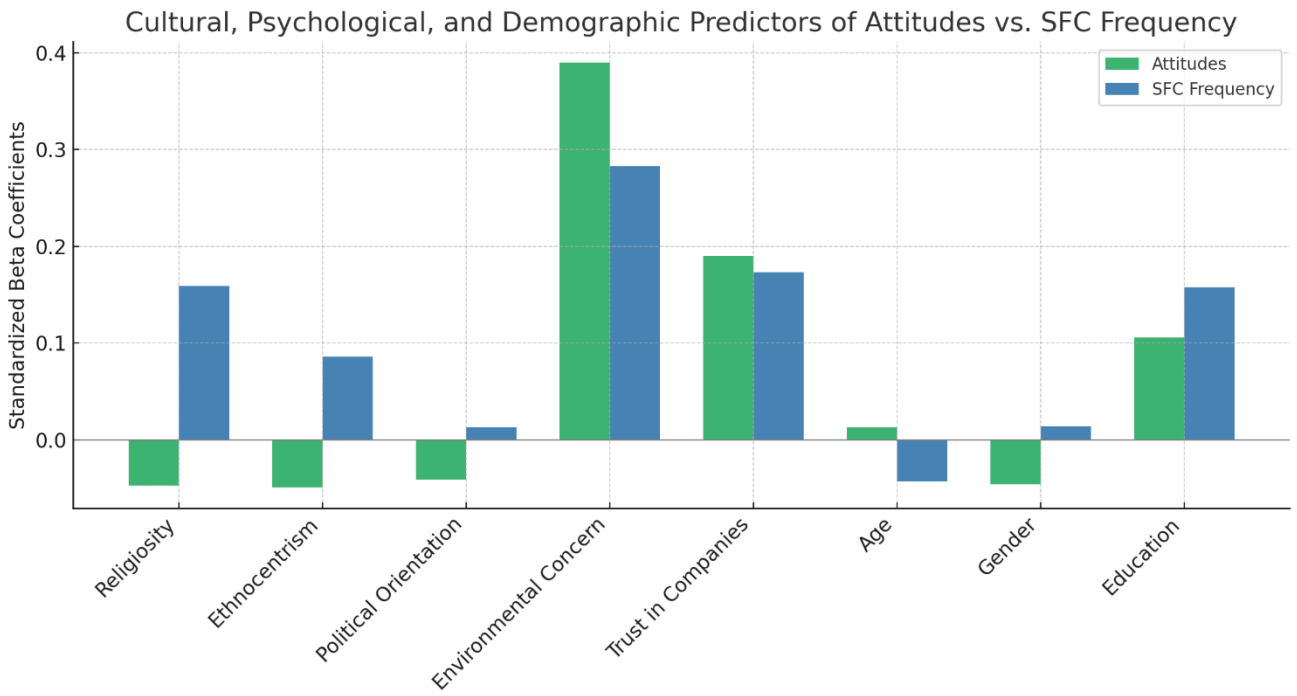


Figure 6 Effects (standardized beta coefficients) for cultural, and demographic predictors of both attitudes toward sustainable food (green bars), and sustainable Food Consumption Frequency (blue bars).

Overall, the findings from this representative study offer a comprehensive view of the drivers and barriers to sustainable food consumption in ten European countries. They highlight that consumer engagement with sustainable food is shaped by an interplay of psychological, social, cultural, and contextual factors, with clear evidence that internalized moral norms influence both attitudes and behaviours, trust in food system actors, and environmental concern. At the same time, values such as ethnocentrism and religiosity, often overlooked in sustainability research, appear to play a significant role. The divergence between the predictors of attitudes and those of actual consumption behavior underscores the importance of designing interventions that go beyond awareness or ideological alignment, and instead focus on enabling conditions, normative influence, and visible environmental cues in everyday settings.

Moreover, the results show that while environmental aspects of sustainability are prioritized, other dimensions (i.e. social, economic, and health-related) are not uniformly ignored. The variability in how participants rank these dimensions points to the importance of framing sustainable food not as a one-dimensional concept but as a pluralistic value set, where different groups prioritize different outcomes. Together, these insights support the need for inclusive, culturally sensitive, and systemically grounded strategies to advance sustainable food transitions and strategies.

2.2 Choice of plant-based products based on attributes at point-of-sale

2.2.1 Aims

The second survey research line investigates the factors that shape consumer preferences for plant-based meat products in point-of-sale contexts. The guiding research question is: *Which attributes of plant-based meat products most influence consumer purchasing preferences at the point of sale, and how do contextual, individual and social factors combine to shape judgments about these products?*

The motivation behind this research line derives from the pressing need to promote dietary shifts toward more sustainable food systems, especially through greater adoption of plant-based alternatives to meat (Sabaté & Soret, 2014). As highlighted in the focus groups, plant-based meat sometimes remains a contested and often misunderstood product category, with many consumers expressing misconceptions, ambivalence or scepticism. Understanding how consumers evaluate these products at the moment of decision-making, and which product attributes drive preference formation, is critical for designing effective labelling, packaging, and marketing strategies that can facilitate more sustainable food choices.

To achieve this, the study adopts a **conjoint-based** experimental design, allowing for the simultaneous testing of multiple attributes and their levels. In addition to choice-based preferences, the survey includes measures assessing participants' ethical judgment, perceived social status anxiety, frugality (i.e., individual sensitivity to price), and trust in producers, factors theorized to shape consumer engagement with plant-based products. These variables were selected for a **fuzzy-set qualitative comparative analysis (fsQCA)**, a configurational approach grounded in complexity theory and the principle of causal asymmetry (Ragin, 2009). This method is particularly suited for exploring how distinct combinations of factors jointly shape ethical evaluations, rather than assuming a uniform set of linear predictors. This approach hence complements the focus groups and regression analyses reported above by capturing a different layer of insight: while focus groups provide interpretive depth and regressions identify effects across populations, fsQCA attempts to uncover multiple, distinct causal pathways that reflect the diversity of real-world consumer decision-making. The use of this method contributes through exploring potential interactional effects that might otherwise remain unexplored in traditional analytical models.

2.2.1.1 Country Selection

The survey was conducted in five European countries: France, Belgium, Germany, the Netherlands, and Spain with a target of 450 participants per country. These countries were selected to represent a mix of food cultures, degrees of plant-based market maturity, and consumer openness toward meat alternatives. This regional spread captures both innovation-leading contexts (such as the Netherlands and Germany) and culturally meat-anchored markets (i.e. Spain or France), thus allowing for meaningful comparisons in terms of how plant-based meat products are perceived, judged, and chosen.

A pre-test was carried out in the Netherlands with 200 respondents to ensure clarity, usability, and robustness of the survey design. Following this pilot, the final survey was launched in April 2025 in all five countries through Bilendi, the same panel provider used in the first survey line.

2.2.2 Methods

The survey used a **choice-based conjoint** design to simulate a realistic point-of-sale context in which consumers were asked to choose between pairs of plant-based meat products. These products varied across six key attributes: price relative to conventional meat, Nutri-Score rating, type of certification, brand familiarity, texture similarity to meat, and type of packaging. The attribute levels reflect a broad range of concerns including economic, health-related, environmental, experiential, and trust (with brand familiarity being of a proxy of it) dimensions. In addition to the conjoint experiment, the survey instrument included a section, intended for **fuzzy-set qualitative comparative analysis**, which explored measures of ethical judgement toward the consumption of plant-based products (Zou et al., 2019), and measures of social status anxiety (i.e. anxiety togain social status through, for instance, consumption behaviours; Chiou & Pan, 2008), perceived trust in companies producing plant-based meat (White et al., 2012), and frugality (i.e. individual's sensitivity to price; Kareklas et al., 2014).

2.2.3 Findings

The final dataset consisted 2508 responses that were retained for subsequent analyses. First, analysis on conjoint-based set up with a binary logistic regression was applied to assess the influence of six binary attributes on choice preference for plant-based meat. Each attribute was coded as a binary variable, with 0 representing the baseline level and 1 representing the preferred or more favourable level (IV stands for Independent Variable). The descriptions of the different levels below are the same as those presented to the participants:

- IV1 (relative price): 1 = same price or 30% lower than regular meat; 0 = 30% higher
- IV2 (Nutri-Score): 1 = Nutri-Score A; 0 = other than that
- IV3 (certification): 1 = credible certification; 0 = no certification or non-credible certification
- IV4 (brand familiarity): 1 = well-known brand; 0 = store brand or new brand
- IV5 (similarity to Meat): 1 = highly or moderately similar to meat; 0 = different from meat
- IV6 (packaging): 1 = recyclable or biodegradable packaging; 0 = standard plastic packaging

This model was used to determine which product features significantly increased the likelihood of a product being chosen. The overall model was statistically significant, $\chi^2 = 6615.23$, $p < .001$, confirming that the selected attributes predicted participant choices. All predictors were significant ($p < .001$). The presence of a credible vegan certification and sustainable packaging (recyclable or biodegradable) predicted consumer choice. Preference was also positively associated with products that had a Nutri-Score A, were well-known brands, resembled meat, and were offered at the same or a lower price than regular meat.

To explore the complex causal pathways leading to positive ethical judgments toward plant-based foods, we applied **fuzzy-set Qualitative Comparative Analysis (fsQCA)** using calibrated data. This method is particularly suitable for uncovering multiple conjunctural causation patterns (i.e., combinations of

independent conditions that jointly explain an outcome) while accounting for asymmetry and equifinality (Ragin, 2008). The outcome variable analyzed w**as (ethical) judgment toward plant-based products, with three theoretically derived independent variables (Frugality, Social status anxiety, Trust).** These variables were selected based on prior literature highlighting their potential relevance in consumer decision-making regarding sustainable food options. For example, frugality has been shown to shape consumption restraint and ethical decision-making (Kareklas et al., 2014; Lastovicka et al., 1999; Pepper et al., 2009), **social status anxiety** influences choices and ethical beliefs (Chiou & Pan, 2008), and **trust in producers and food systems** is a critical factor in the acceptance of sustainable or novel foods (Siegrist, 2008; Hartmann & Siegrist, 2017).

The data were first calibrated into fuzzy-set membership scores (ranging from 0 to 1), reflecting degrees of membership in each condition and the outcome. Calibration followed standard fsQCA procedures, relying on percentiles (e.g., full non-membership = 0.05, crossover = 0.50, full membership = 0.95) and theoretical expectations. We then applied the **fsQCA 3.1 software program**, filtering for configurations with consistency thresholds of 0.80 or higher, which are commonly accepted cut-offs to indicate sufficient causal conditions (Schneider & Wagemann, 2013). Unique combinations of the independent variables were grouped and averaged to assess their sufficiency in producing high levels of ethical judgment. The fsQCA truth table, and subsequent analyses, revealed several distinct causal pathways (i.e., configurations of conditions) that consistently lead to higher ethical judgment of plant-based foods. The analysis yielded thirty-three unique sufficient configurations, out of which eight configurations met the minimum consistency threshold –i.e. with consistency values equal to or greater than 0.80 - and are thus included in the truth table used for solution generation in fsQCA, thus reliably producing the outcome of interest (i.e. ethical judgement). Below, we synthesize the key patterns emerging from the analyses:

1. **Low social status Anxiety + Low frugality + High trust:** Several configurations showed that individuals with low levels of social anxiety and frugality, coupled with high trust, tend to evaluate plant-based foods more ethically (*Example:* Anxiety = 0.1, Frugality = 0.1, Trust = 0.7 → Consistency = 1.00, Outcome = 0.67).
2. **Moderate frugality + high Trust:** Even with slightly higher levels of frugality, trust in plant-based foods or their producers can counterbalance cost-sensitive tendencies, suggesting that trust plays a compensatory role (*Example:* Frugality = 0.2, Trust = 0.7 ⟶ Outcome = 0.71).
3. **High trust alone in some configurative cases:** Trust alone, particularly in configurations with low or moderate levels of the other two variable, was a recurring core condition in most pathways. This underlines the central role of consumer trust in forming more positive judgments toward plant-based products.

Overall, trust emerged as the most frequent core condition across the sufficient configurations. This finding supports linking trust in companies that provide sustainability claims with positive ethical evaluations, aligned with previous literature on various contexts of sustainable food (eg. Nuttavuthisit & Thøgersen, 2017). Low social status anxiety was also frequently present in sufficient combinations, suggesting that individuals who do not feel the need to conform to status-driven norms are more open to ethically evaluating plant-based products. Frugality showed more ambiguous effects; while low frugality was present in many successful pathways, some moderate frugality levels also appeared sufficient when trust was high.

3. Willingness to Reduce Dairy Consumption and Adopt Plant-Based Dairy Alternatives

3.1 Aim

The third research line study aims to identify factors that significantly predict consumers' willingness to (1) reduce their dairy consumption and (2) consuming plant-based dairy alternatives as well as consumers' current (3) dairy consumption and (3) consumption of plant-based dairy alternatives.

While meat consumption and the reduction thereof has received significant academic attention to mitigate its negative impact on the environment, animal well-being and human health, research on dairy consumption and its reduction is currently lacking, despite its significant contribution to these issues (Clay et al., 2019). One pathway to reducing the consumption of dairy products lays in various plant-based dairy alternatives (Schiano et al., 2020). While consumer attitudes, perceptions and behaviors towards plant-based meat have been studied extensively (for a review, see Onwezen et al., 2021), comparable academic literature focusing on various plant-based dairy alternatives (dairy, yoghurt, cheese) remains scarce. To facilitate the transition to more sustainable and plant-based diets, it is therefore necessary to study consumers' facilitators and barriers towards reducing dairy consumption and adopting plant-based alternatives. The theoretical framework for this research is rooted in the Theory of Planned Behavior (Ajzen, 1991) and based on previous research of meat reduction, meat consumption and consumption of plant-based dairy or meat alternatives.

To specifically deepen the understanding on consumers' willingness to reduce dairy consumption and adopt more plant-based alternatives, this research adopts the concept of meat attachment developed by Garca et al. (2015), which refers to consumers' positive bond with meat consumption, to the context of dairy consumption (referred to as dairy attachment).

Further, it is to consider that cultural values significantly impact food choices (e.g., Enriquez & Archila-Godinez, 2022) and that markets of plant-based alternatives vary widely across European countries. Cross-cultural studies on dairy reduction or plant-based dairy alternatives however remain limited: often, the focus lays on a specific country (e.g., Heijnk, Espey, & Schuenemann, 2023), diets like flexitarianism, vegetarianism or veganism rather than plant-based products, (e.g., Bryant, 2019), or specific consumer groups (e.g., young adults, Faberet al., 2020). Thereby, this research aims to address among others the lack of studies on the effects of consumers' backgrounds, including culture, on perceptions of plant-based alternatives as identified by Appiani et al.'s (2023).

3.1.1 Country Selection

The countries studied in this research (Germany, Finland, Spain, Hungary) are representative of the four European regions: North, East, West, and South. This cross-country approach allows for a comparison between varying extent of dairy consumption, awareness of implications of dairy consumption and dairy production, plant-based market maturity, and consumers familiarity with plant-based dairy alternatives. Germany was chosen due to its leading plant-based alternative market. Finland was chosen due to its high levels of dairy consumption. Spain was chosen due to the prevalence of Mediterranean diets implying lower dairy consumption. Hungary represents an Eastern European country with high levels of

meat consumption. These countries (except Finland) are further representative of the countries participating in the Horizon Project CUES.

3.2 Methods

Comparable to the approach of the first research line, the survey instruments were reviewed by associated project partners and potential feedback was implemented respectively. After translating the surveys to local languages and proofreading them by natives, the survey was distributed online to samples of the four countries in April 2024 through the panel provider Bilendi, which was subcontracted via the project partner at KU Leuven. A total of 2106 valid responses were collected, ensuring the intended sample size of 500 participants per country. Representativeness of the sample was guaranteed following the approach of the first research line: age and gender quotas applied through the panel provider and considering statistical representativeness following Krejcie and Morgan (1970).

The samples included any consumers who self-identify themselves as following an omnivore, flexitarian, or vegetarian diet. Participants were required to be older than 18 years of age and to speak the local language. Across the four countries the average age of participants was 50.32 (SD = 15.65). Furthermore, 52.1% identified as female, 47.5% identified as male and .3% identified as other. In terms of education level, the majority of respondents reported to have completed at least primary education (4.0%), lower (11.3%) or upper (19.4%) secondary education or post-secondary non-tertiary education (29.7%). In addition, 20.3% reported to have completed a bachelor's degree or equivalent, 12.8% have completed a master's degree or equivalent and 1.9% have completed a doctorate degree or equivalent.

Most of the respondents reported to be omnivores (87.8%). Flexitarian (8.9%), pescetarian (1.5%) and vegetarian (1.5%) dietary preferences were less often indicated. Finally, 55.2% of the respondents indicated to be living in an urban area. 23.8% of respondents lived in a rural area and 20.9% lived in a suburban area. Table 3 provides an overview of the sample characteristics per country.

Table 3 Descriptives of sample per country.

	Germany	Finland	Spain	Hungary
Sample size	542	515	545	504
Gender				
Male	51.1%	47%	50.6%	40.7%
Female	48.7%	52.2%	49.2%	58.9%
Other	.2%	.6%	.2%	.4%
Prefer not to respond		.2%		
Dietary preference				
Omnivore	75.5%%	90.7%	91.4%	94.4%
Flexitarian	19.2%	5.2%	6.4%	4.2%
Pescetarian	2.0%	2.7%	.7%	.6%
Vegetarian	3.0%	1.2%	1.1%	.8%
Prefer not to respond	.4%	.2%	.4%	
Area				
Urban	38.6%	43.3%	76.0%	62.7%

Suburban	22.7%	36.9%	11.7%	12.7%
Rural	38.6%	19.8%	12.3%	24.4%
Prefer not to respond	.2%			.2%
Other demographics				
Age: M (SD)	52.99 (15.75)	50.50 (16.25)	50.56 (14.13)	47.01 (15.92)

Following the Theory of Planned Behavior (Ajzen, 1991), the survey collected data on consumers' attitudes, social norms, and perceived behavioral control towards dairy products and plant-based dairy alternatives. Further, consumers' willingness to reduce dairy consumption and adopt plant-based dairy alternatives as well as consumers' current dairy and plant-based dairy consumption was assessed. Participants were asked to indicate to which extent they agree or disagree that they are willing to reduce their daily dairy consumption and how willing they are to consume plant-based dairy alternatives (1 = strongly disagree; 5 = strongly agree), how often they consume various dairy and plant-based dairy products (1 = Never; 7 = more than once a day) and how likely they are to buy dairy or plant-based dairy products during their next grocery shopping (0 = not likely, 100 = very likely). These assessments followed previous research on consumer behavior with sustainable food consumption, consumption of animal products and plant-based alternatives (Garca et al., 2015, Steptoe et al., 1995; Pandey et al, 2021; Verain at al., 2015 (see 3.1.1.3); Wang & Scrimgeour, 2021; Mustapa et al., 2024). Specifically for the measurements of Dairy Attachment, we adapted the developed Meat Attachment scale by Garca et al. (2015) to the dairy context. This scale measures hedonism, affinity, entitlement, and dependency to animal product consumption. In the context of dairy consumption, hedonism refers to dairy consumption as source of pleasure, affinity describes one's positive emotional response to dairy consumption, entitlement describes feelings of being entitled to dairy consumption, and dependence indicates feelings of being dependent on dairy consumption. Based on insights from qualitative research on barriers to dairy reduction, a fifth dimension of nostalgia was added describing the emotional longing for the past that is evoked through memories associated with dairy consumption. The data collected was then analyzed through exploratory factor analysis and linear regression.

3.3 Findings

3.3.1 Willingness to reduce dairy consumption

3.3.1.1 The impact of socio-demographic variables

Overall, respondents across the four countries reported relatively low willingness to reduce their dairy consumption (M = 2.69, SD = 1.28). An independent samples t-test revealed a significant difference between **gender** in willingness to reduce dairy consumption, t (2092,18) = 4.56, p <.001. More specifically, females (M = 2.81, SD = 1.30) reported significantly higher willingness to reduce dairy consumption compared to men (M = 2.56, SD = 1.24).

An ANOVA indicated a significant difference between individuals' **dietary preference** in willingness to reduce dairy consumption, F(3, 2097) = 56.01, p<.001. More specifically, vegetarians reported a significantly higher willingness to reduce their dairy consumption (M = 4.20, SD = .97) compared to pescatarians (M = 3.92, SD = .89, p<.001), flexitarians (M=3.43, SD = 1.32, p<.001) and omnivores (M = 2.56, SD = 1.23, p<.001) – see Figure 7.

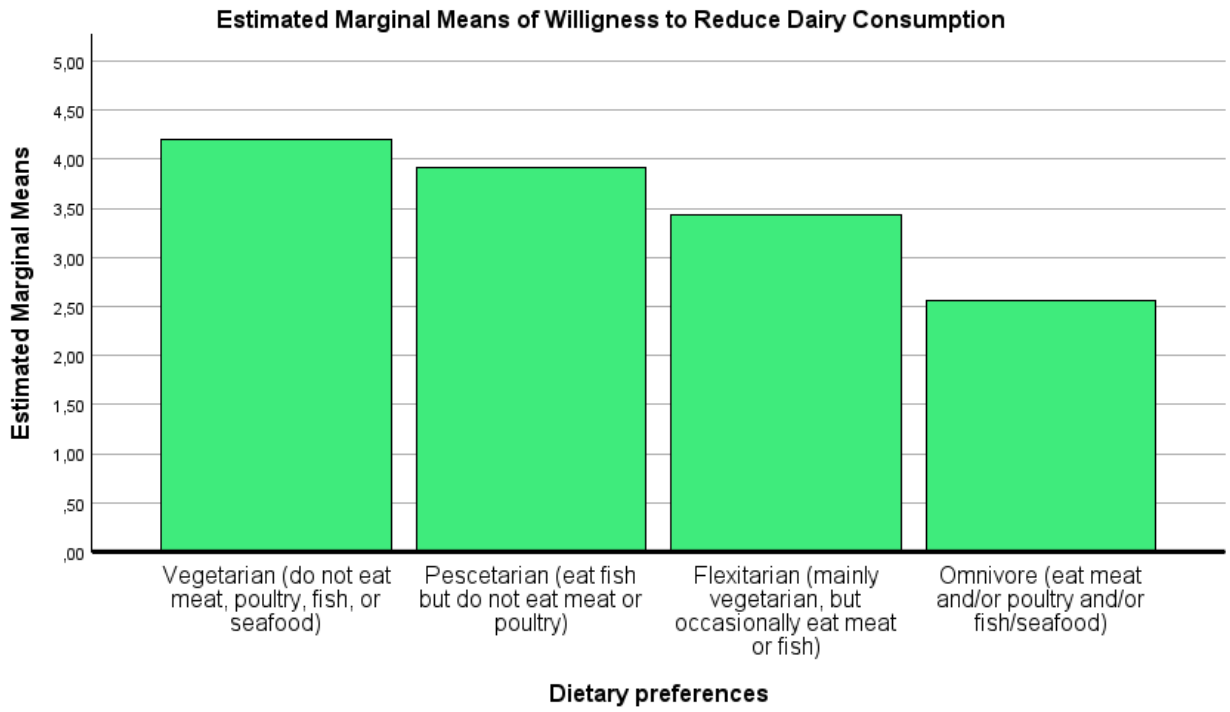


Figure 7 Average willingness to reduce dairy consumption across countries.

When comparing the willingness between the four countries, an ANOVA revealed a significant difference between **countries** in willingness to reduce dairy consumption, $F(3, 2192) = 3.51$, $p = .015$. Nevertheless, the post-hoc comparisons revealed that there was only one significant difference in which German participants reported slightly higher willingness ($M = 2.79$, $SD = 1.31$) to reduce their dairy consumption compared to Spanish participants ($M = 2.54$, $SD = 1.24$), $p = .011$ (Figure 8).

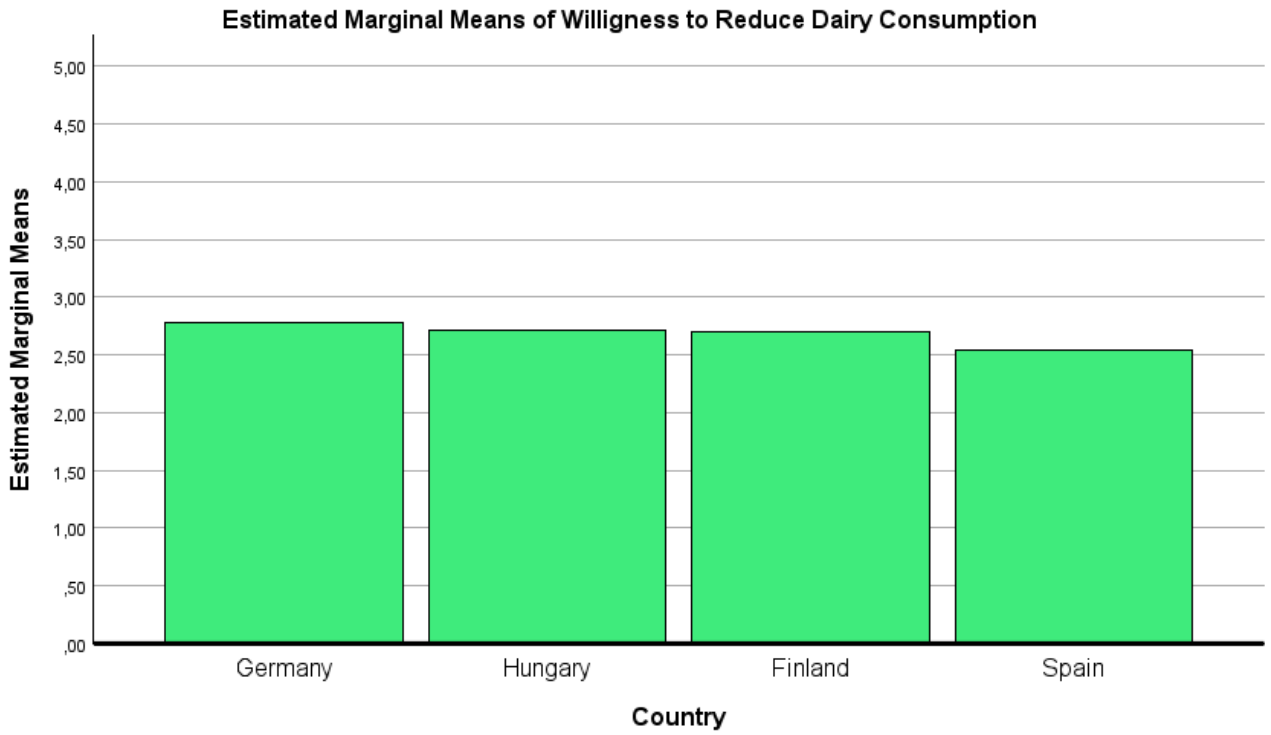


Figure 8 Average willingness to reduce dairy consumption across countries.

3.3.1.2 The impact of affective attitude towards dairy and plant-based dairy

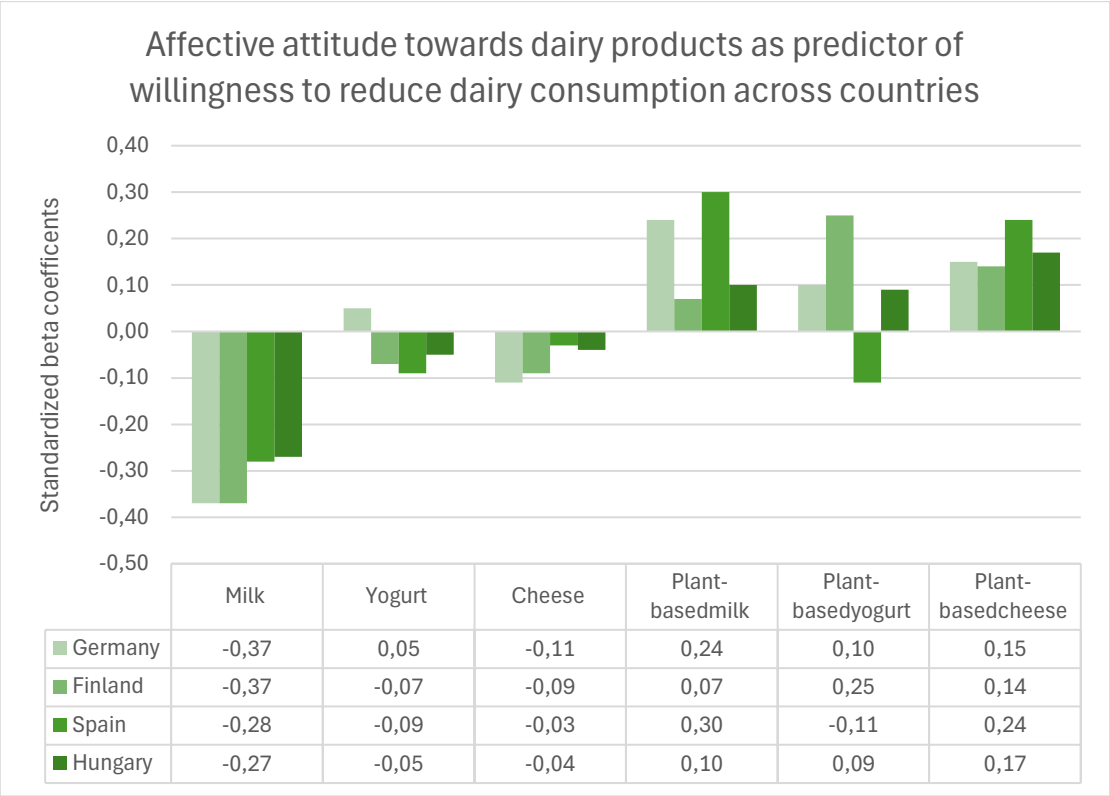
A multiple linear regression was conducted to examine the impact of affective attitude towards both dairy and plant-based dairy on the willingness to reduce dairy consumption. In order to create a more comprehensive framework, respondents were asked to report their affective attitudes towards three types of dairy products: milk, yogurt and cheese. Therefore, a regression was conducted with six predictors of affective attitude on willingness to reduce dairy consumption.

The regression model was statistically significant, $F(6,2099) = 155{,}30$, $p < .001$, indicating that the set of predictors reliably accounts for variance in willingness to reduce dairy consumption. The model explained 30.5% of the variance in the outcome (Adjusted $R^2 = .31$), suggesting a strong and stable model.

Among the six attitudes, it becomes clear that those variables related to dairy have a negative effect on willingness the reduce dairy consumption whereas those related to plant-based dairy have a positive effect on willingness to reduce dairy consumption. More specifically, attitude towards milk ($\beta = -.33$, $p<.001$), yogurt ($\beta = -.06$, $p<.014$) and cheese ($\beta = -.07$, $p=.002$) have a significant negative effect with **attitude towards milk being the strongest predictor**. Furthermore, attitude towards plant-based milk ($\beta = .16$, $p<.001$), yoghurt ($\beta = .10$, $p=.014$) and cheese ($\beta = .17$, $p<.001$) have a significant positive effect on willingness to decrease dairy consumption, indicating that positive attitudes towards plant-based dairy increases the willingness to reduce dairy consumption.

When comparing the influence of affective attitude across countries, overall, a similar result is found (see Figure 9). Affective attitude towards is the strongest negative predictor of willingness to reduce dairy consumption across the four countries ($p<.001$). Affective attitude towards cheese is only significant

positive predictors of willingness to reduce dairy consumption in Germany (p = .008). In Finland, this is a significant negative predictor (p = .025). For Spain (p = .509) and Hungary (p = .439) attitude towards cheese is not a significant predictor.



	Milk	Yogurt	Cheese	Plant-basedmilk	Plant-basedyogurt	Plant-basedcheese
Germany	-0,37	0,05	-0,11	0,24	0,10	0,15
Finland	-0,37	-0,07	-0,09	0,07	0,25	0,14
Spain	-0,28	-0,09	-0,03	0,30	-0,11	0,24
Hungary	-0,27	-0,05	-0,04	0,10	0,09	0,17

Figure 9 Overview of affective attitude towards dairy and plant-based dairy products as predictors of willingness to reduce dairy consumption.

Furthermore, affective attitude towards plant-based milk is a strong positive predictor in Spain (p<.001) and Germany (p<.001) but not in Finland (p = .267) or in Hungary (p = .198). Affective attitude towards plant-based cheese is a positive predictor of willingness to reduce dairy consumption in all countries (p-values >.017). Finally, affective attitude towards plant-based yogurt is only a positive significant predictor in Finland (p<.001), but not in Germany (p=.239), Spain (p=.213) or Hungary (p=.285).

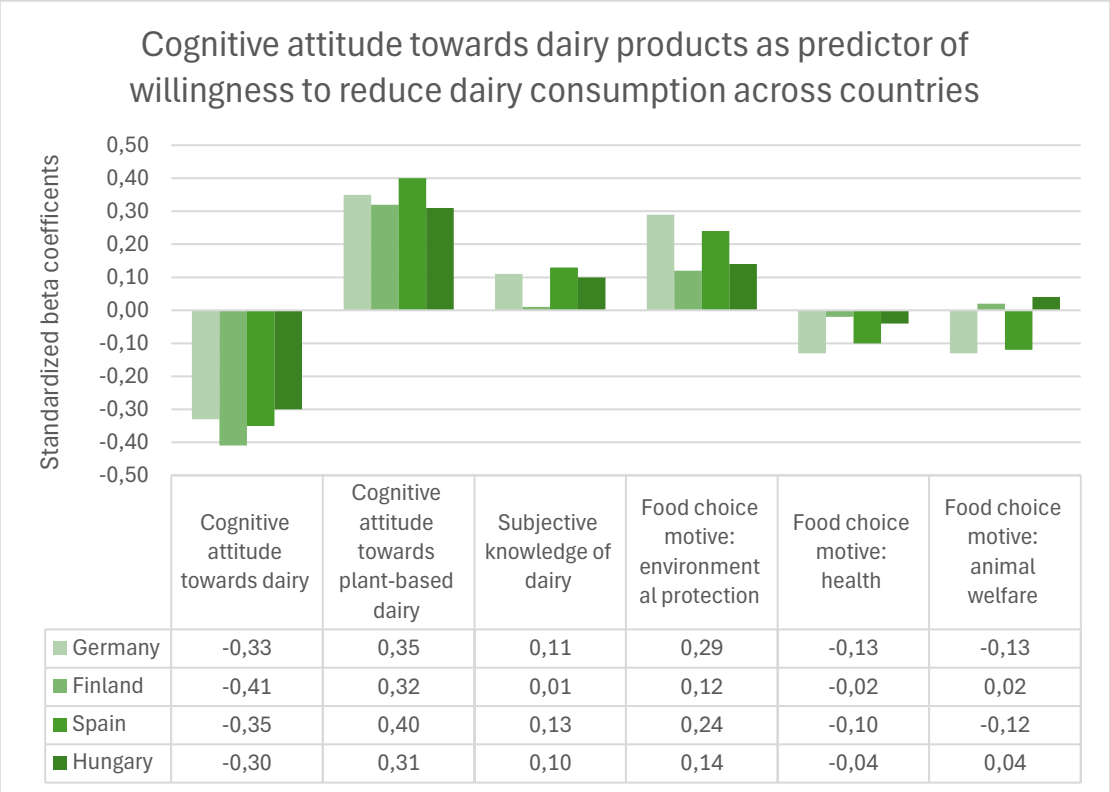
3.3.1.3 The impact of cognitive attitude towards dairy and plant-based dairy

A multiple linear regression was conducted to examine the impact of cognitive attitude towards both dairy and plant-based dairy on the willingness to reduce dairy consumption. Respondents were asked about their cognitive attitude towards dairy and plant-based dairy, their subjective knowledge of dairy products as well as their food choice motives. Therefore, a regression with six predictors was conducted on willingness to reduce dairy consumption.

The regression model was statistically significant, F(6,2099) = 179,06, $p < .001$, indicating that the set of predictors reliably accounts for variance in willingness to reduce dairy consumption. The model explained 33.7% of the variance in the outcome (Adjusted R^2 = .34), suggesting a strong and stable model.

Cognitive attitude towards diary was the strongest negative predictor of willingness to reduce dairy consumption (β = .36, p<.001). In addition, a health food choice motive also decreases willingness to reduce dairy consumption (β = -.08, p<.001). On the other hand, a cognitive attitude towards plant-based dairy is the strongest positive predictor of willingness to reduce dairy consumption (β = .34, p<.001). Furthermore, subjective knowledge of dairy (β = .09, p<.001) and an environmental protection food choice motive (β = .20, p<.001) also increase willingness to reduce dairy consumption. Finally, an animal welfare food choice motive does not significantly affect willingness to reduce dairy consumption (β = -.05, p = .195).

When comparing the influence of affective attitude across countries, overall, a similar result is found (see Figure 10). Cognitive attitude towards dairy is the strongest negative predictor across the four countries (p<.001) and cognitive attitude towards plant-based dairy is the strongest positive predictor across the four countries (p <.001). Subjective knowledge of dairy consumption is a significant positive predictor in Germany (p = .003), Hungary (p = .013) and in Spain (p <.001) but not in Finland (p = .868).



	Cognitive attitude towards dairy	Cognitive attitude towards plant-based dairy	Subjective knowledge of dairy	Food choice motive: environmental protection	Food choice motive: health	Food choice motive: animal welfare
Germany	-0,33	0,35	0,11	0,29	-0,13	-0,13
Finland	-0,41	0,32	0,01	0,12	-0,02	0,02
Spain	-0,35	0,40	0,13	0,24	-0,10	-0,12
Hungary	-0,30	0,31	0,10	0,14	-0,04	0,04

Figure 10 Overview of cognitive attitude towards dairy and plant-based dairy products as predictors of willingness to reduce dairy consumption.

Moreover, when looking at the different food choice motives environmental protection is a positive predictor of willingness to reduce dairy consumption in Germany (p < .001) and Spain (p = .014), but not in Finland (p = .108) or Hungary (p = .089). Furthermore, the health food choice motive is a negative predictor in Germany (p = .003) and in Spain (p = .029) but not in Finland (p = .595) or Hungary (p = .435). Finally, the animal welfare food choice motive is not a significant predictor in none of the countries (p-values >.061).

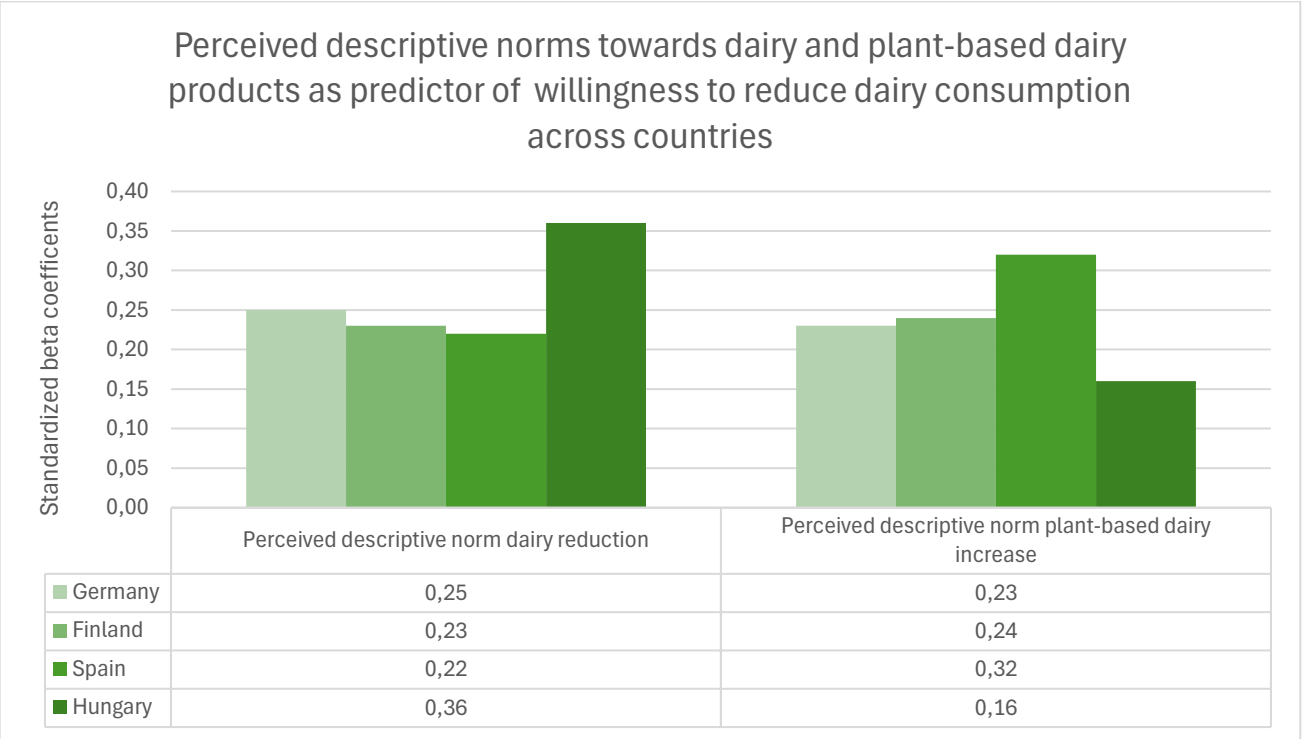
3.3.1.4 The impact of perceived descriptive norm

A multiple linear regression was conducted to examine the impact of social norm on the willingness to reduce dairy consumption. Respondents were asked about their perceived descriptive norms with regards to both decreasing dairy and increasing plant-based dairy consumption. Therefore, a regression with two predictors was conducted on the willingness to reduce dairy consumption.

The regression model was statistically significant, $F(2,2103) = 268.37$, $p < .001$, indicating that the set of predictors reliably accounts for variance in willingness to reduce dairy consumption. The model explained 20.3% of the variance in the outcome (Adjusted $R^2 = .20$), suggesting a strong and stable model.

Overall, both the perceived descriptive norm with regards to decreasing dairy consumption ($\beta = .27$, $p < .001$) and increasing dairy consumption ($\beta = .22$, $p < .001$) have a significant positive effect on willingness to reduce dairy consumption.

When comparing countries, both descriptive norms have a significant impact. However, small differences in the strength of the predictors are present. The perceived descriptive norm with regards to dairy reduction is the strongest in Hungary ($p < .001$), followed by Germany ($p < .001$), Finland ($p < .001$) and Spain ($p < .001$). The perceived descriptive norm with regards to plant-based dairy increase is the strongest in Spain ($p < .001$), followed by Finland ($p < .001$), Germany ($p < .001$) and Hungary ($p = .002$) – see Figure 11 below.



	Perceived descriptive norm dairy reduction	Perceived descriptive norm plant-based dairy increase
Germany	0,25	0,23
Finland	0,23	0,24
Spain	0,22	0,32
Hungary	0,36	0,16

Figure 11 Overview of perceived descriptive norms of dairy reduction and plant-based dairy increase as predictors of willingness to reduce dairy consumption.

3.3.1.5 The impact of perceived behavioral control

A multiple linear regression was conducted to test the impact of perceived behavioral control on willingness to reduce dairy consumption. Respondents were asked about their self-efficacy to both reduce dairy consumption and increase plant-based dairy consumption. Moreover, they were asked about the perceived convenience, perceived availability and accessibility and perceived affordability of both dairy and plant-based dairy products. Therefore, a regression with eight predictors was conducted on the willingness to reduce dairy consumption.

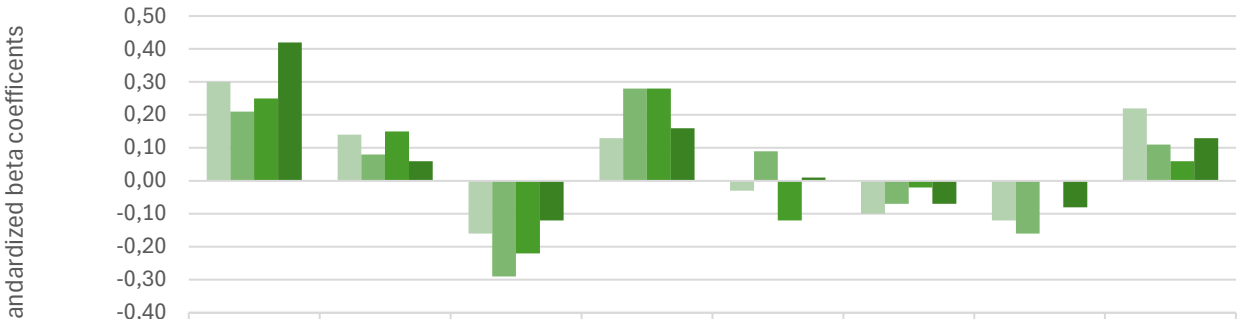
The regression model was statistically significant, $F(8, 2097) = 127.36$, $p < .001$, indicating that the set of predictors reliably accounts for variance in willingness to reduce dairy consumption. The model explained 32.4% of the variance in the outcome (Adjusted $R^2 = .32$), suggesting a strong and stable model.

Self-efficacy to reduce dairy consumption was the strongest positive predictor of willingness to reduce dairy consumption ($\beta = .31$, $p < .001$), followed by perceived convenience of plant-based dairy products ($\beta = .20$, $p < .001$), perceived affordability of plant-based dairy products ($\beta = .14$, $p < .001$) and self-efficacy to increase plant-based dairy consumption ($\beta = .11$, $p < .001$). The strongest negative predictor of willingness to reduce dairy consumption was perceived convenience of dairy products ($\beta = -.20$, $p < .001$), followed by perceived affordability of dairy products ($\beta = -.11$, $p < .001$), perceived availability and accessibility of plant-based dairy products ($\beta = -.06$, $p = .004$). Perceived availability and accessibility of dairy products was not a significant predictor of willingness to reduce dairy consumption ($\beta = -.03$, $p = .106$).

When comparing countries, similar patterns emerge (Figure 12). The strongest positive predictor remains self-efficacy to reduce dairy consumption ($p < .001$), followed by perceived convenience of plant-based dairy products (p -values < .013). However, small differences can be detected between countries: self-efficacy to increase plant-based dairy consumption is a significant positive predictor in Spain ($p < .001$) and Germany ($p = .013$), but not in Finland ($p = .124$) or Hungary ($p = .232$). Perceived affordability of plant-based dairy products is a significant predictor in Germany ($p < .001$), Hungary ($p = .005$) and Finland ($p = .017$), but not in Spain ($p = .188$).

Next, when looking at the negative predictors of willingness to reduce consumption, perceived convenience of dairy products is the strongest predictors across all countries (p-values <.004). The perceived availability and accessibility of plant-based dairy products only has a significant negative effect in Germany ($p = .037$), but not in other countries (p-values>.106). Perceived affordability of dairy products has a negative effect on willingness to reduce dairy consumption in Finland ($p < .001$) and in Germany ($p = .004$), but not in Spain ($p = .993$) or Hungary ($p = .065$).

Surprisingly, perceived availability and accessibility of dairy products has a significant positive effect on willingness to reduce dairy consumption in Finland ($p = .031$), and a significant negative effect in Spain ($p = .002$). No significant effect was found in Germany ($p = .442$) or Hungary ($p = 769$).



	Self-efficacy to reduce dairy consumption	Self-efficacy to increase plant-based dairy consumption	Perceived convenience of dairy products	Perceived convenience of plant-based dairy products	Perceived availability and accessibility of dairy products	Perceived availability and accessibility of plant-based dairy products	Perceived affordability of dairy products	Perceived affordability of plant-based dairy products
Germany Beta	0,30	0,14	-0,16	0,13	-0,03	-0,10	-0,12	0,22
Finland Beta	0,21	0,08	-0,29	0,28	0,09	-0,07	-0,16	0,11
Spain Beta	0,25	0,15	-0,22	0,28	-0,12	-0,02	0,00	0,06
Hungary Beta	0,42	0,06	-0,12	0,16	0,01	-0,07	-0,08	0,13

Figure 12 Overview of behavioural control as predictors of willingness to reduce dairy consumption.

3.3.1.6 The impact of emotional attachment to dairy products

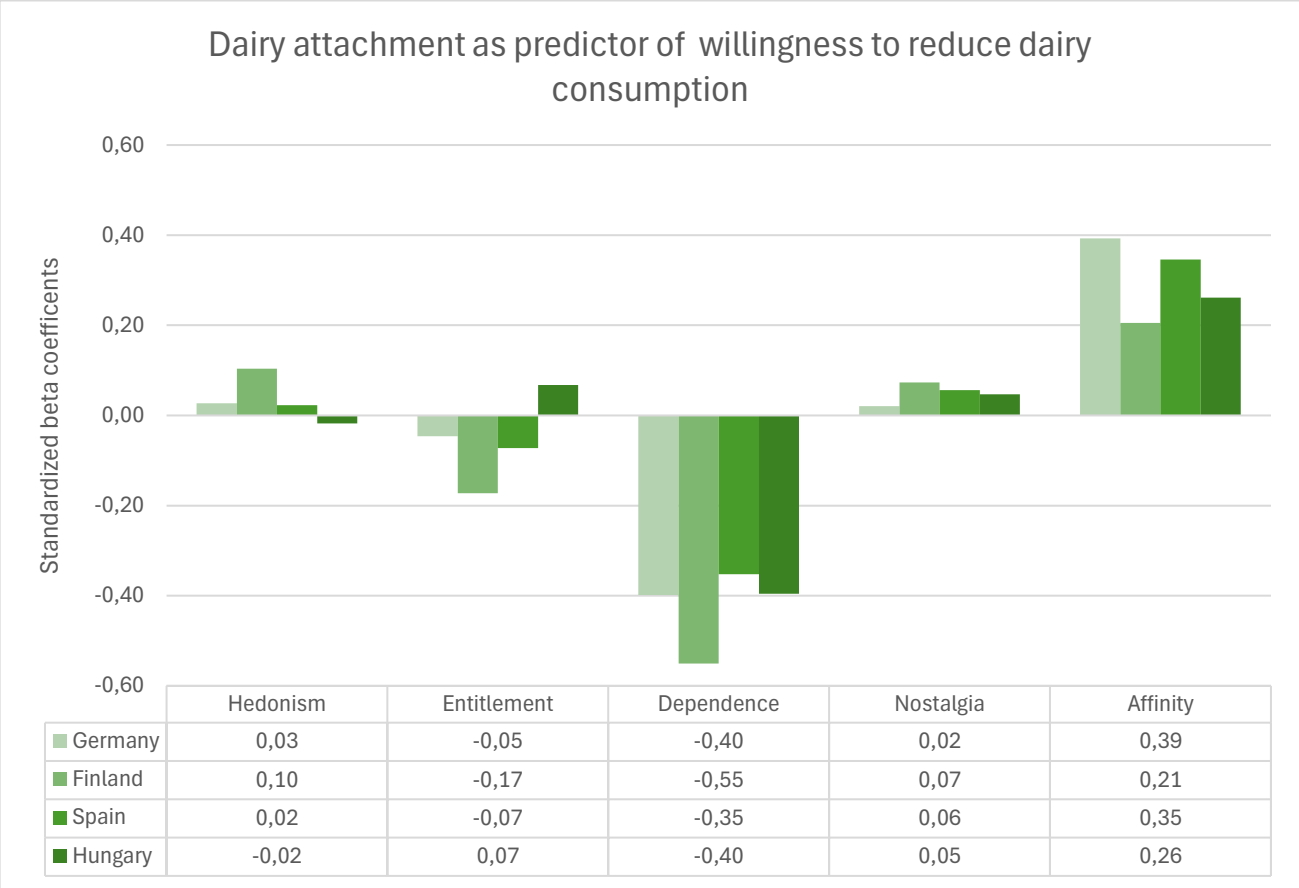
In order to broaden the understanding of people's willingness to reduce dairy consumption, we adopted the concept of meat attachment previously reported to the context of dairy consumption. As such, respondents were asked about five dimensions of emotional attachment to dairy products: hedonism, entitlement, dependence, nostalgia and affinity with animal welfare. Therefore, a multiple linear regression with five predictors was conducted on willingness to reduce dairy consumption.

The regression model was statistically significant, $F(5, 2100) = 228{,}77$, $p < .001$, indicating that the set of predictors reliably accounts for variance in willingness to reduce dairy consumption. The model explained 35.1% of the variance in the outcome (Adjusted $R^2 = .35$), suggesting a strong and stable model.

Two emotional attachment dimensions are significant predictors of willingness to reduce dairy consumption. The strongest predictor is dependence ($\beta = -.42$, $p<.001$): consumers who perceived themselves as dependent on dairy products would be less willing to decrease their dairy consumption. On the other hand, consumers who have a stronger affinity for animal welfare would have more willingness to decrease their dairy consumption ($\beta = .32$, $p<.001$). None of the other dimensions of dairy attachment had a significant effect on willingness to reduce dairy consumption.

When comparing countries, small differences appear. However, overall, dependence and affinity are the strongest negative ($p<.001$) and positive ($p<.001$) predictors of willingness to reduce dairy consumption (see Figure 13). However, in Finland hedonism ($\beta = .10$, $p = .045$) and entitlement ($\beta= -.17$, $p<.001$) also

influence the outcome, whereas this is not the case in the other three countries (p-values hedonism > .563; p-values entitlement > .144).



	Hedonism	Entitlement	Dependence	Nostalgia	Affinity
Germany	0,03	-0,05	-0,40	0,02	0,39
Finland	0,10	-0,17	-0,55	0,07	0,21
Spain	0,02	-0,07	-0,35	0,06	0,35
Hungary	-0,02	0,07	-0,40	0,05	0,26

Figure 13 Overview of dairy attachment as predictors of willingness to reduce dairy consumption.

3.3.2 Willingness to increase plant-based dairy consumption

3.3.2.1 The impact of socio-demographic variables

Similarly to the willingness to reduce their dairy consumption, respondents across the four countries report low willingness to increase their plant-based dairy consumption (M = 2.64, SD = 1.30). An independent samples t-test indicated a significant difference between **males** (M = 2.51, SD = 1.26) and **females** (M = 2.77, SD = 1.31), t(2091) = 4.61, p<.001.

An ANOVA indicated a significant difference between individuals' **dietary preference** in willingness to increase plant-based dairy consumption, F(3, 2097) = 80.47, p<.001. More specifically, vegetarians (M = 4.38, SD = .80) report higher willingness to increase plant-based dairy consumption compared to flexitarians (M = 3.61, SD = 1.24, p =.007) and omnivores (M = 2.49, SD = 1.23, p <.001), but not compared to pescatarians (M = 3.91, SD = 1.07, p = .761). In addition, both pescatarians (p <.001) and flexitarians (p<.001) report higher willingness compared to omnivores. The willingness of pescatarians and flexitarians did not significantly differ (p = 1.000 – see Figure 14).

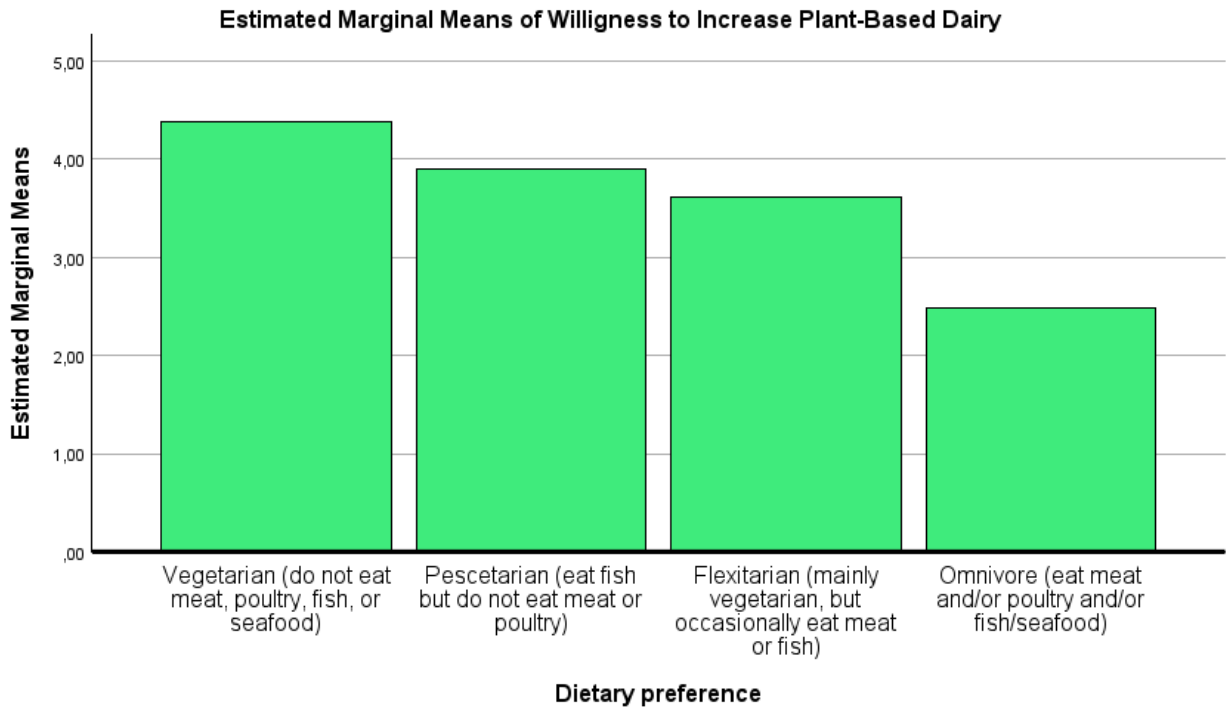


Figure 14 Average willingness to increase plant-based dairy consumption across dietary preferences.

Another ANOVA indicated a non-significant difference in willingness to increase plant-based dairy consumption between the four **countries** studied, F (3, 2097) = 2.53, p = .055 (Figure 15).

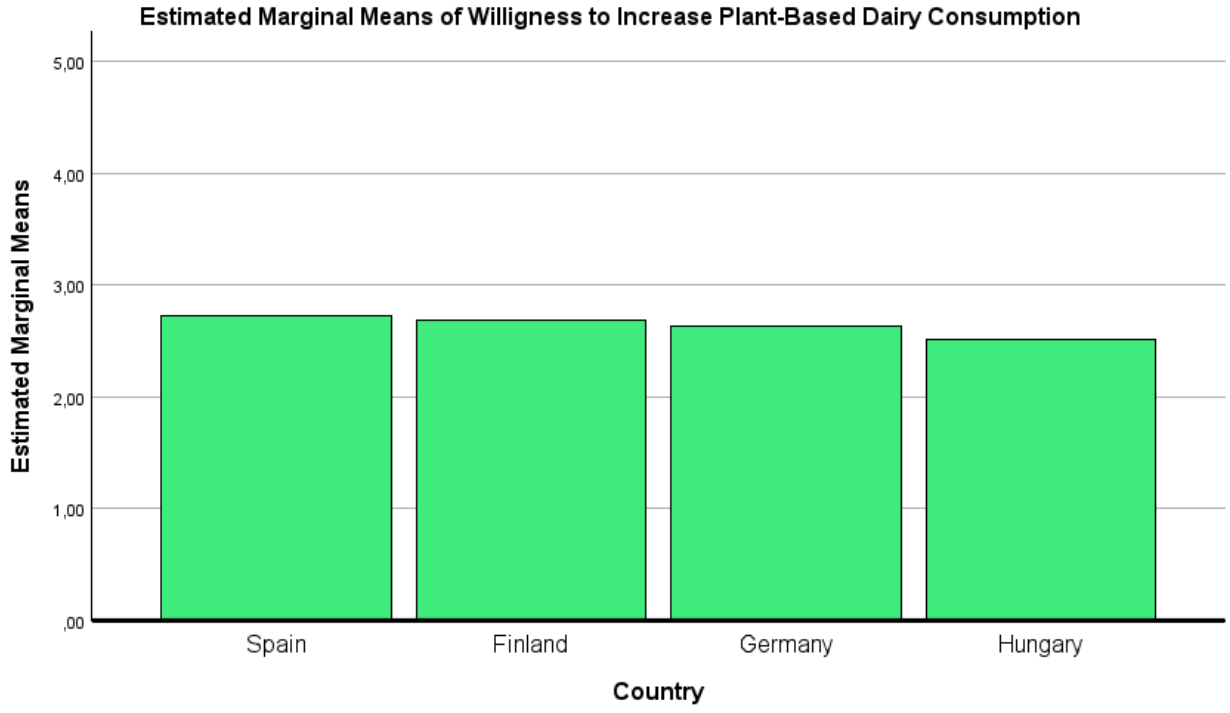


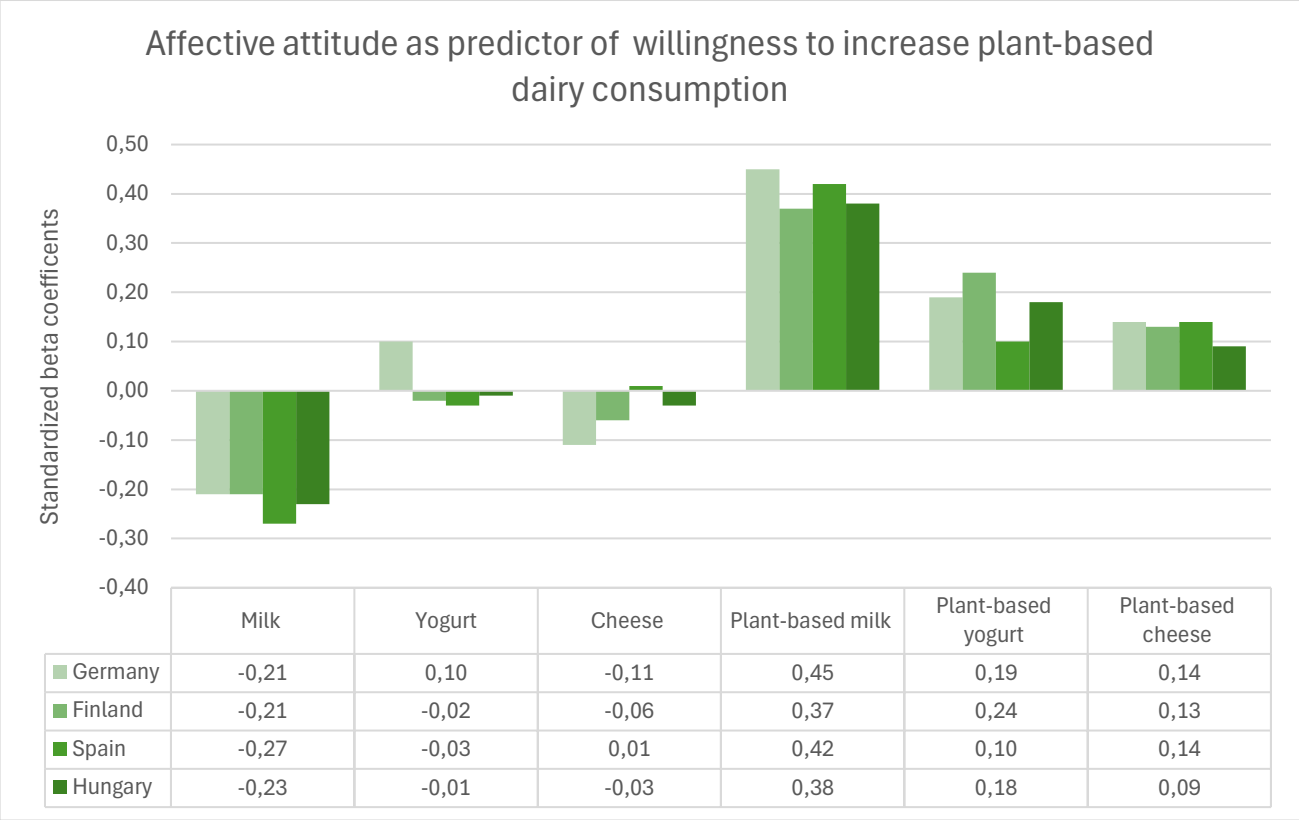
Figure 15 Average willingness to increase plant-based dairy consumption across countries.

3.3.2.2 The impact of affective attitude towards dairy and plant-based dairy

A multiple linear regression was conducted to examine the impact of affective attitude towards both dairy and plant-based dairy on the willingness to increase plant-based dairy consumption. Similarly, to the framework of willingness to reduce dairy consumption, respondents reported their attitudes towards three types of dairy products: milk, yogurt and cheese. Therefore, a regression was conducted with six predictors of affective attitudes on willingness to increase plant-based dairy consumption.

The regression model was statistically significant, $F(6, 2099) = 353.08$, $p<.001$, indicating that the set of predictors reliably accounts for variance in willingness to increase plant-based dairy consumption. The model explains 50.1% of the variance in the outcome (Adjusted $R^2 = .50$), suggesting a strong and stable model.

The variables related to dairy consumption have a negative effect on the willingness to increase plant-based dairy consumption. More specifically, attitude towards milk ($\beta = -.23$, $p<.001$) and attitude towards cheese ($\beta = -.06$, $p<.001$), but not attitude towards yogurt ($\beta = .00$, $p<.995$) have a negative effect with **attitude towards milk** being the strongest negative predictor (Figure 16).



	Milk	Yogurt	Cheese	Plant-based milk	Plant-based yogurt	Plant-based cheese
Germany	-0,21	0,10	-0,11	0,45	0,19	0,14
Finland	-0,21	-0,02	-0,06	0,37	0,24	0,13
Spain	-0,27	-0,03	0,01	0,42	0,10	0,14
Hungary	-0,23	-0,01	-0,03	0,38	0,18	0,09

Figure 16 Overview of affective attitude towards dairy and plant-based dairy products as predictors of willingness to increase plant-based dairy consumption.

On the other hand, attitude towards plant-based dairy all have a significant positive effect on willingness to increase plant-based dairy consumption. More specifically, **attitude towards plant-based milk** ($\beta = .40$, $p<.001$), yogurt ($\beta = .20$, $p<.001$) and cheese ($\beta = .11$, $p<.001$) all positively increase willingness to increase plant-based dairy consumption.

When comparing the influence of affective attitude across countries, overall similar patterns emerge. In all countries, attitude towards milk has the strongest negative impact (p<.001) and attitude towards plant-based milk has the strongest positive effect (p<.001).

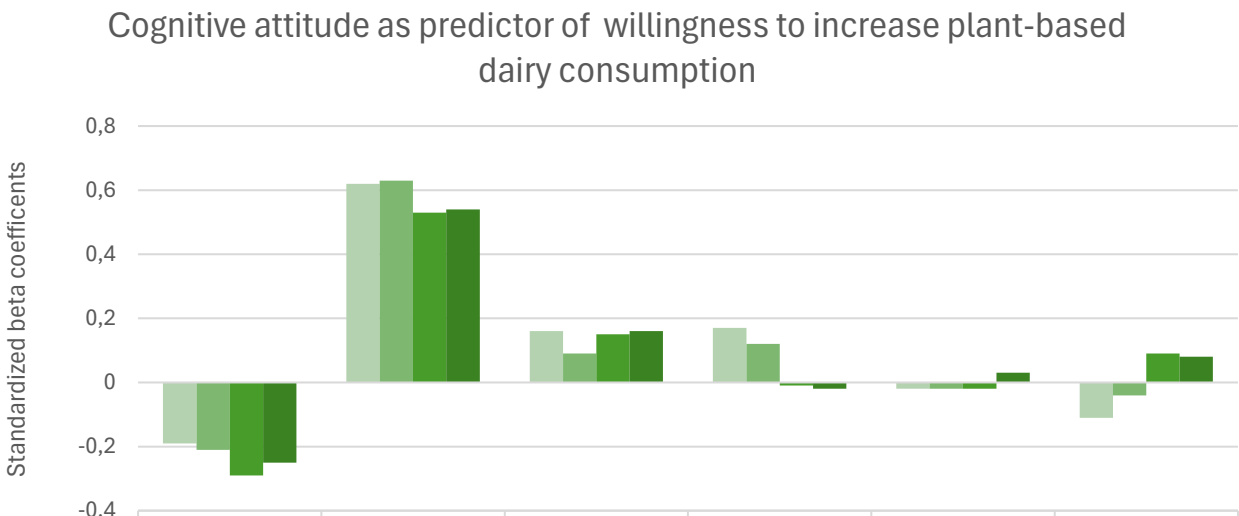
3.3.2.3 The impact of cognitive attitude towards dairy and plant-based dairy

A multiple linear regression was conducted to examine the impact of cognitive attitude towards both dairy and plant-based dairy on the willingness to increase dairy consumption. Respondents were asked about their cognitive attitude towards dairy and plant-based dairy, their subjective knowledge of dairy products as well as their food choice motives. Therefore, a regression with six predictors was conducted on willingness to increase plant-based dairy consumption.

The regression model was statistically significant, F (6, 2099) = 355,36, p<.001, indicating that the set of predictors reliably accounts for variance in willingness to increase plant-based dairy consumption. The model explained 50.3% of the variance in willingness to increase plant-based dairy consumption (Adjust R^2 = .50), suggesting a strong and stable model.

Cognitive attitude was towards plant-based dairy was the strongest positive predictor of willingness to increase plant-based dairy consumption (β = .58, p<.001). In addition, subjective knowledge of dairy also has a positive effect on willingness to increase plant-based dairy consumption (β = .15, p<.001). **Cognitive attitude towards dairy** is a negative predictor of willingness to increase plant-based dairy consumption (β = -.26, p<.001). None of the food choice motives had a significant effect on willingness to increase plant-based dairy (environmental: β = .05, p = .170; health: β = .01, p =.502; animal welfare: β = .02, p = .493).

In comparison of the four countries under study, a similar pattern emerges with cognitive attitude towards plant-based dairy being the strongest, positive, predictor in all countries (p <.001) and cognitive attitude towards dairy being the strongest negative predictor (p<.001) (see Figure 17). Moreover, in Germany the environmental protection food choice motive has a positive, significant influence (β - .17, p = .007) on willingness to increase plant-based dairy consumption but does not have a significant in the three other countries (p- values > .063). Neither the health nor the animal welfare food choice motive has a significant effect in none of the countries (p-values >.072).



	Cognitive attitude towards dairy	Cognitive attitude towards plant-based dairy	Subjective knowledge of dairy	Food choice motive: environmental protection	Food choice motive: health	Food choice motive: animal welfare
Germany	-0,19	0,62	0,16	0,17	-0,02	-0,11
Finland	-0,21	0,63	0,09	0,12	-0,02	-0,04
Spain	-0,29	0,53	0,15	-0,01	-0,02	0,09
Hungary	-0,25	0,54	0,16	-0,02	0,03	0,08

Figure 17 Overview of cognitive attitude towards dairy and plant-based dairy products as predictors of willingness to increase plant-based dairy consumption.

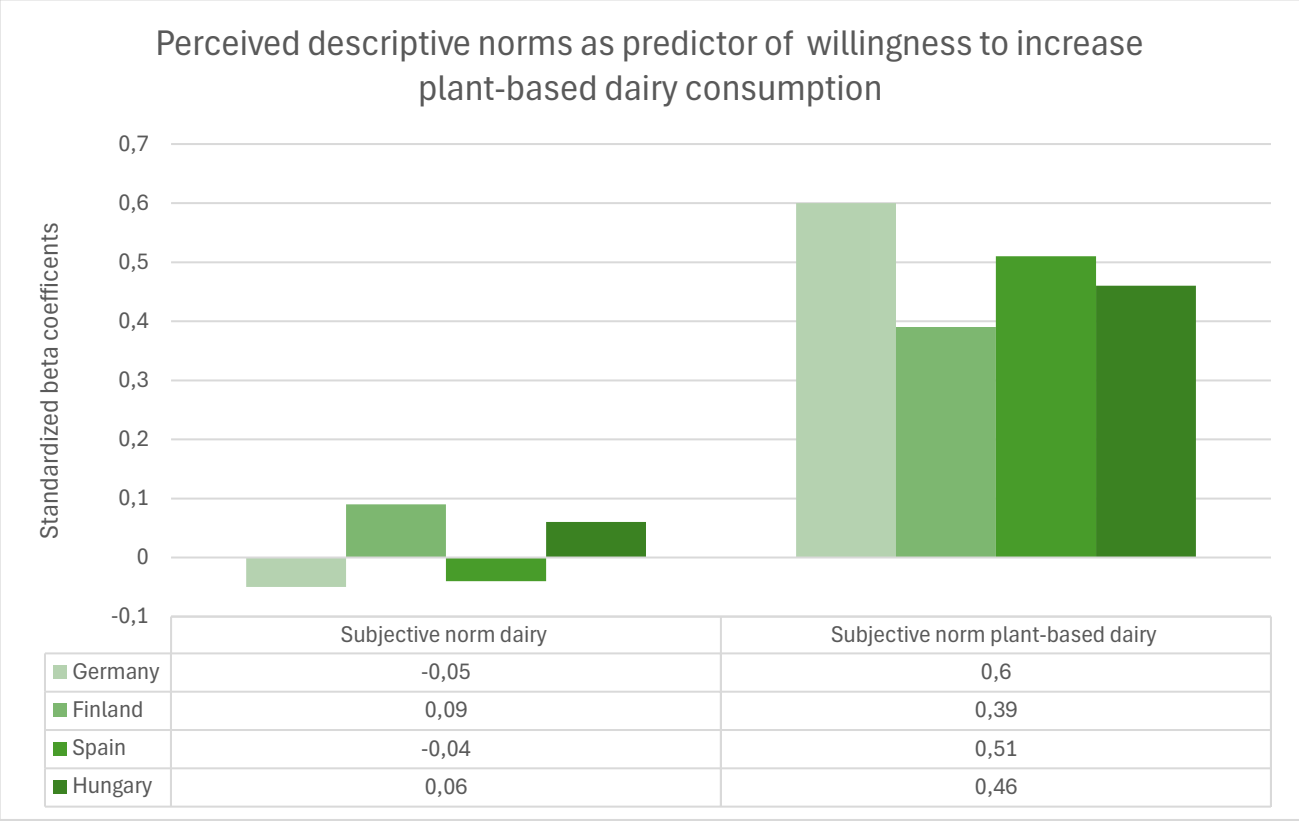
3.3.2.4 The impact of perceived descriptive norm

A multiple linear regression was conducted to examine the impact of social norm on the willingness to increase plant-based dairy consumption. Respondents were asked about their perceived descriptive norms with regards to both decreasing dairy and increasing plant-based dairy consumption. Therefore, a regression with two predictors was conducted on the willingness to increase plant-based dairy consumption.

The regression model was statistically significant, $F(2,2103) = 347,11$, $p < .001$, indicating that the set of predictors reliably accounts for variance in willingness to reduce dairy consumption. The model explained 24.7% of the variance in the outcome (Adjusted $R^2 = .25$), suggesting a strong and stable model.

Overall, only perceived descriptive norm with regards to plant-based dairy consumption has a significant and positive effect on willingness to increase plant-based dairy ($\beta = .489$, $p<.001$). Perceived descriptive norm with regards to dairy consumption does not have a significant effect on willingness to increase plant-based dairy ($\beta = .013$, $p = .493$).

The same pattern remains when comparing the four countries. Perceived descriptive norm with regards to plant-based dairy consumption has a significant positive effect on willingness to increase plant-based dairy in all counties ($p<.001$) as shown in Figure 18. Furthermore, perceived descriptive norms with regards to dairy consumption does not have a significant effect on the outcome (p-values > .101).



	Subjective norm dairy	Subjective norm plant-based dairy
Germany	-0,05	0,6
Finland	0,09	0,39
Spain	-0,04	0,51
Hungary	0,06	0,46

Figure 18 Overview of perceived descriptive norms with regards to dairy and plant-based dairy products as predictors of willingness to increase plant-based dairy consumption.

3.3.2.5 The impact of perceived behavioral control

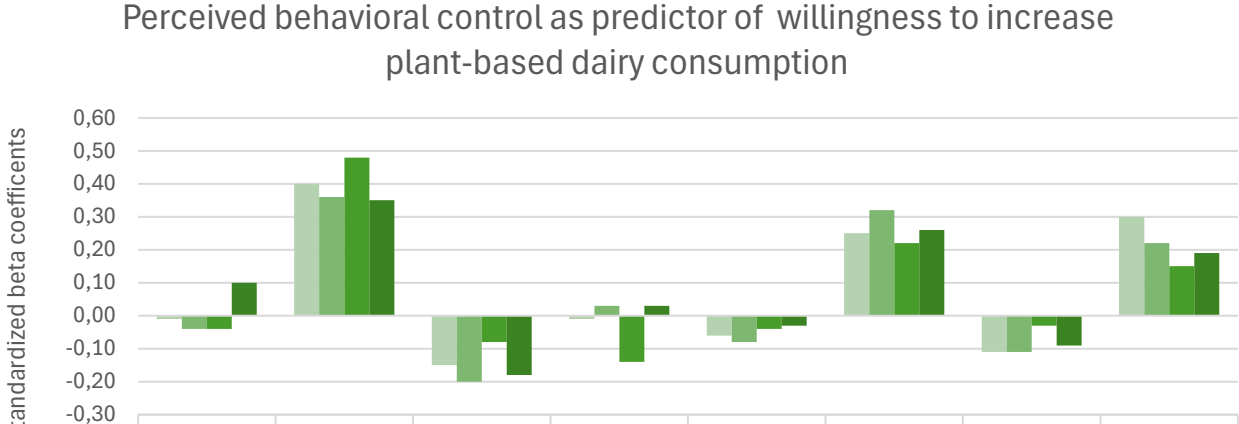
A multiple linear regression was conducted to test the impact of perceived behavioral control on willingness to increase plant-based dairy consumption. Respondents were asked about their self-efficacy to both reduce dairy consumption and increase plant-based dairy consumption. Moreover, they were asked about the perceived convenience, perceived availability and accessibility and perceived affordability of both dairy and plant-based dairy products. Therefore, a regression with eight predictors was conducted on the willingness to increase plant-based dairy consumption.

The regression model was statistically significant, $F(8, 2097) = 234{,}73$, $p < .001$, indicating that the set of predictors reliably accounts for variance in willingness to reduce dairy consumption. The model explained 47.0% of the variance in the outcome (Adjusted $R^2 = .47$), suggesting a strong and stable model.

Self-efficacy to increase plant-based dairy consumption has the strongest positive impact on willingness to increase plant-based dairy consumption ($\beta = .41$, $p < .001$). In addition, both perceived convenience ($\beta = .27$, $p < .001$) and affordability ($\beta = .22$, $p < .001$) of plant-based dairy have a positive effect on the outcome. Perceived convenience of dairy ($\beta = -.16$, $p < .001$), perceived availability and accessibility of plant-based dairy ($\beta = -.09$, $p < .001$), perceived affordability of dairy ($\beta = -.06$, $p = .002$) and perceived availability and accessibility of dairy ($\beta = -.04$, $p = .041$) all have significant negative effects, albeit smaller, on willingness to increase plant-based dairy consumption.

When comparing the four different countries, self-efficacy to increase plant-based dairy consumption is consistently the strongest predictor (p<.001) across all countries (see Figure 19), followed by the perceived availability and accessibility (p <.001) and affordability of plant-based dairy products (p<.001). Self-efficacy to reduce dairy consumption only has a significant positive effect in Hungary (p = .018), but not in the other three countries (p-values > .321). Perceived availability and accessibility of dairy products only has a significant positive effect on the outcome for Finnish respondents (p = .035), whereas this was not the case for others (p-values >.113).

Perceived convenience of dairy products (p-values < .021) is a negative predictor in all countries. Perceived affordability of dairy products is a negative predictor in all countries (p-values < .029), except in Spain (p =.454). In Spain, perceived convenience of plant-based dairy products is a more important negative predictor of willingness to increase plant-based dairy consumption (p<.001) – whereas this is not the case in the other three countries (p-values >.364).



	Self-efficacy to reduce dairy consumption	Self-efficacy to increase plant-based dairy consumption	Perceived convenience of dairy products	Perceived convenience of plant-based dairy products	Perceived availability and accessibility of dairy products	Perceived availability and accessibility of plant-based dairy products	Perceived affordability of dairy products	Perceived affordability of plant-based dairy products
Germany	-0,01	0,40	-0,15	-0,01	-0,06	0,25	-0,11	0,30
Finland	-0,04	0,36	-0,20	0,03	-0,08	0,32	-0,11	0,22
Spain	-0,04	0,48	-0,08	-0,14	-0,04	0,22	-0,03	0,15
Hungary	0,10	0,35	-0,18	0,03	-0,03	0,26	-0,09	0,19

Figure 19 Overview of behavioural control as predictors of willingness to increase plant-based dairy consumption.

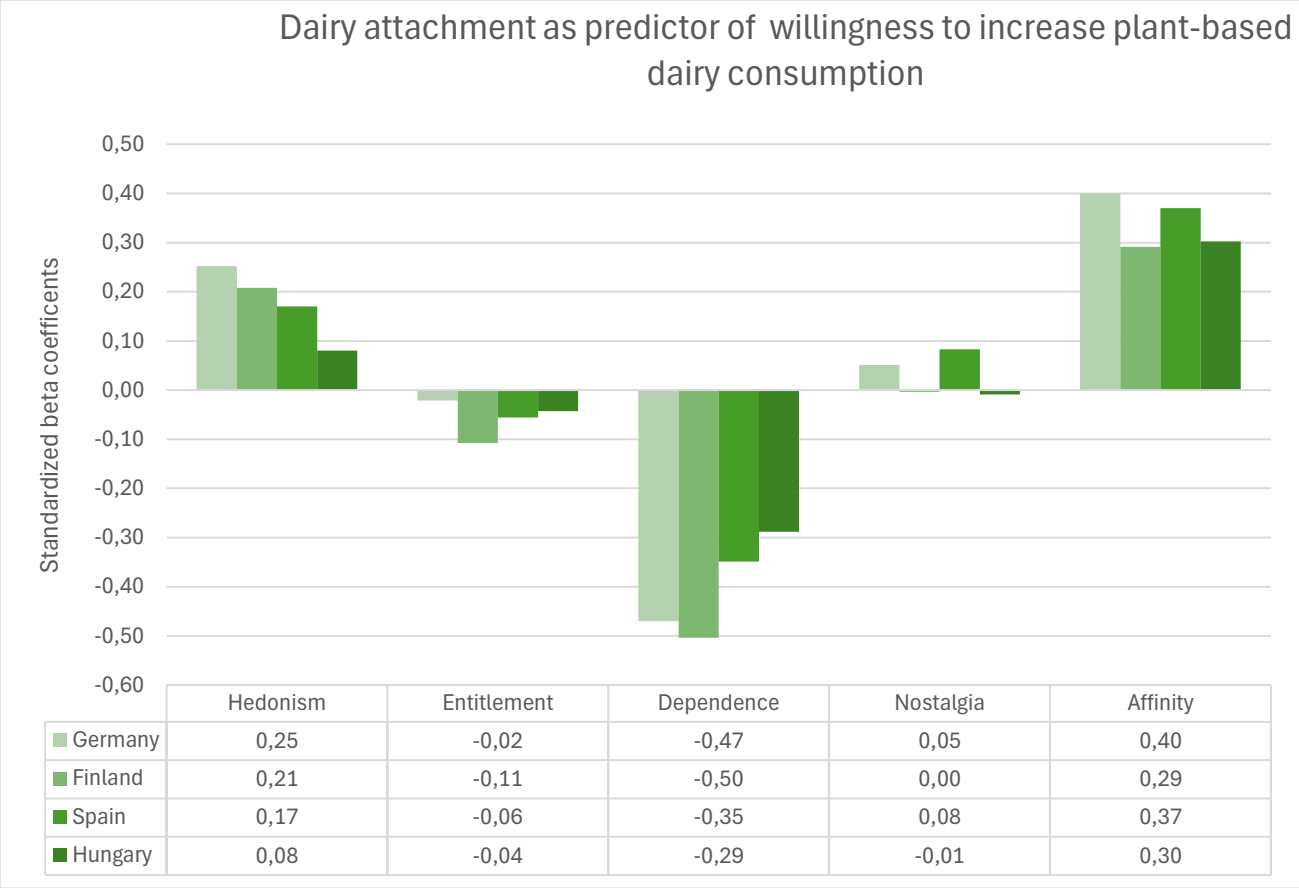
3.3.2.6 The impact of emotional attachment to dairy products

Similarly to the willingness to reduce dairy consumption, we also want to broaden the understanding of people's willingness to increase plant-based dairy consumption. As such, respondents were asked about five dimensions of emotional attachment to dairy products: hedonism, entitlement, dependence, nostalgia and affinity with animal welfare. Therefore, a multiple linear regression with five predictors was conducted on willingness to increase plant-based dairy consumption.

The regression model was statistically significant, F (5, 2100) = 209.55, p < .001, indicating that the set of predictors reliably accounts for variance in willingness to reduce dairy consumption. The model explained 29.5% of the variance in the outcome (Adjusted R^2 = .30), suggesting a strong and stable model.

Three emotional attachment dimensions are significant predictors of willingness to increase plant-based dairy consumption. The strongest predictor is dependence (β = -.43, p<.001): consumers who perceived themselves as dependent on dairy products would be less willing to increase their plant-based dairy consumption. On the other hand, consumers who have a stronger affinity with animal welfare (β = .35, p<.001) and enjoy plant-based dairy (β = .20, p<.001) would be more willing to increase their plant-based dairy consumption None of the other dimensions of dairy attachment had a significant effect on willingness to reduce dairy consumption.

When comparing countries, small differences appear. However, overall, dependence and affinity are the strongest negative (p<.001) and positive (p<.001) predictors of willingness to increase plant-based dairy consumption (see Figure 20). Where in Germany, Finland and Spain hedonism has a positive effect on the outcome (p-values ≤.001), this is not the case in Hungary (p = .171). Moreover, in Finland, entitlement (p = .040). has a negative effect on the willingness to increase plant-based dairy consumption. However, this is not the case in the three other countries (p-values >.276)



	Hedonism	Entitlement	Dependence	Nostalgia	Affinity
Germany	0,25	-0,02	-0,47	0,05	0,40
Finland	0,21	-0,11	-0,50	0,00	0,29
Spain	0,17	-0,06	-0,35	0,08	0,37
Hungary	0,08	-0,04	-0,29	-0,01	0,30

Figure 20 Overview of dairy attachment as predictors of willingness to increase plant-based dairy consumption.

This research line shows that consumers' willingness to reduce dairy and adopt plant-based alternatives is shaped by a mix of attitudes, social norms, emotional attachment, and perceived control. Positive views of plant-based products and higher self-efficacy strongly predict openness to change, while emotional dependence on dairy hinders it. Cross-country differences highlight the role of cultural and market context, pointing to the need for tailored strategies in promoting plant-based transitions.

4. Surveys Among Vulnerable Groups

4.1 Aging Population

4.1.1 Aims and Method

4.1.1.1 Introduction

Two shorter surveys were conducted among the subgroups that CUES' intervention cases in WP3 and WP4 focus on. The first survey aimed to assess the factors that influence sustainable dietary habits among aging individuals (65+ years) in Europe. Based on the literature reviews in T2.1, few studies have examined the aging population in the context of food sustainability, thus presenting a significant gap in the literature. Previous research on aging individuals has primarily focused on health impacts of dietary choices, and on the relative prevalence of food waste avoidance behaviors compared to younger generations. The current study aimed to examine the perceptions of and motivations for sustainable dietary habits among aging European citizens. Specifically, we used two different indicators for sustainable dietary habits: The frequency of sustainable food consumption—in which the consumption of products related to the three dimensions of sustainability (i.e., social, economic, and environmental) are assessed—and food waste behaviors. These indicators were also part of the survey among representative samples (see 2.1) allowing for meaningful cross-group comparisons while keeping the instrument concise and accessible for the target population groups.

4.1.1.2 Country Selection and Participants

Data was collected in four European countries, each representing one of the European regions. Countries were selected based on CUES WP3 and WP4 intervention locations. Specifically, Hungary (representing Eastern Europe) was selected to connect to the intervention led by TVE in WP3 on a digital application to provide product sustainability-related information to aging individuals. Hungary is also the location for the intervention led by KLT and FINT in WP4, which has the objective to enhance consumers' trust through integrating technological innovations that help maximize transparency and traceability in farmers' communication. Italy (representing Southern Europe) was selected due to the digital hackathon intervention led by DOT in WP3, which aims to include aging individuals. The WP4 intervention led by TCA and FINT on food traceability and transparency in the value chain of food manufacturers is also situated in Italy. Finally, Ireland (representing Northern Europe) and the Netherlands (representing Western Europe) were selected to connect to the WP3 intervention formerly led by EFDN to promote more sustainable food choices during sports events.

Data collection was conducted through Dynata, a survey panel provider. A total of 1998 responses (55% male, 45% female) were collected. Participants had an average age of 70.50 (SD = 4.49). The majority of the sample (84%) indicated that they were retired. The average number of people living in the household was 2.05 (SD = 1.24). The sample mostly included people who were the main food purchaser (68%) or one of the main food purchasers (25%) in their household. The average number of children was 2.10 (SD = 6.29) and the average number of grandchildren was 2.23 (SD = 2.85). Most of the participants felt that their household income was sufficient to meet their living expenses (62%) or that their household income was sometimes sufficient (25%). A smaller portion of the sample indicated that they do not have pre-existing health conditions (37%). Descriptive statistics of participants per country are presented in Table 4.

	Hungary	Italy	Ireland	Netherlands
Sample size	501	495	503	499
Gender				
Male	40%	59%	57%	64%
Female	60%	41%	43%	36%
Dietary preference				
Meat eater	93%	66%	82%	80%
Flexitarian	6%	27%	11%	17%
Pescetarian	0%	4%	2%	1%
Vegetarian	0%	3%	4%	1%
Vegan	1%	0%	1%	1%
Other demographics				
Age: M (SD)	70.29 (4.13)	70.09 (4.48)	70.51 (4.63)	71.10 (4.64)
Retired	95%	76%	82%	82%
Household size: M (SD)	2.01 (1.75)	2.24 (1.03)	2.14 (1.26)	1.81 (0.55)
Children: M (SD)	2.07 (3.31)	1.66 (3.28)	2.21 (1.79)	2.46 (11.43)
Grandchildren: M (SD)	2.27 (2.39)	1.10 (2.27)	2.76 (3.17)	2.83 (3.13)

Table 4 Description of participants per country of the aging population survey.

4.1.1.3 Variables

Two outcome measures were used to indicate **sustainable dietary habits**. First, **frequency of sustainable food consumption** was assessed with 21 items based on Verain et al. (2015; 2021), in which each item represented a sustainable food product category. Participants were asked to indicate how many times each week they consume the sustainable food products for their main meal on a 5-point scale (1 = never; 5 = one or more times a day). Second, 5 items by Stefan et al. (2013) were used to assess

how much food was thrown away in a regular week on a 5-point scale (1 = not at all; 5 = more than a half). Both measures were also included in the survey among the representative sample.

Nine single items were used to assess different **food motivations** (Onwezen et al., 2019; Steptoe et al., 1995): "It is important to me that the food I eat on a typical day is…"; e.g., healthy, affordable (1 = strongly disagree; 5 = strongly agree). **Motivations to avoid food waste** were assessed using an adjusted scale by Ribbers et al. (2023). The scale included four motivations: Environmental, moral, financial, and social. Each motivation was measured with three items on a 5-point scale (1 = strongly disagree, 5 = strongly agree). Based on the goal-framing theory (Lindenberg & Steg, 2007), five different **associations with sustainable diets** were assessed: Financial gain, health gain, hedonic, moral, and normative associations. Each type of association was measured with three items on a 5-point scale (1 = strongly disagree, 5 = strongly agree).

To prepare for the digital interventions among aging individuals, we introduced five self-developed items to assess how often participants in the last six months **accessed digital media for sustainable food related information**. A 5-point scale was used (1 = never, 5 = very often).

4.1.2 Findings

4.1.2.1 Sustainable Food Consumption Categories

A principal component analysis indicated that the 21 items that assessed frequency of sustainable food consumption clustered together in five different sustainable product categories. Results of a repeated measures analysis showed that within the aging population, the **product categories differed significantly in frequency of consumption**, $F(3.79, 7577.13) = 2159.75$, $p < .001$.

The highest-ranked product category regarding frequency of consumption related to **seasonal vegetables and fruits, and local and regional food products** ($\alpha = .79$; $M = 3.27$, $SD = 0.81$). The frequency of consumption was significantly lower for the second most consumed product category, $F(1, 1997) = 1789.56$, $p < .001$, which included the **consumption of free-range meat and dairy, as well as consuming smaller portions of meat and dairy** ($\alpha = .70$; $M = 2.45$, $SD = 0.68$).

The third-highest ranked product category referred to the **consumption of vegetables and fruit with Fairtrade labels, as well as products, meat and dairy with a sustainability label** ($\alpha = .84$; $M = 2.15$, $SD = 0.76$). This product category was again significantly less often consumed than the second product category, $F(1, 1997) = 320.02$, $p < .001$, but did not differ from the fourth highest-ranked product category, $F(1, 1997) = 1.93$, $p = .165$, on the **consumption of organic meat, vegetables, fruit, and dairy** ($\alpha = .84$; $M = 2.12$, $SD = 0.86$).

The fifth-ranked and thereby least popular sustainable product category among the aging population was the **consumption of vegetarian burgers and meals, hybrid meat, and plant-based products instead of meat** ($\alpha = .75$; $M = 1.58$, $SD = 0.62$). The difference in frequency of consumption was significant compared to the fourth-ranked product category, $F(1, 1997) = 896.23$, $p < .001$.

These findings (Figure 21) thus indicate that among the aging population, the attractiveness of consuming a sustainable diet appears to depend on the type of sustainable food products. For the remainder of section 3.1, we will focus on the average score of overall sustainable food product consumption.

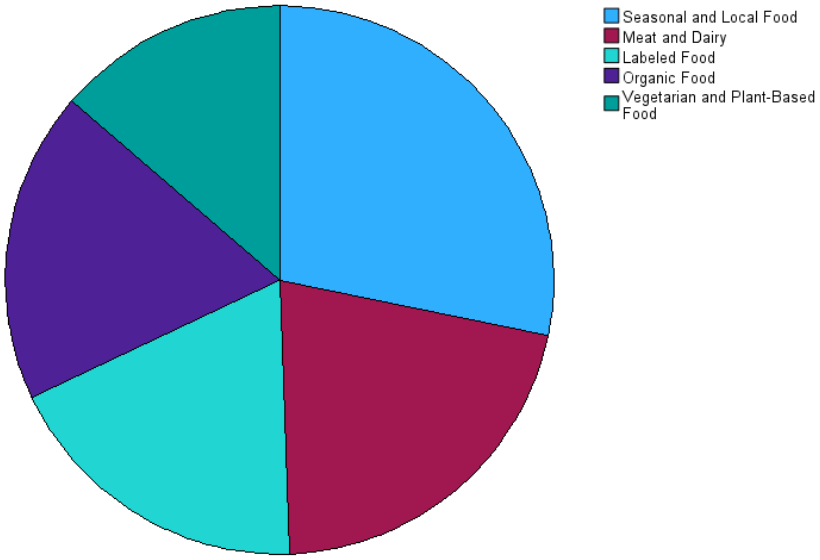


Figure 21 Frequency of sustainable product consumption (N = 1,998), measured on a 1–5 scale, where 1 = Never and 5 = One or more times a day.

4.1.2.2 Sociodemographic Variables and Sustainable Dietary Habits

The **frequency of sustainable food consumption** was influenced by various sociodemographic factors. An ANOVA revealed a significant difference between **countries** in sustainable food consumption, $F(3, 1994) = 55.66$, $p < .001$. Aging individuals in Ireland ($M = 2.45$, $SD = 0.58$) and Italy ($M = 2.39$, $SD = 0.49$) did not differ in their sustainable food consumption, $p = .283$, but both countries had significantly higher sustainable food consumption scores than aging individuals in the Netherlands ($M = 2.16$, $SD = 0.47$), $p < .001$, and Hungary ($M = 2.11$, $SD = 0.48$), $p < .001$. The two latter countries did not differ significantly, $p = 339$.

Another ANOVA was conducted on **perceived income sufficiency** to meet individuals' living expenses, which was shown to be a significant predictor of frequency of sustainable food consumption ($F(2, 1987) = 11.45$, $p < .001$. Participants who answered 'yes' ($M = 2.28$, $SD = 0.51$) or 'sometimes' ($M = 2.33$, $SD = 0.57$) to whether they felt their household income was sufficient to meet their living expenses, consumed sustainable food products more frequently than participants who answered 'no' ($M = 2.15$, $SD = 0.49$). An ANOVA using **occupational status** as a predictor showed no significant effect on sustainable food consumption.

A multiple regression analysis was conducted with **gender** (0 = male, 1 = female), **pre-existing health conditions** (0 = pre-existing health conditions, 1 = no pre-existing health conditions), **household size**, number of **children**, number of **grandchildren**, and **age** as predictors of frequency of sustainable consumption. The model was significant, $F(6,1840) = 7.31$, $p < .001$, $R^2 = .02$. Results indicated that a larger household was associated with more frequent sustainable food consumption, $\beta = .11$, $p < .001$. Furthermore, women consumed sustainable products significantly more frequently than men, $\beta = .09$, $p < .001$. People who indicated that they did not have pre-existing health conditions reported more frequent sustainable food consumption than those who did not indicate this, $\beta = .07$, $p = .004$. No

significant effects were found of the number of children, number of grandchildren, and age on frequency of sustainable food consumption.

In sum, frequency of sustainable food consumption within the aging population was influenced by country, perceived income sufficiency, household size, gender, and pre-existing health conditions. In contrast, occupational status, number of children, number of grandchildren, and age did not impact frequency of sustainable food consumption.

Similar analyses were conducted to examine the impact of sociodemographic variables on **food waste behavior**. An ANOVA showed that there were significant differences between **countries** in the amount of food that is wasted. Specifically, aging individuals in Ireland tended to waste more food ($M = 1.78$, $SD = 0.64$), than aging individuals in Italy ($M = 1.39$, $SD = 0.56$), $p < .001$, the Netherlands ($M = 1.38$, $SD = 0.48$), $p < .001$, and Hungary ($M = 1.36$, $SD = 0.50$), $p < .001$. Thus, while Irish aging consumers were shown to most frequently consume sustainable food products, these consumers also reported the highest food waste. Food waste did not differ among Italian, Dutch, and Hungarian aging consumers.

An ANOVA indicated that participants who answered 'sometimes' to whether their **household income** was sufficient to meet their living expenses wasted more food ($M = 1.59$, $SD = 0.67$) than those who answered either 'yes' ($M = 1.45$, $SD = 0.53$) or 'no' ($M = 1.41$, $SD = 0.56$), $F(2, 1987) = 11.86$, $p < .001$. In line with the results on frequency of sustainable food consumption, an ANOVA with **occupational status** as a predictor showed no significant effect on food waste behavior.

A multiple regression analysis was conducted with **gender** (0 = male, 1 = female), **pre-existing health conditions** (0 = pre-existing health conditions, 1 = no pre-existing health conditions), **household size**, number of **children**, number of **grandchildren**, and **age** as predictors of food waste behaviors. The model was significant, $F(6, 1840) = 6.48$, $p < .001$, $R^2 = .02$. Results indicated that a larger household was associated with more food waste, $\beta = .08$, $p < .001$. Furthermore, women reported less food waste than men ($\beta = -.11$, $p < .001$). No significant effects were found of pre-existing health conditions, number of children, number of grandchildren, or age on food waste behaviors. **Thus, food waste behaviors were impacted by country, perceived income sufficiency, household size, and gender.** No effects were found on food waste behaviors by pre-existing health conditions, occupational status, number of children, number of grandchildren, and age. Results are summarized in Table 5.

Table 5 Summary of results.

Predictors	Sustainable food consumption	Food waste
Country	Highest in Ireland and Italy	Highest in Ireland
Gender	Higher among women	Higher among men
Age	Not significant	Not significant
Household size	Positive relation	Positive relation
Income sufficiency	Highest among (sometimes) sufficient	Highest among sometimes sufficient
Health	Highest among no pre-existing conditions	Not significant
Occupation	Not significant	Not significant
Children	Not significant	Not significant
Grandchildren	Not significant	Not significant

4.1.2.3 Food Motivations and Sustainable Dietary Habits

We explored how nine different food motivations were linked to sustainable dietary habits. First, a multiple regression analysis was conducted using **frequency of sustainable food consumption** as the dependent variable. The model was significant, $F(9, 1988) = 49.67$, $p < .001$, $R^2 = .18$. The two strongest predictors were motivations related to **environmental friendliness**, which emerged as a positive driver of frequency of sustainable food consumption, $\beta = .21$, $p < .001$, and **affordability** as a negative driver of frequency of sustainable food consumption, $\beta = -.20$, $p < .001$. Other positive predictors of frequent sustainable food consumption were whether the food was **fairly traded**, $\beta = .16$, $p < .001$, **animal friendly**, $\beta = .11$, $p < .001$, and **high in protein**, $\beta = .05$, $p = .032$. People who were motivated by the **convenience of buying and preparing food** were less likely to frequently consume sustainable products, $\beta = -.06$, $p = .013$. Food motivations related to perceived healthiness, familiarity, and the extent to which the food provides pleasurable sensations were not significantly associated with frequency of sustainable food consumption.

A second multiple regression analysis on food motivations was conducted, now using **food waste behaviors** as the dependent variable. The two strongest predictors of food waste were motivations related to **healthiness**, $\beta = -.12$, $p < .001$, and to **affordability**, $\beta = -.11$, $p < .001$, such that stronger health and affordability motivations were associated with less food waste. Participants who were motivated by **convenience**, $\beta = .06$, $p = .020$, and by whether **protein levels** were high, $\beta = .07$, $p = .002$, tended to waste more food. Food waste behaviors were not influenced by motivations related to environmentally friendliness, pleasurable sensations, animal friendliness, fair trade, or familiarity.

4.1.2.4 Food Waste Motivations and Food Waste Behavior

Four different types of **motivations to avoid food waste** were compared. Moral motivations (i.e., the behavior is unacceptable) were the highest among the aging population ($M = 4.44$, $SD = 0.67$), followed by financial motivations (e.g., the behavior is a waste of money; $M = 4.27$, $SD = 0.74$), environmental motivations (e.g., the behavior damages the environment; $M = 4.20$, $SD = 0.75$), and finally social motivations (e.g., the behavior might be judged by others; $M = 2.70$, $SD = 1.21$ – see Figure 22).

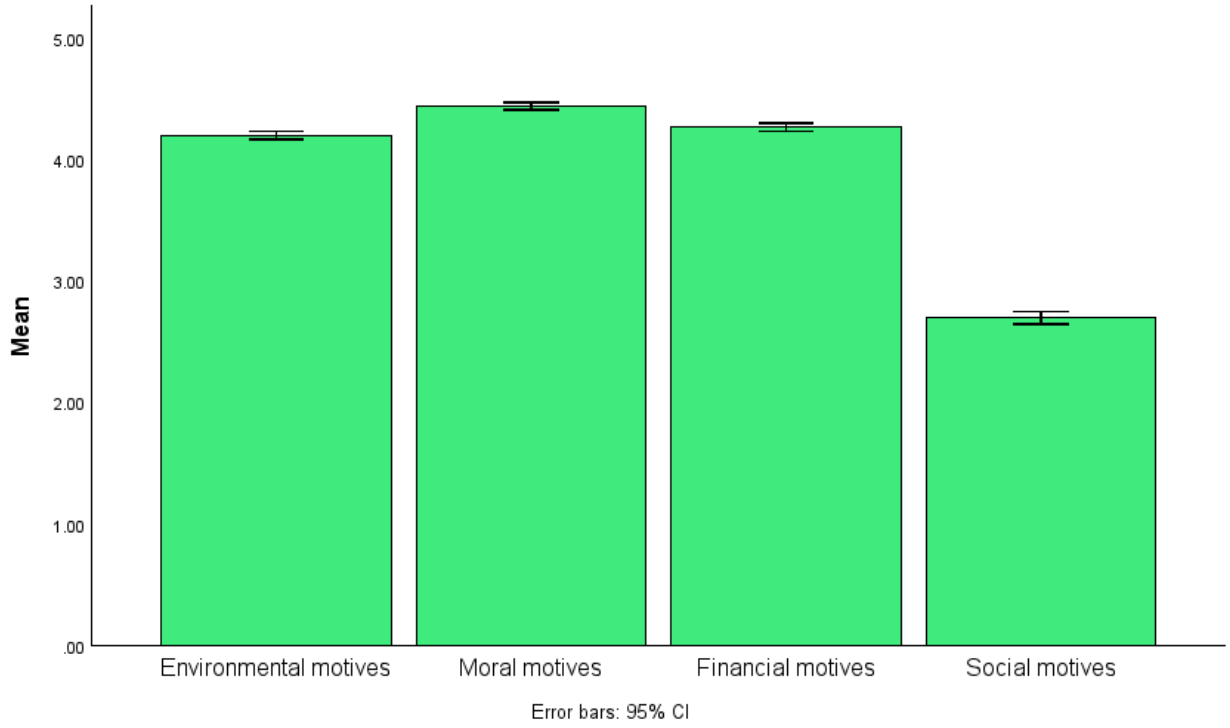


Figure 22 Motivations to avoid food waste (answer scale 1-5), where higher scores reflect stronger motivations. The visible error bars represent the confidence intervals.

A multiple regression analysis was conducted with the four food waste motivations as predictors and food waste behavior as the outcome variable. The model was significant, $F(4, 1993) = 68.70$, $p < .001$, $R^2 = .12$. Aging individuals who reported higher **moral**, $\beta = -.28$, $p < .001$, and **financial** motivations, $\beta = -.11$, $p < .001$, were less likely to waste food. In contrast, higher **social** motivations were associated with more food waste, $\beta = .12$, $p < .001$. Food waste behavior was not influenced by environmental motivations.

4.1.2.5 Associations with Sustainable Diets

When asked for their beliefs about sustainable diets, aging consumers reported the highest scores for such a diet being healthy ($M = 3.93$, $SD = 0.84$) and moral ($M = 3.73$, $SD = 0.92$). Furthermore, hedonistic ($M = 3.50$, $SD = 0.93$) and normative ($M = 3.45$, $SD = 0.92$) associations were also relatively high, while associations with sustainable diets representing a financially beneficial choice were the lowest ($M = 2.84$, $SD = 1.04$). A repeated measures analysis revealed that scores of all associations differed significantly from each other, $F(2.94, 5869.05) = 984.16$, $p < .001$. Figure 23 shows an overview of associations with sustainable diets scores.

A multiple regression analysis was conducted with the five associations as predictors, and frequency of **sustainable consumption** as the outcome measure. A significant model was found, $F(5, 1992) = 78.73$, $p < .001$, $R^2 = .16$. The strongest positive predictors were **financial**, $\beta = .14$, $p < .001$, and **health** associations, $\beta = .14$, $p < .001$. Stronger associations with sustainable diets and **hedonistic** outcomes, $\beta = .09$, $p = .012$, or **social norms**, $\beta = .09$, $p = .015$, also positively predicted sustainable food consumption. Moral associations were not a significant predictor.

Thus, while sustainable diets are construed as a healthy and a moral choice among aging consumers, the strongest drivers of behaviours related to sustainable diets were financial and health perceptions.

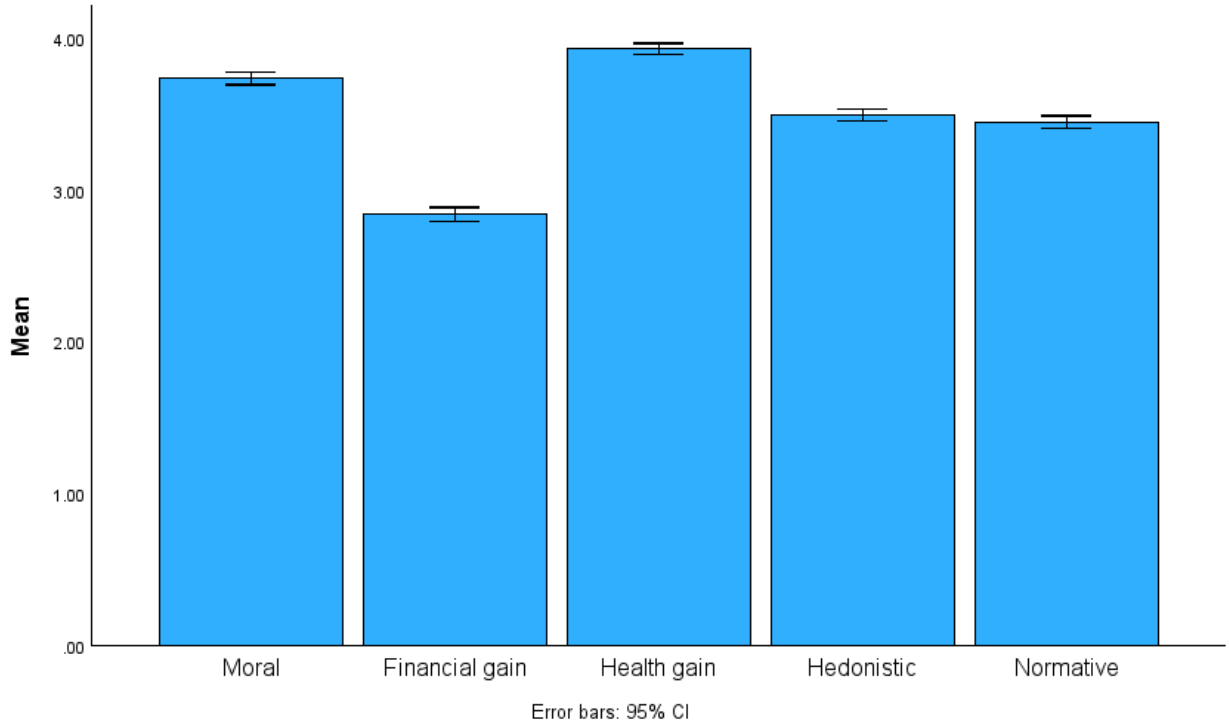


Figure 23 Associations with sustainable diets (answer scale 1-5), where higher scores reflect stronger associations. The visible error bars represent the confidence intervals.

4.1.2.6 Digital Media Use

For all digital media, average scores of use were below the scale midpoint (2.5). This thereby indicates that **aging individuals did not commonly use digital media** to obtain more information about sustainable food. A repeated measures analysis showed that usage differed significantly across the different types of digital media, $F(3.88, 7737.85) = 336.27$, $p < .001$. News websites ($M = 2.32$, $SD = 1.26$) were more often used than social media ($M = 2.04$, $SD = 1.23$), $p < .001$. In turn, usage of social media was somewhat higher than usage of mobile apps ($M = 2.00$, $SD = 1.22$), $p = .043$. No difference was found in the use of mobile apps and email newsletters ($M = 1.99$, $SD = 1.21$). Finally podcasts use ($M = 1.52$, $SD = 0.97$) was significantly lower than the use of email newsletters, $p < .001$. Thus, while aging consumers might be less inclined to rely on digital media to learn more about sustainable food overall, **news websites are most likely to be used**, whereas **podcasts use is the least likely** among this group (Figure 24).

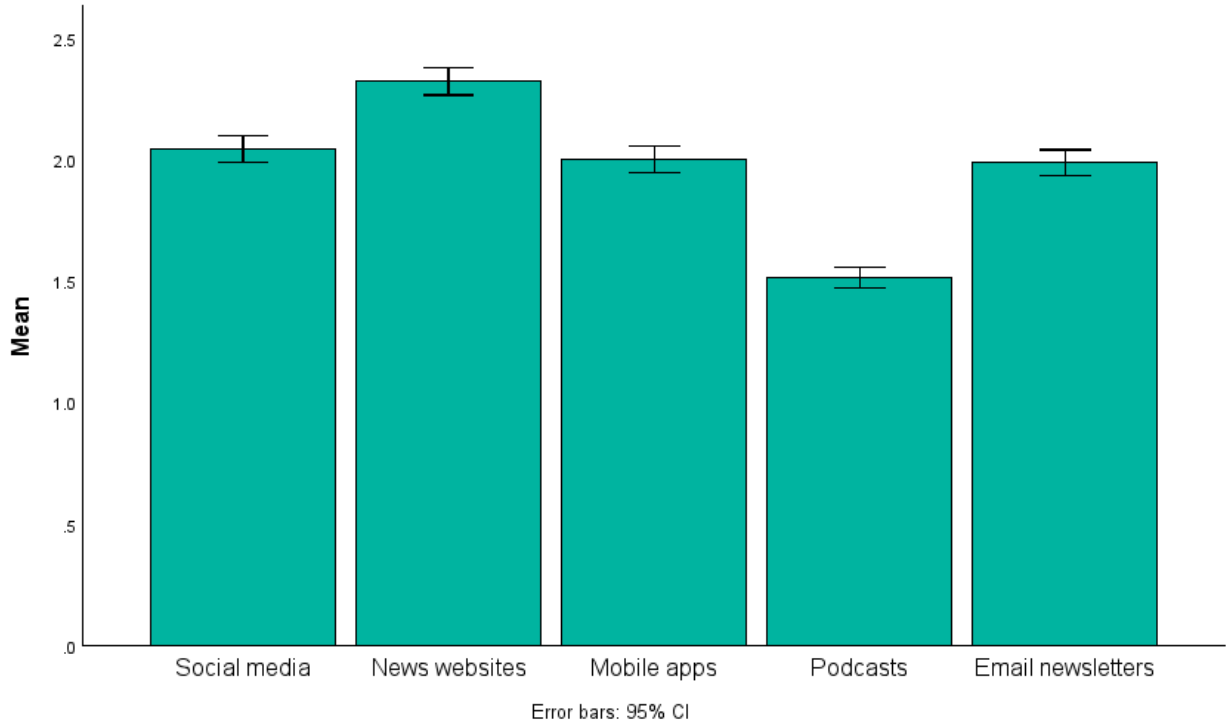


Figure 24 Use of digital media, measured on a 5-point scale (1 = never, 5 = very often). The visible error bars represent the confidence intervals.

4.2 Low Income Population

4.2.1 Aims and methods

4.2.1.1 Introduction

The second shorter survey was also conducted among the subgroups that CUES' intervention cases in WP3 and WP4 focus on. It aimed to assess the factors that influence sustainable dietary habits among low-income population in Europe. Based on the literature reviews in T2.1, previous research examining the low-income population in the context of food sustainability was rather limited, thus presenting a significant gap in the literature. Previous research on low-income population has primarily focused on health impacts of dietary choices. The current study aimed to examine **how socioeconomic and environmental factors affect sustainable dietary habits among low-income European citizens**, as well as **how low-income population's sustainable food competences and attitudes shape their dietary habits**. Specifically, we used 1) the frequency of sustainable food consumption and 2) diet quality (the frequency of healthy food consumption and unhealthy food consumption) to indicate sustainable dietary habits. The first indicator is also part of the surveys among representative samples and aging population samples, and the second indicator is tailored to the low-income population, given that this specific group may face practical challenges to access or afford more healthy food.

4.2.1.2 Country Selection and Participants

Data was collected in four European countries, each representing one of the European regions. Countries were selected based on CUES WP3 and WP4 intervention locations. Specifically, **Hungary** (representing Eastern Europe) was selected to connect to the intervention led by TVE in WP3 on a digital application to provide product sustainability-related information to vulnerable individuals. Hungary is also the location for the intervention led by KLT and FINT in WP4, which has the objective to enhance consumers' trust through integrating technological innovations that help maximize transparency and traceability in farmers' communication. **Portugal** (representing Southern Europe) was selected due to the intervention led by FBPA in WP4, which aims to include low-income families. The intervention is designed to address two challenges among the low-income: First, the lack of awareness about sustainability challenges along the food value chain. Second, the lack of guidance on how to cook sustainable meals and food surplus. Utilizing the survey to understand the citizens' dietary habits in Portugal will offer good insights for developing the intervention. Finally, **Ireland** (representing Northern Europe) and the **Netherlands** (representing Western Europe) were selected to connect to the WP3 intervention formerly led by EFDN to promote more sustainable food choices during sports events. They also enable a comparison of part of the results between the aging population survey and the low-income population survey.

Data collection was conducted through Dynata, a survey panel provider. The cut-off point for filtering the low-income population was adapted for each country. The final sample consisted of 1309 responses (33.31% male, 66% female, 0.23% other, 0.46% prefer not to respond). Participants had an average age of 42.76 (SD = 14.77). Most of the people (72.58%) do not have a university degree. The sample included people who are currently working full-time (28.7%), working part-time (20.46%), unemployed (20.15%), unable to work—health problems (13.05%), retired (9.77%), and students (7.86%). The net yearly income of most households (58.9%) is between 5,001-10,000 euro, followed by the household income up to 5,000 euro (29,49%). Only a small group of people (11.61%) reported their income between 10,001-15,000 euro. The sample mostly included people who were the main food purchaser (72.42%) or one of the main food purchasers (20.4%) in their household. Most of the participants live in an urban area (45.5%), followed by a rural area (31.91%), and a suburban area (21.3%). The majority are native to the country they currently live in (82.5%). Only a small group are immigrants (7.72%). Descriptive statistics of participants per country are presented in Table 6.

Table 6 Description of participants per country of the low-income population survey.

	Hungary	Portugal	Ireland	Netherlands
Sample size	336	274	340	359
Gender				
Male	38.39%	36.13&	31.47%	28.13%
Female	60.71%	63.87%	67.35%	71.31%
Household net yearly income				
Up to 5,000	39.88%	38.69%	17.94%	23.68%
5,001 – 10,000	60.12%	61.31 %	37.35%	76.32%

10,001 – 15,000	N/A	N/A	44.71%	N/A
Other demographics				
Age: M (SD)	39.33 (12.74)	37.85 (13.28)	43.67 (14.23)	48.84 (15.81)
Household size: M (SD)	2.89 (2.70)	2.72 (2.20)	2.84 (2.39)	1.73 (1.40)
Children: M (SD)	0.83 (1.22)	0.61 (0.90)	4.68 1.11)	0.36 (0.79)

4.2.1.3 Variables

Two outcome measures were used to indicate **sustainable dietary habits**. First, **frequency of sustainable food consumption** was assessed with 21 items based on Verain et al. (2015; 2021), in which each item represented a sustainable food product category. Participants were asked to indicate how many times each week they consume the sustainable food products for their main meal on a 5-point scale (1 = never; 5 = one or more times a day). The items were then grouped into four sustainable food categories according to the original scale and the confirmation factor (CFA) analysis results: organic food fairtrade food (6 items), seasonal and local food (3 items), meat replacement food (5 items), and free range products (7 items). Second,11 items by Uyar et al. (2023) were used to assess **diet quality** in a regular week on a 5-point scale (1 = never; 5 = one or more times a day). The items were then classified into the healthy food group (6 items) and unhealthy food group (5 items) based on the original scale and the CFA results.

Two measures—**food accessibility and food affordability**—were used to assess **socioeconomic factors**, and two measures—**cultural food preferences and social norms**—were used to assess **environmental factors**, since the relevance of these factors has been confirmed for vulnerable groups in previous literature. All four variables were measured on a 5-point scale. More specifically, one self-developed item was used to assess food accessibility, because this variable is relatively easy to assess with a single straightforward question. Six items formed the food affordability measure based on Ville et al. (2019). The cultural food preferences factor which represents an individual's attitude toward traditional food was measured by three items based on Pieniak et al. (2009). The fourth factor—social norms—was measured by three items based on Koklic et al. (2019).

Additionally, two variables were used to assess **sustainable food competences and attitudes**. Following Chen et al. (2001), **self-efficacy** was measured by 8 items on a 7-point scale (1 = strongly disagree; 7 = strongly agree). **Attitudes toward sustainable food consumption** was measured by 3 items on a 7-point scale based on White and Simpson (2013).

All variables discussed above were included in the model below (see Figure 25) and tested using structural equation modeling with R packages.

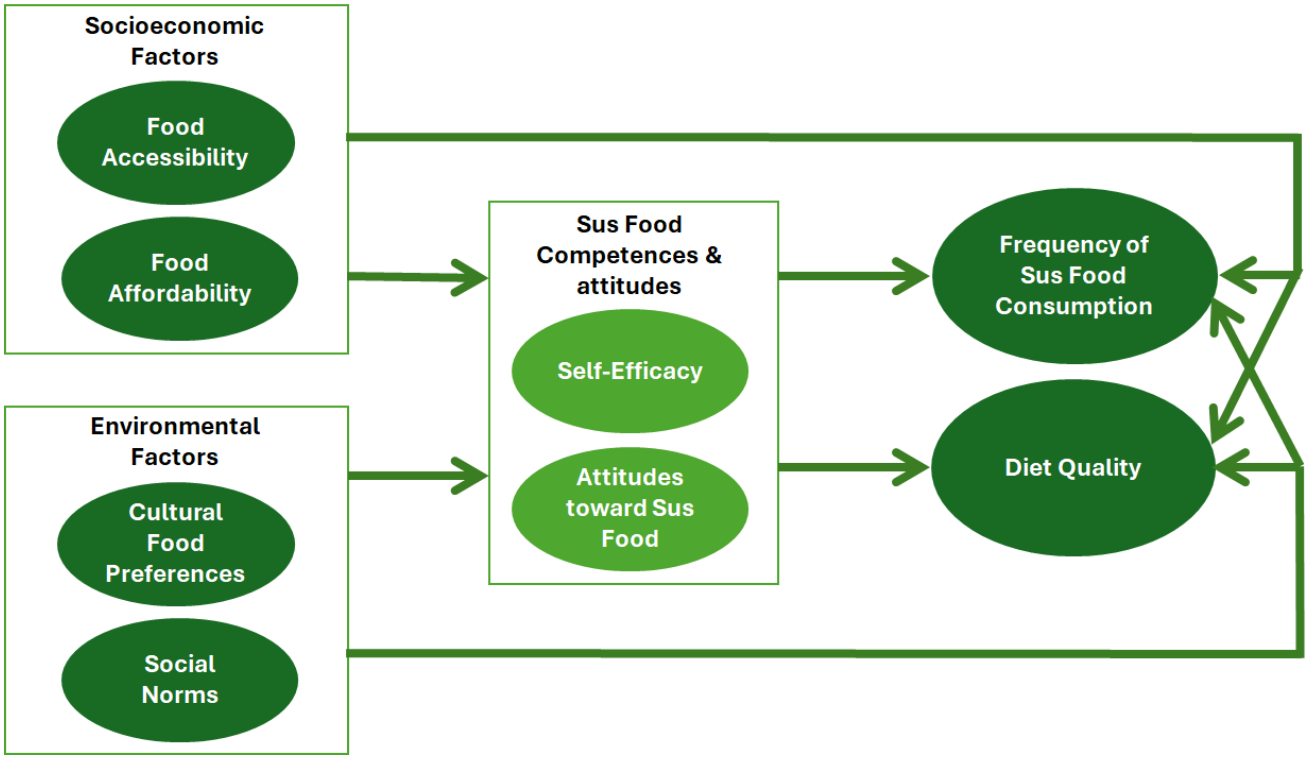


Figure 25 Conceptual model for understanding sustainable food consumption among low-income populations.

4.2.2 Findings

4.2.2.1 Descriptive statistics: a cross-country comparison

Table 7 shows the descriptive statistics of the key variables presented in the conceptual model (see Figure 26). On average, sustainable food consumption behaviors were moderate to low across the sample, with higher engagement in consuming seasonal and local products (M = 2.96, SD = 0.79) and lower engagement in meat replacement (M = 1.84, SD = 0.66). Notably, **Portuguese participants reported the highest levels of sustainable consumption in both organic & fairtrade products** (M = 2.55, SD = 0.80) **and seasonal & local products** (M = 3.17, SD = 0.75). **Hungarian participants showed the lowest Means across most sustainable consumption measures**. Regarding diet quality, the overall sample reported a relatively high level of healthy food consumption (M = 3.20, SD = 0.66) and moderate consumption of unhealthy foods (M = 2.60, SD = 0.80). However, **Irish respondents reported lower healthy food consumption compared to the other countries** (M = 2.60, SD = 0.66).

Table 7 Descriptive statistics: a cross-country comparison.

	Full Sample M (SD)	Hungary M (SD)	Portugal M (SD)	Ireland M (SD)	Netherlands M (SD)
Sustainable food consumption – *organic & fairtrade*	2.16 (0.82)	1.86 (0.78)	2.55 (0.80)	2.28 (0.77)	2.02 (0.77)
Sustainable food consumption – *seasonal &local*	2.96 (0.79)	3.05 (0.91)	3.17 (0.75)	2.93 (0.75)	2.74 (0.70)
Sustainable food consumption – *meat replacement*	1.84 (0.66)	1.73 (0.65)	1.93 (0.69)	1.82 (0.63)	1.90 (0.66)
Sustainable food consumption – *free range products*	2.31 (0.74)	2.35 (0.78)	2.55 (0.76)	2.29 (0.70)	2.09 (0.66)
Diet quality – *healthy food*	3.20 (0.66)	3.00 (0.68)	3.20 (0.60)	2.60 (0.66)	3.31 (0.63)
Diet quality – *unhealthy food*	2.60 (0.80)	2.78 (0.87)	3.20 (0.74)	2.78 (0.75)	2.35 (0.74)
Food accessibility	3.39 (1.84)	3.32 (2.03)	3.58 (1.96)	3.37 (1.78)	3.33 (1.59)
Food affordability	3.93 (1.78)	4.30 (1.81)	4.38 (1.67)	3.70 (1.74)	3.47 (1.73)
Cultural food preferences	5.32 (1.29)	5.19 (1.27)	5.78 (1.29)	5.45 (1.27)	4.98 (1.22)
Social norms	3.86 (1.39)	3.80 (1.43)	4.14 (1.39)	4.15 (1.31)	3.43 (1.31)
Attitudes toward sus food consumption	4.80 (1.45)	4.72 (1.47)	4.97 (1.29)	4.91 (1.47)	4.63 (1.50)
Self-efficacy	4.78 (1.23)	4.54 (1.39)	4.84 (1.18)	4.88 (1.14)	4.94 (1.16)

In terms of socioeconomics and environmental factors, food accessibility (M = 3.39, SD = 1.84) and affordability (M = 3.93, SD = 1.78) varied moderately, with **Portugal reporting higher scores for affordability** (M = 4.38, SD = 1.67). Cultural food preferences were particularly strong across all countries (M = 5.32, SD = 1.29), with Portuguese participants scoring the highest (M = 5.78, SD = 1.29). Social norms supporting sustainable food consumption were moderate (M = 3.86, SD = 1.39), with Ireland and Portugal showing slightly higher Means compared to Hungary and the Netherlands.

Additionally, participants reported relatively high positive attitudes toward sustainable food consumption (M = 4.80, SD = 1.45) and self-efficacy (M = 4.78, SD = 1.23), with the **Netherlands showing the highest self-efficacy levels** (M = 4.94, SD = 1.16).

4.2.2.2 Impact of socioeconomic and environmental factors on sustainable dietary habits

Structural equation modeling (SEM) was chosen for this part of the analysis because it allows for the simultaneous estimation of multiple dependent variables and the modeling of latent constructs, offering a more comprehensive view of interrelated influences. The SEM analysis evaluated the impact of food accessibility, food affordability, cultural preferences, and social norms on six outcome variables: consumption of organic products, seasonal and regional products, meat replacements, free-range products, and diet quality (both healthy and unhealthy food). The model showed a good fit to the data, with $\chi^2(842) = 3563.33$, $p < .001$, CFI = 0.91, TLI = 0.90, RMSEA = 0.05, SRMR = 0.06.

Regarding the path analysis results, the consumption of organic and fair-trade food was significantly influenced by people's ability to afford food ($\beta = 0.09$, $p = .01$), their cultural preferences ($\beta = 0.14$, $p < .001$), and social norms ($\beta = 0.38$, $p < .001$). All three factors had a positive effect on organic food consumption, indicating that low-income individuals who can better afford food, have strong cultural attachments to food, and are embedded in social environments that encourage sustainable eating are more likely to consume organic food products. Seasonal and local food consumption was significantly influenced by cultural preferences ($\beta = 0.16$, $p < .001$) and social norms ($\beta = 0.19$, $p < .001$), both showing positive effects. This suggests that cultural and social contexts play critical roles in promoting seasonal and local food choices. In the case of meat replacement consumption, social norms were the only significant factor ($\beta = 0.23$, $p < .001$), highlighting that social influence strongly encourages the adoption of meat alternatives. Similarly, the consumption of free-range products, products with a sustainability label, and smaller portions of meat and dairy products was positively and significantly associated with cultural preferences ($\beta = 0.13$, $p < .001$) and social norms ($\beta = 0.37$, $p < .001$). In summary, **social norms played a strong role in shaping low-income individuals' sustainable dietary habits**, compared to other variables.

Healthy food consumption (diet quality) was significantly influenced by low-income individuals' ability to afford food ($\beta = 0.20$, $p < .001$), cultural preferences ($\beta = 0.08$, $p = .03$), and social norms ($\beta = 0.17$, $p < .001$), all contributing positively. This highlights **the important role of financial access, cultural attachments, and social encouragement in promoting healthier eating behaviors**. Conversely, unhealthy food consumption was significantly negatively influenced by people's ability to afford food ($\beta = -0.11$, $p < .01$), suggesting that **low-income individuals with better financial means are less likely to consume unhealthy foods**.

4.2.2.3 The mediation effects of self-efficacy and attitudes toward sustainable food consumption

To examine how low-income individuals' self-efficacy and attitudes mediate the proposed relationships of socioeconomic and environmental factors and sustainable dietary habits, we conducted a structural equation modeling (SEM) analysis using the maximum likelihood estimation method. To ensure the robustness of the mediation testing, we employed a bootstrapping procedure with 5,000 resamples.

The results showed that both self-efficacy and attitude mediated the relationships between the predictors (food accessibility, food affordability, cultural preferences, and social norms) and sustainable dietary habits, but their roles differ when it comes to the consumption of unhealth food. More

specifically, the impact of food affordability, cultural preferences, and social norms on all six outcome variables are mediated by self-efficacy (on organic food consumption: $\beta = 0.20$, $p < .001$; on seasonal food consumption: $\beta = 0.22$, $p < .001$; on meat replacement consumption: $\beta = 0.20$, $p < .001$; on free-range food consumption: $\beta = 0.15$, $p < .001$; on healthy food consumption: $\beta = 0.33$, $p < .001$; on unhealthy food consumption: $\beta = -0.16$, $p < .001$). It means that **the impact of socioeconomic and environmental factors on low-income individuals' sustainable dietary habits, including the consumption of various sustainable food types, was significantly driven by their sustainable food competences (i.e. self-efficacy)**. Similar effects were observed for the attitudes toward sustainable food consumption, except the effect on unhealth food (on organic food consumption: $\beta = 0.30$, $p < .001$; on seasonal food consumption: $\beta = 0.15$, $p < .001$; on meat replacement consumption: $\beta = 0.35$, $p < .001$; on free-range food consumption: $\beta = 0.31$, $p < .001$; on healthy food consumption: $\beta = 0.24$, $p < .001$; on unhealthy food consumption: $\beta = 0.00$, $p = 0.96$). This finding implies that **low-income individuals' consumption of unhealth food does not significantly depend on whether they hold a positive attitude toward sustainable food**. Rather, as confirmed in the main effects, it can depend on socioeconomic factors such as strong financial constraints.

5. Conclusion

This report provides a comprehensive and multidimensional examination of the factors shaping sustainable food choices across Europe, combining qualitative and quantitative methods to map the individual, social, psychological, economic, and cultural settings in which food-related behaviors occur. Through this integrative approach, we offer a rich empirical foundation to guide future interventions, communication strategies, and policy designs aimed at promoting sustainable food systems.

The first phase of this research employed in-depth focus group discussions across a wide range of European countries to explore consumers' current understanding, expectations, and informational needs surrounding sustainable food. These discussions moved beyond the conventional environmental focus and unpacked the equally critical social and economic dimensions of sustainability. The findings highlighted that while consumers often express positive intentions toward sustainable food, their actual choices are embedded within complex webs of emotional attachments, social norms, structural constraints, and varying levels of information availability. In particular, three focus group research lines shed light on distinct yet complementary dimensions of resistance and engagement: general perceptions and motivations around sustainable food; the ideological and emotional resistance among anti-vegans, revealing how moral imposition and cultural identity fuel opposition to plant-based diets; and consumer attitudes and perceived authenticity of novel plant-based fish and seafood alternatives, a product category at the frontier of sustainable innovation. These qualitative insights provide essential input for understanding how consumers define and negotiate sustainability in real-life food contexts and underscore the importance of culturally sensitive and emotionally intelligent communication strategies.

Building on these insights and on the findings of earlier literature reviews, the second phase involved the design and deployment of large-scale surveys in diverse EU member states. These surveys further disentangled the drivers and barriers to sustainable food behavior, offering robust quantitative evidence for the influence of normative beliefs, perceived behavioral control, informational cues, trust in

producers, and cultural orientations. They also captured the gap between consumers' positive attitudes and their actual consumption patterns—a recurrent theme across countries, suggesting the need for system-level changes alongside consumer-facing interventions.

The conjoint experiment added further nuance by simulating point-of-sale choices for plant-based meat alternatives. This design revealed which product attributes (e.g. price parity, credible certification, Nutri-Score rating, packaging sustainability) most influence purchase likelihood, while the fuzzy-set qualitative comparative analysis showed how combinations of psychological factors—particularly trust and low social status anxiety—foster more ethical judgments toward plant-based products.

In parallel, we tailored surveys for two population groups often underrepresented in sustainability discourse: older adults and individuals with low income. These instruments revealed how structural vulnerabilities, digital exclusion, emotional food motivations, and food waste attitudes intersect with sustainable behavior. The results point to the need for inclusive, targeted interventions that account for practical limitations while tapping into existing motivations, such as concerns over health or local economy support.

Together, these research strands confirm that sustainable food choices are not simply a matter of individual preference or knowledge gaps. Instead, they are shaped by a constellation of interconnected factors: values and identities, social expectations, structural affordances, economic realities, and the effectiveness of persuasive cues in everyday contexts. Importantly, this report demonstrates that consumer behavior cannot be changed by awareness alone—it must be supported by credible information, culturally resonant narratives, affordable and accessible options, and systemic support across the value chain.

By synthesizing focus group insights and large-scale survey data, this deliverable provides critical input for the design of evidence-based, context-sensitive interventions in the next stages of the project. The findings inform future modeling, co-design efforts, and scenario development across the CUES project, offering practical guidance for intervention design in Work Packages 3 and 4 and strategic alignment with broader policy frameworks. Ultimately, this research helps pave the way for the transition to a more inclusive, equitable, and effective, sustainable food system—one attuned to environmental imperatives and the lived realities and values of diverse consumer groups across Europe.

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7. Appendix

Table 8 Overview of research lines, countries studied, methodology, and thematic focus

Research Line	Countries Studied	Methodology	Thematic Focus
Focus Groups – Dimensions of Sustainable Food Choices and Influencing Factors	Netherlands, Belgium, Germany, Italy, Spain, Portugal, Greece, Hungary	Qualitative Focus Groups	Perceptions, expectations around sustainable food; perceived drivers and barriers; social, economic, and environmental dimensions; perceptions of food value chain, policy and sustainable labelling
Focus Groups – Sensemaking and Resistance of Anti-Vegans	Greece, Netherlands	Qualitative Focus Groups	Sense-making, identity resistance, moral disengagement and cultural values opposing plant-based diets
Focus Groups – Plant-Based Fish and Seafood Alternatives	Germany, Netherlands, Belgium	Qualitative Focus Groups and Product Testing	Consumer perceptions of novel plant-based seafood; sensory and packaging feedback; communication and labelling relevance
Main Representative Survey	Netherlands, Belgium, Greece, Italy, Portugal, Bulgaria, Hungary, Ireland, Iceland, Sweden	Quantitative Survey (Multivariate analysis)	Measurement of attitudes, norms, culture, media influence, and other factors in shaping sustainable food consumption
Survey on Choice of plant-based products based on attributes at point-of-sale	Netherlands, Belgium, Germany, Greece, Italy, Portugal, Hungary	Conjoint Analysis, fsQCA	Assessment of point-of-sale attributes influencing consumer preferences for plant-based meat; identification of ethical judgment antecedents through conditional pathways
Survey on Willingness to Reduce Dairy Consumption and Adopt Plant-Based Dairy Alternatives	Germany, Finland, Spain, Hungary	Quantitative Survey (Multivariate analysis)	Examination of willingness to reduce dairy and adopt alternatives using TPB, cognitive/emotional attitudes, norms, behavioral control, and dairy attachment

Surveys on Vulnerable Groups	Netherlands, Ireland, Hungary, Italy (Aging Population) Hungary, Portugal, Ireland, Netherlands (Low-Income Population)	Shorter-Form Quantitative Surveys (Multivariate analysis and Structural Equation Modeling)	Targeted survey among vulnerable populations (including subgroups of intervention cases in WP3/4); informed by representative survey important indicators (frequency of sustainable food consumption and food waste behavior); focused on key barriers, motivations, and perceptions related to sustainable food; including socioeconomic and environmental factors

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