Örebro Studies in Culinary Arts and Meal Science 19

Ansung Kim

Seeds of change for plant-based food consumption

Products, restaurants and everyday life

Author: Ansung Kim
Title: Seeds of change for plant-based food consumption

Publisher: Örebro University, 2025
www.oru.se/publikationer

Print: Örebro University, Repro 10/2025
Cover image: AI generated

ISSN: 1652-2974
ISBN: 978-91-7529-711-8 (print)
ISBN: 978-91-7529-712-5 (pdf)

Abstract

The contemporary food system is no longer just a matter of nourishment; it has become a mirror reflecting the ecological, social and psychological tensions of our time. The manner in which we produce and consume food is intricately linked to a number of the most pressing challenges facing society, including climate change and rising health issues. The significance of dietary choices is becoming increasingly evident, with the heart of the matter being why people eat what they do and how people's food choices can be changed. This dissertation explores the role of hedonic and social factors in shaping the adoption of sustainable food choices by exploring three themes: Products, Restaurants and Everyday life. Each theme is explored through a combination of different methodological approaches, including consumer sensory evaluation, field experimentation and a randomised controlled trial enriched with social network analysis. The findings collectively highlight the need for multi-level strategies, which must integrate psychological, social and situational factors in order to be effective. While consumer preferences for the sensory attributes of plant-based meat alternatives differ depending on consumer psychographics (i.e. meat attachment), a preference for products that replicate the sensory experience of conventional meat remains dominant. Beyond sensory drivers, meat also carries symbolic meanings associated with tradition, strength and status. These cultural associations reinforce a 'meat-centric' gastronomic logic, even in vegetarian formats. However, consumer choice can be influenced when a gastronomic authority (i.e. a chef) recommends a less-popular, non-meat-mimicking vegetarian dish. The same cannot be said for social cues (i.e. cues from other guests), which do not appear to influence consumer choice. It is possible that the fragmentary information – whether factual or social – provided to participants within the studies of this dissertation was insufficiently potent to induce continuous and systematic dietary changes in everyday life, suggesting that influence may stem more from particularly influential individuals than from generic others. All in all, this dissertation provides insights into segmentation strategies that may be considered for future product development within the industry, for use within the food-service sector and for methodological application to future research.

Keywords: Food choice; consumers; behaviour change; influence

"Two roads diverged in a wood, and I—

I took the one less traveled by,

And that has made all the difference."

— Robert Frost, The Road Not Taken

Table of Contents

LIST OF PAPERS **7**

RELATED PAPERS 7

GLOSSARY **9**

INTRODUCTION **10**

CURRENT CHALLENGES AROUND FOOD CONSUMPTION 10

THEORY: INFLUENCES OF HEDONIC AND SOCIAL FACTORS ON FOOD CHOICES 13

Hedonic factors *16*

Social factors *18*

OUTLINE OF THIS DISSERTATION 21

AIM **23**

THEMATIC APPROACH **24**

PRODUCT – CONSUMER SENSORY STUDY (PAPER I) 26

Why meat alternatives? *27*

Meat attachment *28*

Research questions *31*

Materials and methods *31*

RESTAURANT – A FIELD EXPERIMENT (PAPER II) 35

Why a restaurant? *35*

Cues and influence on food choices *36*

Cues and menu design as tools *37*

Research questions *38*

Materials and methods *38*

EVERYDAY LIFE – RANDOMISED CONTROLLED TRIAL AND SOCIAL NETWORK ANALYSIS (PAPERS III AND IV) 44

Everyday meals and social influence *44*

Influential individuals and people susceptible to influence *45*

Research questions *46*

Materials and methods *46*

ETHICAL CONSIDERATIONS 53

FINDINGS ***55***

PRODUCTS – PAPER I 57
RESTAURANT – PAPER II 61
EVERYDAY LIFE – PAPERS III AND IV 64

GENERAL DISCUSSION 69

THE IMPACT OF HEDONIC FACTORS ON FOOD CHOICES 70
THE IMPACT OF SOCIAL FACTORS ON FOOD CHOICES 74
METHODOLOGICAL REFLECTIONS 77
Reliability and validity 77
Causality and possible bias 79
Generalisation and representation 81

CONCLUDING REMARKS 84

SCIENTIFIC AND SOCIETAL CONTRIBUTIONS 85
FUTURE DIRECTIONS 86

SAMMANFATTNING PÅ SVENSKA 88

ACKNOWLEDGEMENTS 91

REFERENCES 95

List of papers

This thesis is based on the following studies, referred to in the text by their Roman numerals.

I. Kim, A., Öström, Å., Mihnea, M., & Niimi, J. (2024). Consumers' attachment to meat: Association between sensory properties and preferences for plant-based meat alternatives. *Food Quality and Preference*, *116*, 105134. https://doi.org/10.1016/j.foodqual.2024.105134

II. Kim, A., Baptista, I., Zorell, C. V., Neuman, N., Niimi, J., & Öström, Å. A field experiment on expert- versus social-based cues on dish selection in a restaurant. *Journal of Environmental Psychology*, *108*, 102806. https://doi.org/10.1016/j.jenvp.2025.102806.

III. Zorell, C. V., Kim, A., & Neuman, N. (2024). Studying factual versus social cues as triggers of change in food behaviour. *Journal of Nutritional Science*, *13*, e88. https://doi.org/10.1017/jns.2024.82

IV. Kim, A., Neuman, N., & Zorell, C. V. Use of a social-media-like mobile application to explore network dynamics and social influence on eating behaviour: insights and lessons learned. [Manuscript].

Reprints were made with permission from the respective publishers.

Related papers

(Not included in the dissertation)

I. Zorell, C. V., Kim, A., & Neuman, N. (2023). Diffusion of eating behaviour in different social networks: A study protocol and preliminary reflections from a randomised controlled trial. [Preprinted by Research Square].

II. Westling, M., Baptista, I., Kim, A., Engelheart, S., Berg, P., & Öström, Å. (2025). Cooks as collaborative creators and evaluators: An iterative sensory-driven workshop to create

vegetarian dishes. *International Journal of Food Design*, *10*(1), 87–108. https://doi.org/10.1386/ijfd_00079_1

III. Auer, J., Kim, A., Heupl, S., Mihnea, M., Öström, Å., Niimi, J., & Maud, L. Consumer preferences of plant-based minced meat analogs: Linking physico-chemical properties, structural features and sensory attributes [Manuscript submitted to Food Structure].

IV. Baptista, I., Kim, A., Neuman, N., & Öström, Å. Hybrids just as liked as meat: insights on serving plant-based alternatives in a large weekday lunch restaurant [Manuscript submitted to Future Foods].

Glossary

Animal-based foods: foods (including both whole foods and processed products) derived from animals, including meat, dairy, eggs and other animal-origin ingredients

Behaviour(al) change: any alteration or adjustment of behaviour that affects the individual, whether brought about by external factors or occurring naturally

Cue: something that serves as an instruction/signal to induce behavioural change

Home use test (HUT): a test performed in the consumer's home, as opposed to testing at a central location

Meat alternatives (MA): food products made from plant-based ingredients or other non-conventional food sources such as mycoprotein (mycelium of fungi) and insect protein

Meat Attachment Questionnaire (MAQ): a scale that measures an individual's positive bond with or attachment to meat consumption

Social network analysis (SNA): a research methodology that maps and measures relationships and interactions among entities in a network in order to explore underlying patterns, structures and dynamics within that network

Plant-based foods: foods (including both whole foods and processed products) derived from plants, such as fruits, vegetables, nuts, seeds, vegetable oils, whole grains, legumes and beans

Plant-based meat alternatives (PBMAs): food products made from plant-based ingredients that are designed to mimic the sensory and nutritional properties of conventional animal-based products such as beef, chicken and seafood

Introduction

Current challenges around food consumption

People are faced with a multitude of choices and decisions on a daily basis, including 'what to eat' and 'where to eat'. In light of concerns about environmental degradation and health risks related to lifestyle, the choice of everyday foodstuffs has become a matter of great importance. In recent years, an increasing number of studies and reports have shown that food systems contribute approximately one-third of global greenhouse gas (GHG) emissions, about one-third of global terrestrial acidification and about 78% of global freshwater and ocean eutrophication (Clark et al., 2019; Crippa et al., 2021; Poore & Nemecek, 2018). Furthermore, global meat production – which has increased over the past decades – has a significant impact on these environmental indicators, which affect land use, water use, biodiversity and ecological resilience (Clark et al., 2019; Poore & Nemecek, 2018; Ritchie et al., 2019; Springmann et al., 2021; Xu et al., 2021). Moreover, an association has been demonstrated between the high consumption of red meat (especially processed red meat) in combination with the low consumption of plant-based foods and an increased risk of various diseases, including cardiovascular disease, type 2 diabetes and colorectal cancer (Clark et al., 2019; Murray et al., 2020; Rockström et al., 2025). Thus, the literature demonstrates that replacing half of the animal-based foods in people's current diet with plant-based equivalents has the potential to reduce food systems' usage of natural resources and overall environmental burden, while also contributing to the prevention of certain chronic diseases (Poore & Nemecek, 2018; Röös et al., 2020; Rockström et al., 2025; Sabaté & Soret, 2014; Springmann et al., 2016).

Based on such findings, various countries have introduced dietary guidelines that take environmental factors into account. For example, the recently published *Nordic Nutrition Recommendations 2023* by Blomhoff et al. (2023) integrates environmental impact into dietary guidelines, suggesting limited red meat intake and predominantly plant-based diets. This is further translated into food-based dietary guidelines that recommend a weekly consumption of no more than

350 g of cooked unprocessed red meat, along with reduced consumption of processed meat. Similarly, it is recommended that the consumption of processed white meat (e.g. chicken) should be kept to a minimum. The recommendations also state that a decrease in red meat consumption should not result in an increase in white meat consumption as a substitution. All in all, to mitigate environmental impacts, the guidelines recommend that individuals replace their consumption of red and white meat with increased consumption of plant foods such as legumes. In relation to fish and seafood, which have less impact than red meat but a greater environmental impact than poultry, the recommended weekly intake is 300–450 g of cooked or ready-to-eat weight. This recommendation balances the health benefits of eating fatty fish while limiting the environmental effects of fish consumption; at least 200 g of the weekly amount should be constituted of fatty fish, which contain long-chain n-3 fatty acids. For both health and the environment, pulses and legumes should be included as a significant part of the regular diet, and at least 500 g of a variety of vegetables, fruits and berries is recommended for daily consumption. Eating 20–30g of nuts and seeds per day is also recommended.

Despite the identified global challenges, meat consumption has increased globally in line with population growth and rising individual affluence, as evidenced by the continuous increase in meat consumption observed in middle-income countries. However, high-income countries show either stagnation or a decline in meat consumption (Godfray et al., 2018; OECD/FAO, 2023). While the reasons for such developments in the high-income countries are unclear, it has been suggested that consumers in high-income countries are shifting their dietary choices towards meat with a lower environmental impact (e.g. from red meat to white meat) and reducing their overall meat consumption for health, environmental and animal-welfare reasons (OECD/FAO, 2023). At the same time, however, individuals in high-income countries consume fruits and vegetables at only half the recommended levels (FAO, 2020). For example, in Sweden, total meat consumption per capita has fallen by about 8 kg from 2016 (88.3 kg) to 2024 (80.5 kg), accompanied by an increase in poultry consumption of around 1 kg and decreases in pork

and beef consumption of around 5 kg and 3 kg, respectively (Swedish Board of Agriculture, 2025). Despite a decline in total meat consumption, Swedish consumers still eat more meat per person per year than the European average (Swedish Board of Agriculture, 2025). In contrast, their consumption of vegetables, fruits and berries appears to be inadequate, with the median intake for Swedish adults being around 270 g per day (Livsmedelsverket, 2025). These dietary patterns have a detrimental effect on public health; indeed, diet-related risk factors are among the foremost causes of mortality and disability in Sweden (Institute for Health Metrics and Evaluation, n.d).

Changing one's eating behaviour is a complex undertaking, given that eating is a habitual and routinised practice (Neuman, 2024; Warde, 2016). In addition, healthy eating is a more complex matter than simply adhering to a recommended diet, and sustainable eating remains somewhat ambiguous, with many individuals underestimating or being unaware of the environmental implications of meat consumption (Hazley & Kearney, 2024). Reducing meat intake is particularly complex, given meat's strong sensory satisfaction and its role throughout human evolutionary history as a source of high-quality protein and various nutrients (Fiddes, 2004; F. Leroy et al., 2023). In addition, it should be noted that not all meals containing animal-based foods are necessarily environmentally harmful. In fact, sustainably produced (e.g. grazing-based) livestock products have been shown to have a positive impact on certain ecosystems, such as the maintenance of pasture ecosystems, the management of landscapes and the protection of biodiversity (T. Garnett, 2011; Röös et al., 2013).

Several policy instruments have been suggested in recent years to promote environmentally sustainable and healthy dietary practices in Nordic countries (Jungsberg et al., 2024; Röös et al., 2021), including economic incentives or disincentives (e.g. subsidies for environmentally friendly foods and consumption taxes on high-emission and unhealthy foods), regulatory measures (e.g. public procurement targets or labelling requirements) and consumer awareness and support (e.g. informational campaigns, knowledge-

building or nudging). These tools differ in their expected effectiveness, cost-efficiency and societal acceptability. For instance, economic instruments are more likely to encounter greater resistance, as they can bring distributional concerns such as disproportionate burdens on low-income groups, compared with softer approaches such as providing information (Ejelöv et al., 2025).

While the suggested instruments form the structural foundation of food-system transformation, their real-world success depends on psychological and social dynamics. Among the multitude of factors that influence eating behaviours, sensory preferences (i.e. hedonic factors) and social influences may determine how individuals perceive and adopt these policy tools. For example, even if price incentives or public messaging are employed, consumers may remain resistant to change if they find the taste or texture of environmentally friendly foods unappealing. Similarly, behavioural shifts are likely to be limited if social norms or identities do not align with values that promote environmentally sustainable choices, even if consumers enjoy the taste. Therefore, it is imperative to integrate hedonic satisfaction and social engagement into the design and delivery of policy instruments to ensure that changing eating behaviour is not only easy and affordable but also hedonically appealing and socially accepted. This perspective is explored in detail in the following section.

Theory: influences of hedonic and social factors on food choices

It is important to note that, although eating behaviours are habitual and routinised, they are not fixed; rather, they are fluid and change over time and across environments (e.g. see Tellström, 2024, on Swedish food culture over 800 years). This makes modifying eating behaviours a significant challenge. Nevertheless, concerted efforts have been made to identify and comprehend the multifaceted factors that influence food choices.

Food choice is a complex decision-making process that is difficult to explain by a single motive. It is formed in response not only to the sensory properties and nutritional value of food but also to interactions in various dimensions, including biological

characteristics and psychological mechanisms within individuals, socio-cultural contexts and structural factors at the environmental and policy levels. Story et al. (2008) proposed an ecological framework of the factors influencing food choices at four levels: individual (e.g. cognition, skills, behaviour and demographics), social environment (e.g. social norms and support), physical environment (e.g. availability, accessibility and places where food choices are made) and macro-level environment (e.g. policies and regulations). Similarly, Chen & Antonelli (2020) created a model segmented into three main categories (i.e. food-related features, individual differences and society-related features) with multiple domains, such as food-internal (e.g. sensory and perceptual features), food-external (e.g. information, social and physical environment), personal-state (e.g. biological, physiological, psychological and habit), cognitive (e.g. knowledge, skills and attitude) and sociocultural domains (e.g. culture, economics and politics).

Despite their similarities, the two models differ in scope and conceptual detail. Story et al.'s (2008) model is a policy-oriented framework that focuses on the environmental and structural factors public health authorities can use to shape healthier eating environments. Therefore, it helps researchers and policymakers understand the macro- and meso-level driving forces – such as food policy, physical access and social norms – needed to shift food choices on a large-scale community level. In contrast, Chen and Antonelli's (2020) more detailed categorisation places greater emphasis on perceptual, cognitive and identity-based determinants. In particular, Chen and Antonelli focus on micro-level decision-making dynamics, including how sensory experiences, cognitive identities and social environments intersect to influence individual choices. By doing so, they provide a comprehensive map of individual-level variation to inform product development, marketing and personalised behaviour-change strategies. As described below, aspects from the work of both Story et al. (2008) and Chen and Antonelli (2020) were combined to form a model tailored to the objectives of this dissertation (Figure 1).

This dissertation focuses on hedonic and social factors as key determinants of food choice, examining their roles at the intersections of the individual, food and societal levels. More specifically, individuals' sensory preferences for plant-based foods are first examined to determine how hedonic factors influence consumers' subjective evaluation and preferences based on different individual factors. Second, social factors – including social influence, information from trusted authorities and contextual elements such as the environments in which food is consumed – are examined to shed light on how social and informational dynamics interact to encourage or hinder changes in food choices.

The following sections provide a detailed discussion of the hedonic and social factors examined in this dissertation.

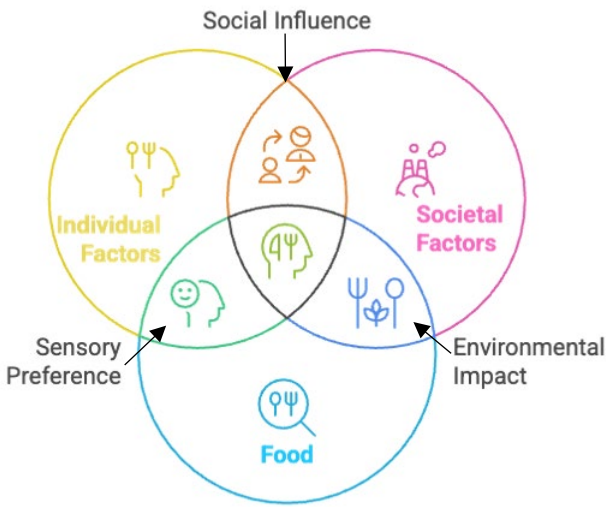

Figure 1. A Venn diagram illustrating how hedonic and social factors intersect at multiple levels, highlighting their overlapping influence on eating behaviour and food choice.

Hedonic factors

The consumption of food is not merely a matter of survival; it is also a pursuit of pleasure. In fact, studies have shown that the influence of hedonic factors – that is, sensory preferences in terms of taste, aroma/flavour, texture and appearance – and the emotional and psychological dimensions of food significantly affect consumer food choices and consumption patterns (Connors et al., 2001; Hirschman & Holbrook, 1982; Köster, 2009).

The sense of *taste* is sensitive to stimuli that are evolutionarily linked to survival stimuli, such as sweet, salty, sour, bitter and umami. Sweet taste is preferred because it acts as a signal of high energy density, while bitter taste acts as a warning signal suggesting the presence of a natural toxin and elicits an instinctive avoidance response (Armelagos, 2014; Breslin, 2013). Certain cruciferous vegetables, such as broccoli, kale and Brussels sprouts, have a bitter taste due to glucosinolates, and people who are sensitive to this taste (e.g. 6-n-propylthiouracil (PROP) sensitives) tend to avoid them (Drewnowski & Gomez-Carneros, 2000; Pollard et al., 2002). While this aversion can be mitigated to some extent by cultural exposure and repeated learning, it can act as a barrier to the initial acceptance of plant-based foods. Sour taste, similar to bitterness, can act as a barrier to the acceptance of plant-based food, as those who are highly sensitive to bitterness can also be highly sensitive to sourness (Pagliarini et al., 2021). In addition, salty taste is a signal of the sodium content of food, as sodium is important for various physiological functions; it also contributes to taste quality by suppressing a bitter taste at any intensity levels or enhancing sweetness at low intensities (Liem et al., 2011). Therefore, saltiness plays an important role in the overall palatability of foods. Umami has been linked to protein-rich foods, thereby reinforcing the preference for meat (Breslin, 2013; Yamaguchi & Ninomiya, 2000). It has been identified as one of the key sensory attributes meat-alternative products should aim to mimic (He et al., 2020).

Smell is an important sense that determines flavour through the aroma of food. Integrating the senses of taste and texture allows for complex flavour perception, facilitating the effective identification

and recognition of both familiar and novel foods (Breslin, 2013). These integrated senses form the foundation for the development of consumer food choices and preferences, with the reproduction of flavour – a crucial aspect of meat consumption – being regarded as a pivotal challenge in increasing the acceptability of meat alternatives.

Texture provides hedonic satisfaction from the eating process itself through tactile-based attributes such as chewiness, softness and crispness; it is one of the key sensory factors in consumers' food choices and acceptance (Chen & Rosenthal, 2015). In particular, texture plays a significant role in the sensory evaluation of meat and meat alternatives. The unique texture of meat – namely, its chewiness, tenderness and juiciness – has been identified as a key factor in the consumer experience. Therefore, achieving these meat-like textural attributes in meat-alternative products has been identified as an important step in gaining consumer acceptance (Fiorentini et al., 2020; He et al., 2020; Michel et al., 2021; Sogari et al., 2023).

The *appearance* of food has been demonstrated to influence expectations and satisfaction in the pre-consumption phase. A study by Delwiche (2012) suggested that people's perception of food as aesthetically pleasing significantly affects the likelihood of consumption. In particular, food colour is directly related to expectations of freshness and flavour, while unnatural colour or appearance can give consumers an artificial and alien impression, reducing acceptability (Garber Jr. et al., 2000).

Beyond these sensory characteristics, the emotional and psychological dimensions associated with food exert substantial influence on food choices and eating behaviours. Foods associated with nostalgic flavours or comforting aromas can evoke positive emotional responses, increasing preference and consumption (Reid et al., 2015, 2023). Such emotional connections are also relevant in the context of meat consumption. Meat is frequently associated with traditions, social identity and symbolic meanings such as strength, status and familial bonds (Fiddes, 2004; Sobal, 2005), creating a strong attachment to meat that can serve as a psychological barrier to dietary change (Graça, Calheiros, et al., 2015; Graça, Oliveira, et al., 2015).

The interactions between the genetic, psychological and experiential factors shaping individual differences lead to wide variability in food preferences and choices (Hejazi et al., 2024; Leigh Gibson, 2006; Silventoinen & Konttinen, 2020; A. D. Smith et al., 2016); however, such aspects will not be addressed in this dissertation. Instead, this work investigates preferences and choices within a broader social context, where the latter can amplify or reduce the impact of these factors, as discussed below.

Social factors

Individual sensory preferences and hedonic satisfaction are shaped and moderated by societal contexts. In other words, a multitude of social factors exert a profound influence on the shaping of food choices and preferences. In particular, close social networks involving family, friends and/or peers play a key role in social learning and repetitive reinforcement. The power of social networks has been well established in the literature on health behaviours (Christakis & Fowler, 2007, 2013; K. P. Smith & Christakis, 2008). As social networks act as channels that shape behaviour through norms, modelling and affiliation, social influence can be an effective strategy to accelerate behavioural changes. In fact, research shows that the dietary choices of family members or friends (close social ties) significantly affect individual behaviour (Pachucki et al., 2011). Furthermore, a study has demonstrated that even weak or transient social connections – such as individuals immediately ahead in a checkout queue (i.e. potential eating partners) – can influence purchasing decisions in on-campus dining settings (Gligorić et al., 2021).

Social network theory is a useful theoretical framework for structurally explaining these various social factors. This theory proposes that entities such as individuals and other social actors (e.g. organisations), referred to as 'nodes', are not isolated actors but are embedded within networks of social relations. The density, centrality and strength of the connections (i.e. ties) between each node affect the speed and stability of the spread of a particular behaviour or piece of information. Individuals with a high degree of centrality are more

likely to be connected to others in the network (degree centrality), to act as intermediaries in the information flow path (betweenness centrality) or to be in close proximity to the entire network (closeness centrality), making it more likely that new behaviours or information will spread effectively through these individuals (Borgatti, 2005; Emirbayer & Goodwin, 1994; Newman, 2016). Building on this theoretical background, Centola (2010) demonstrated in an online health-behaviour experiment that behaviours spread more rapidly throughout a highly clustered network (i.e. with more redundant ties) than it did through a random network (i.e. with fewer clusters, but faster diffusion of information). He also found that networks characterised by higher levels of homophily (i.e. the tendency for individuals to associate with those having similar characteristics, such as age, gender and so on) showed significantly accelerated adoption of health behaviours in comparison with unstructured networks (Centola, 2011). Thus, network structure and social similarity play a critical role in promoting health-related choices, and this association can be extended to eating behaviours.

Social norms refer to people's perception of what 'most people' do or do not do (i.e. descriptive norms) and what 'most people' approve or disapprove of (i.e. injunctive norms) (Cialdini et al., 1991). These norms operate as explicit or implicit cues in everyday social contexts, guiding or constraining individual behaviour. This process is often facilitated by a psychological mechanism called *social influence*, which is broadly distinguished into informational and normative influence (Deutsch & Gerard, 1955). Informational influence reflects the way in which people view the behaviour of others as reliable information about the environment, leading to adjustments in one's own behaviour. Normative influence, on the other hand, is characterised by the tendency to conform to the expectations of others, driven by a desire to maintain a sense of belonging or avoid social rejection. Both factors exert a direct and enduring influence on a variety of behaviours. For instance, guests at hotels were found to be more inclined to reuse towels when they saw a message regarding the towel reuse of other guests (Goldstein et al., 2008; Reese et al., 2014); individuals were more likely to download and like songs that had already been downloaded and liked by others (Salganik et al., 2006);

and households conserved more energy (Harries et al., 2013; Nolan et al., 2008) and were more likely to join a food-waste recycling scheme (Nomura et al., 2011) upon learning about actions in their neighbourhoods.

In relation to food choice or intake, social influence is known to affect what, when and how much individuals eat (Hackel et al., 2018; Higgs, 2015; Larson & Story, 2009; Robinson et al., 2014; Ruddock et al., 2019; Vartanian et al., 2015; Zorell, 2022). However, the food behaviour appears to be relatively resistant to change, and social influence is not always strong (Chater & Loewenstein, 2023; Marteau, 2017; Marteau et al., 2012). In particular, the influence of social factors has been shown to be more pronounced in situations of high uncertainty or when the affiliation motive is activated (i.e. when maintaining relationships with others is perceived to be important), albeit not to the same extent in different contexts (Cruwys et al., 2015; Higgs & Thomas, 2016). For instance, individuals tend to imitate others' choice regarding high-energy-density foods, such as snacks, whereas imitative behaviour is less common for healthy but potentially unpalatable foods, such as vegetables and fruits (Cruwys et al., 2015; Vartanian et al., 2008). These findings suggest that the hedonic value of food and an individual's pre-existing preference or routines may have a greater influence on behaviour than social factors, as the former are likely to be less susceptible to change in response to new social information (Cruwys et al., 2015; Higgs & Thomas, 2016).

Furthermore, food choices are strongly influenced by the context in which consumption takes place, with particular emphasis on out-of-home settings, such as restaurants, canteens and cafés. In such contexts, environmental and informational factors – including labelling, menu composition, presentation and availability – have been observed to influence food choices (Baptista et al., 2025; Cadario & Chandon, 2020; Greene et al., 2023). While some of these influences do not arise from social ties in the strict sense of social network theory, they nevertheless represent external cues from other actors, such as expert recommendations or the observed choices of other consumers.

In the context of restaurants, consumers are presented with a predetermined array of options within a designed environment structure, which has emerged as an effective intervention strategy for changing food choice behaviour. This concept is considered a key component of choice architecture, given its ability to influence behaviour in a specific direction without imposing restrictions on individual choice (Thaler & Sunstein, 2021). For instance, making plant-based options the default or increasing the number of plant-based options on the menu has been shown to increase the rate of choice (E. E. Garnett et al., 2019; Gravert & Kurz, 2021; Saulais et al., 2019). Menu labelling, calorie counts and carbon footprint or environmental impact information can also have a positive impact on consumer food choices (Ding et al., 2025; Vandenbroele et al., 2020; Velema et al., 2018), but the results vary and effects are generally small.

Furthermore, social cues that indicate information suggesting a plurality of choices (e.g. 'most popular') could increase demand for the highlighted options (Bookwala et al., 2022; Cai et al., 2009). However, a similar social cue, 'many people here choose green options', did not result in a measurable increase in overall vegetarian option sales (Reinholdsson et al., 2023). In addition, cues such as 'chef's recommendation' have been suggested to be an effective strategy for encouraging healthy and environmentally sustainable choices (Lachat et al., 2011). Survey studies have found that such a recommendation can increase the likelihood of consumers selecting the highlighted options (Bacon & Krpan, 2018; Catarci et al., 2024), yet the impact of cues on actual choices remains unclear (Bookwala et al., 2022), suggesting that not all cues carry the same persuasive power. This suggests the question is less about whether external cues work and more about which kinds of cues, delivered at what intensity, actually change eating behaviour.

Outline of this dissertation

As demonstrated above, food choice should be understood as a multifaceted behaviour, influenced by numerous factors operating at different levels. Within this context, this dissertation adopts a

multidisciplinary approach, with the objective of providing a comprehensive understanding of how hedonic and social factors can influence and modify food choices. More specifically, the dissertation presents the specific contexts in which food choices are made, dividing these into three main themes, namely, Products, Restaurant and Everyday life, each of which is characterised by distinct sensory and social contexts. Consequently, a range of methodological approaches are employed to address these contexts in a more sophisticated manner.

In the Product theme (Paper I), consumer sensory evaluation was employed to investigate how consumers' attachment to meat was associated with their preferences for commercial plant-based meat alternatives (PBMAs) and whether the sensory perception of these products differs across levels of meat attachment (MA). The study also examined whether distinct ideal product profiles would emerge depending on MA. Within the Restaurant theme (Paper II), a field experiment was conducted in a real dining environment to validate how social and expert cues on the menu affected customers' food choices and whether these cues influenced customers' hedonic experiences.

The Everyday life theme (Papers III and IV) combined a randomised controlled trial (RCT) with social network analysis (SNA). Paper III explored the relative effectiveness of two approaches (providing social vs. factual information) in achieving increased consumption of plant-based foods and reduced consumption of animal-based foods. In Paper IV, the spontaneous formation of social networks within groups of the RCT was explored with a view to gaining a more comprehensive understanding of social interactions and the potential factors that enhance such interactions.

Lastly, the discussion explores how these findings can be harnessed to drive a shift towards increasing plant-based and decreasing animal-based food consumption.

Aim

The overarching aim of this dissertation is to explore how hedonic and social factors facilitate behavioural change towards healthier and more environmentally sustainable food choices, with a specific focus on reducing animal-based food consumption and increasing the acceptance of plant-based food. The research is structured around three interlinked themes, Product, Restaurant, and Everyday life, each of which reflects a different level of influence on food-related decision-making. The objectives of each theme were explored through a combination of different methodological approaches, including consumer sensory evaluation, field experimentation and an RCT enriched with SNA, as described below.

- **Products** (**Paper I**): This study aimed to investigate the relationship between consumers' levels of MA (where MA utilised as a tool for consumer segmentation and as an analysis factor), sensory perceptions of and preferences for PBMAs from various plant-based protein sources, and ideal sensory properties.
- **Restaurant** (**Paper II**): This study aimed to examine the extent to which various claims, expert-based cues (e.g. 'chef's recommendations') and social cues (derived from other guests) presented on a restaurant menu influenced customers' choices between dishes in a real-life context and whether these cues affected customers' hedonics.
- **Everyday life** (**Papers III and IV**): The study comprised two linked sub-studies. Paper III aimed to explore whether different types of information sources (i.e. fact-based or social-norm-based) would influence changes in self-reported intakes of plant-based foods relative to animal-based foods. In Paper IV, an exploratory network analysis was used to understand how social interactions formed within RCT groups and their potential influence on food choice.

By integrating these empirical studies, this dissertation contributes further understanding of the complex drivers of and barriers to dietary transitions.

Thematic approach

Contemporary consumers make food decisions within a variety of physical and social environments, where decisions are shaped not only by the properties of the food itself but also by the presence of others, social norms and spatial context. To increase our comprehension of the roles of hedonic and social factors in influencing food choice, as stated earlier, each theme was explored through a range of research methods (see Table 1).

The following structure is employed in the division of each theme: Paper I investigates how sensory factors influence PBMA preference across varying levels of MA in a consumer home-use test (HUT) setting. The research involved quantitative experiments focusing on consumer sensory evaluation. Paper II analyses the impact of external cues on food choice and their potential influence on hedonic satisfaction in a real-world setting. This analysis is informed by sales and survey data from a field experiment conducted at a restaurant, which provide insights from choices made by customers within a real-life environment. Papers III and IV further address the issue of eating-behaviour change within everyday life. To this end, an RCT was employed to ascertain the influence of different types of information sources on food intake. Paper III presents the primary outcome of the intervention, while Paper IV takes a social network approach to explore the formation of social interactions within the RCT groups and their impact on food intake.

Each specific study was designed on the basis of relevant literature and the application of state-of-the-art approaches to each theme, the details of which are described below.

Table 1. Overview of papers incorporating the themes and methods addressed in this dissertation

Paper	Theme	Method	Material	Analytical approach
I	Product	Consumer sensory study	Pre-screening questionnaire: demographics, Meat Attachment Questionnaire (MAQ) Consumer testing: rate-all-that-apply (RATA), likings	Nonparametric tests Principal component analysis (PCA) Multiple factor analysis (MFA) Agglomerative hierarchical clustering (AHC) Penalty analysis
II	Restaurant	Field experiment	Menu choice: sales Survey: demographics, likings, satisfaction of meal experience	Chi-square test Binomial logistic regression Nonparametric tests
III	Everyday life	Randomised controlled trial	Mobile phone application: food intake by portions, social interaction through 'likes' Pre- and post-questionnaires	Mixed-model repeated-measures ANOVA Profile analysis T-test
IV				Social network analysis

Product – consumer sensory study (Paper I)

When people make decisions about what to eat or buy, the food itself – particularly its sensory and perceptual properties – plays a major role in influencing their food choice (Boesveldt & de Graaf, 2017; McCrickerd & Forde, 2016; Sørensen et al., 2003). Food is necessary for human sustenance, and the human senses have evolved to help distinguish between what is safe and unsafe to consume (Tuorila & Monteleone, 2009). In addition, because people generally seek tasty or pleasurable food, it is ultimately unproductive to produce products that are unlikely to be accepted by consumers (Tuorila & Monteleone, 2009). That said, sensory perception and food preferences can vary significantly between individuals (Hejazi et al., 2024; Silventoinen & Konttinen, 2020; A. D. Smith et al., 2016). This is where sensory and consumer research becomes critical, as it contributes to the development of food products that are both improved and more widely accepted.

Sensory and consumer science is defined as an 'interdisciplinary field that encompasses sensory-only research and consumer-centric studies, focusing both on responses to specific products and consumer behaviour more generally' (Jaeger et al., 2025, p. 6). By addressing real-world problems, such as the adoption of environmentally sustainable eating behaviours to combat climate change, sensory and consumer research plays a vital role in understanding how consumers perceive sustainable foods and what factors influence consumer acceptance (Aschemann-Witzel et al., 2019). The field thus facilitates the quantification of product characteristics through the utilisation of descriptive analysis and profiling techniques. This process enables the standardisation and optimisation of product properties. Furthermore, sensory science incorporates consumer studies to explore the emotional and experiential dimensions of products, thereby offering a relatively holistic understanding of consumer experiences (Martens, 1999).

Why meat alternatives?

Among several emerging strategies for reducing global meat consumption, alternative protein sources (e.g. cultured meat, insect-based products, etc.) are being explored, with PBMAs emerging as a mainstream option (Onwezen et al., 2021). Plant-based protein sources such as tofu, tempeh and seitan have been consumed as a major protein source for centuries, particularly in Asia (He et al., 2020; Tan et al., 2025). These traditional plant-based products demonstrate the potential for PBMAs to become mainstream protein sources in the global diet.

However, the success of integrating PBMAs into mainstream Western food habits has been limited (Dekkers et al., 2018; Giacalone et al., 2022), and many consumers still seek products with characteristics that resemble the taste, flavour, texture of conventional meat products and that require similar cooking methods (Elzerman et al., 2011; Fiorentini et al., 2020; Hoek et al., 2011; Röös et al., 2022). This consumer demand for meat-like products is an important factor in the integration of PBMAs into Western food culture, particularly among consumers who are willing to reduce their meat consumption for health, environmental or ethical reasons, yet remain attached to the sensory and cultural familiarity of meat products (Collier et al., 2021). PBMAs could serve as a strategic solution to this tension by providing a middle ground between conventional meat consumption and plant-based food intake. These products are specifically designed to replicate key attributes of meat, including taste, texture and overall eating experience (Ketelings et al., 2023), thereby minimising the perceived compromises associated with dietary change.

Despite consumers' evident interest in alternative proteins and the considerable advances being made in related technologies (He et al., 2020), PBMAs still have limited public acceptance. This is partly because the sensory attributes they offer are perceived to be lacking in comparison with those of conventional meat and partly because many consumers find PBMAs unfamiliar and inconvenient (Aschemann-Witzel et al., 2021; Collier et al., 2021; Röös et al., 2022; Szenderák et al., 2022). In particular, the issue of sensory palatability is consistently raised as one of the main barriers to the acceptance of PBMAs

(Fiorentini et al., 2020). However, the optimal level of sensory attributes required for consumers to perceive PBMAs as palatable is not yet clearly defined, and research in this area is ongoing. Furthermore, consumer preferences for PBMAs' meat resemblance are not uniform; some consumers prefer products that are as similar as possible to conventional meat, while others prefer PBMAs to have their own sensory identities (Hoek et al., 2011; Kerslake et al., 2022; Michel et al., 2021). These heterogeneous preferences highlight the complexity of consumer demands and expectations and have significant implications for PBMA development and marketing strategies.

By offering a sensory experience that addresses these diverse demands, PBMAs can better achieve a balance between authenticity and innovation. On the one hand, products with a very meat-like profile are appealing to those reluctant to sacrifice meat's familiar taste and texture; on the other hand, alternatives with unique sensory profiles attract consumers who embrace plant-based eating as a separate category rather than a substitute (Hoek et al., 2011; Kerslake et al., 2022; Michel et al., 2021). To better address these heterogeneous preferences, understanding consumers' degree of MA can be a useful tool for segmentation strategies, as it can help identify whether consumers prefer PBMAs similar to meat or not and which sensory characteristics are preferred.

Meat attachment

Previous studies have shown that people's willingness to reduce their meat consumption while increasing their PBMA consumption is associated with their MA (Circus & Robison, 2019; Graça, Calheiros, et al., 2015; Graça, Oliveira, et al., 2015; Lentz et al., 2018). MA refers to an individual's positive bond with the consumption of meat, which can act as one of the main psychological barriers hindering dietary change or acceptance of meat alternatives. Graça, Calheiros, et al. (2015) developed the Meat Attachment Questionnaire (MAQ) to define the level of MA and describe it in terms of four dimensions: *hedonism*, *affinity*, *entitlement* and *dependence*. The interplay of these dimensions contributes to the formation of an individual's degree of

bonding with meat consumption, thereby facilitating a comprehensive understanding of the underlying rationales for meat consumption and the factors that perpetuate it.

Hedonism stems from the notion that meat is perceived as an important source of sensory pleasure. Many consumers closely associate meat consumption with sensory satisfaction, such as taste, flavour, texture and satiety, and consider the sensory satisfaction of meat as a key element of their dining experience (Fiddes, 2004). These hedonic associations have been shown to reinforce resistance to dietary change, due to the perception that alternative foods do not provide the same level of sensory reward (Fiorentini et al., 2020). In societies with a developed meat-centric culinary culture, where 'proper' meals have meat as a core part (Mäkelä & Niva, 2019; Niva & Mäkelä, 2020), these sensory-driven expectations are particularly strong, hindering the acceptability of meat alternatives.

Affinity for meat consumption can be defined as an emotional response that is positively associated with the consumption of meat. This affinity can be conceptualised as being diametrically opposed to the repulsion that is often observed in individuals who do not consume meat when presented with it (Graça, Oliveira, et al., 2015). As individuals progress through their life cycle, they inherently assimilate the consumption of meat within the context of their familial, communal and cultural milieu. This process fosters a perception of meat that transcends its mere function as sustenance. For instance, meat is frequently a pivotal element of holiday meals and family traditions, which can result in the adoption of a vegetarian diet being perceived as a loss of part of one's identity or sense of belonging (Fischler, 1988). In direct contrast, while repulsion originated as a biological defence mechanism, such as distaste or oral rejection response, it has expanded into an emotional rejection of meat consumption based on factors such as animal welfare, moral judgments and environmental concerns (Fessler et al., 2003; Rozin et al., 1999).

Entitlement refers to a psychological attitude that considers meat consumption to be an individual's natural right and a legitimate choice. This dimension is generally associated with an

anthropocentric worldview and is linked to cognitive structures that justify meat consumption as 'necessary', 'natural', 'normal' and 'nice' (Piazza et al., 2015). These justification strategies may act as a defence mechanism to reduce the cognitive dissonance of being aware of animal ethical issues or the environmental consequences of meat consumption but choosing not to change one's meat-eating behaviour.

Dependence on meat consumption reflects the perception that individuals may experience emotional or psychological deficits if they do not consume meat. It refers to the internalisation of meat as a means of emotional security, rather than just as a food resource. This can be attributed to the central symbolism and cultural role of meat in meals, which manifests as a form of food dependence or habitual fixation in eating behaviour (Fiddes, 2004; Niva & Mäkelä, 2020). Dependence reinforces emotional factors in food choice and can act as a psychological barrier to the acceptance of PBMAs (Graça, Oliveira, et al., 2015; Onwezen et al., 2021).

All in all, consumers who are highly attached to meat are likely to consume more meat and to view the intention to follow a plant-based diet negatively (Graça, Calheiros, et al., 2015). For example, in New Zealand, Lentz et al. (2018) reported that MA is one of the strongest predictors of individuals' willingness and intention to reduce their meat consumption. The degree of MA also influences consumers' attitudes towards alternative protein sources, including cultured meat, edible insects and PBMAs (Circus & Robison, 2019). For example, consumers with lower MA scores who primarily adhered to meat-excluding diets showed greater willingness to consume PBMAs, but only a limited number expressed willingness to consume cultured meat or edible insects. In contrast, those with higher MA scores who predominantly followed a meat-eating diet showed greater willingness to consume cultured meat and PBMAs, but displayed limited interest in edible insects (Circus & Robison, 2019). Moreover, consumers – particularly those who adhere to an omnivorous diet – have lower sensory expectations for PBMAs than for conventional meat (Michel et al., 2021; Slade, 2018; Vural et al., 2023), as observed

in consumer preferences during tasting (Cordelle et al., 2022; Elzerman et al., 2011; Grasso et al., 2022; Hoek et al., 2013).

Those who follow a meat-free diet tend to report greater liking for PBMAs than meat-eaters; moreover, consumers select sensory attributes and rate intensities differently based on the consumer's dietary orientation (Pointke et al., 2022). Yet, recent studies have demonstrated partial consumer acceptance of meat alternatives to conventional meat products, with PBMAs occasionally performing better than meat (Cordelle et al., 2022; Niimi, Sörensen, et al., 2022; Sogari et al., 2023). Therefore, factors other than dietary orientation or demographics may explain the differences in hedonic preference for PBMAs.

Research questions

To examine the relationship between consumers' MA and their sensory perceptions of and preference for commercial PBMAs, the MAQ was applied as a screening tool and MA was taken as an analysis factor to segment consumer groups and to identify their ideal product. The hypotheses tested in this study were as follows: (1) consumers will prefer each PBMA differently, depending on their MA level; (2) consumers with high meat attachment (HMA) will prefer PBMAs with more meat-related sensory attributes over products with less meat-related sensory attributes, and vice versa for consumers with low meat attachment (LMA); and (3) based on their MA levels, consumers will have different ideal product profiles.

Materials and methods

Participants, samples and consumer sensory evaluation

This study adopted a two-step research design, incorporating a pre-screening procedure and a consumer sensory evaluation. An online pre-screening questionnaire was conducted to recruit participants for the consumer sensory evaluation study. The questionnaire encompassed demographic information, food allergies and dietary orientation (omnivore, flexitarian, pescatarian, vegetarian, vegan or other). It also includes an MAQ comprising 16 items (e.g. 'Meat is

irreplaceable in my diet') on a 5-point Likert scale (0 = strongly disagree; 4 = strongly agree). Following the exclusion of respondents unable to participate in the sensory evaluation and other erroneous entries, the remaining 208 participants were divided into three equal groups based on their MA scores. The theoretically possible scores for MA ranged from 0 to 64, with scores of ≤20 indicating a low level and scores of 21–30 and >31 indicating medium and high levels, respectively. To facilitate a more precise understanding of the impact of the MA, focus was directed towards the upper and lower tertiles of the MA scale; that is, only the low and high MA groups were invited to participate in a subsequent consumer sensory evaluation (n = 140). In light of the restrictions imposed by the COVID-19 pandemic in February 2022, the evaluations were conducted under HUT conditions. This resulted in a total of 100 consumers taking the tasting package. Of these, 99 completed the evaluation process.

A total of seven commercial PBMAs in the form of mince were selected based on different protein sources (soy, pea, oat and grey pea). The selection of samples was based on the greatest variety of the main plant-based raw materials available in the Swedish market at the time of testing, with the objective of demonstrating a wide range of sensory properties. The products were pre-seasoned, but the degree of seasoning varied considerably depending on the manufacturers, ranging from very simple (e.g. only salt added) to complex (i.e. incorporating various flavours and spices). All samples were prepared using the same cooking process, which involved stir-frying with vegetable oil for 8 minutes at the medium heat setting. The cooked samples were portioned into plastic containers with lids, each labelled with a three-digit code. The samples were packaged with serviettes, cutlery, plain crackers, a list of attributes with definitions, instructions on tasting protocols and a QR code link to access the questionnaire. The packages were stored in a refrigerator until they were handed out to consumers.

Prior to the consumer sensory evaluation, a list of sensory attributes was generated with the assistance of six experienced sensory panellists. The list was derived through a process of sample tasting and discussion, utilising a consensus-based approach. This process ensured

that each sensory attribute was accompanied by a clear definition, enabling consumers to use unified language during the sensory evaluation.

Consumers were instructed to collect the tasting package from a designated location (Gothenburg, Sweden), store it in the refrigerator and then leave it at room temperature for 30 minutes prior to evaluation. The evaluation was conducted within a 24-hour period following the collection of the tasting package. The evaluation questionnaires were accessed via the consumers' smartphones, and the three-digit code of each of the seven samples was presented to each consumer in a random order on the questionnaire for each sample evaluation. The hedonic values of the samples were evaluated on a 9-point scale (1 = extremely dislike; 5 = neither like nor dislike; 9 = extremely like) according to appearance, aroma, taste, texture and overall liking. Sensory attribute intensity was scored on a 5-point rate-all-that-apply (RATA) scale (1 = very low; 3 = moderate; 5 = very high). The RATA method was specifically chosen because it offers a discriminative ability comparable to those of other sensory methods, such as check-all-that-apply (CATA), which effectively captures consumer-perceived sensory differences among products (Vidal et al., 2018), and descriptive sensory analysis, which provides detailed profiling but requires trained panels and considerable time resources (Oppermann et al., 2017). After evaluating all the samples, consumers indicated the intensities of attributes that would signify their ideal PBMA product using the same attribute list and RATA scale. In addition, consumers were asked about the frequency of their consumption of meat, red meat and PBMAs, with six possible answers ranging from 'never' or 'less than once a month' to 'five or more times a week'.

Data analysis

The data collected from the evaluation of the samples comprised hedonic scores, sensory profiles and the ideal product profiles. Prior to the analysis, which aimed to investigate differences in hedonic ratings across MA levels and samples, attribute-level differences between MA groups, and differences in ideal product sensory profiles

between MA groups, the normality of the hedonic and RATA data was tested using the Shapiro–Wilk test. As the data did not meet the normality assumptions ($p < 0.05$), non-parametric tests were employed to ensure robust comparisons for ordinal or non-normally distributed continuous data. Specifically, the Mann–Whitney U test was used to compare MA groups, and the Kruskal–Wallis test was used to analyse differences across samples (Meyners et al., 2016; Nahm, 2016). Furthermore, principal component analysis (PCA) and multiple factor analysis (MFA) were performed on the mean data to visualise the sensory space and assess the discrimination ability across MA levels. PCA reduces data dimensionality by identifying principal components that explain the largest variance in the dataset, thereby facilitating the interpretation of product discrimination based on the variance in products' sensory characteristics (Næs et al., 2021). MFA handles multiple data tables, making it possible to explain whether MA groups aligned in their perception of product attributes or exhibited distinct sensory configurations (Abdi et al., 2013). Agglomerative hierarchical clustering (AHC) was adopted as a methodological approach to ascertain consumers' perceptions of the sensory attributes associated with their ideal product based on their MA levels, which made it possible to gain a deeper understanding of the clustering patterns exhibited by attributes in relation to their respective intensities.

Lastly, a modified penalty analysis was conducted based on RATA data from the products and ideal product profiles. In this study, pseudo just-about-right (JAR) scores, which were transformed from RATA data by calculating deviations between the ideal attribute intensity and the perceived intensity of the matching attribute, were measured in each sample for all participants. This was made possible by the assumption that the attribute intensities in the ideal profiles of each consumer were JAR for every attribute, as desired by the consumers following the evaluation of all the samples. A traditional penalty analysis was coupled to the JAR data to evaluate the impact of specific attributes on consumers' overall liking of samples by quantifying penalties associated with deviations from the optimal attribute levels (Meullenet et al., 2007; Plaehn, 2013).

Restaurant – a field experiment (Paper II)

This study adopted a field experiment to capture consumers' real-life behaviour. As a methodological approach, a field experiment is conducted in a natural environment, such that the results are more likely to reflect real-world behaviour and conditions, in comparison with results obtained through controlled laboratory experiments (Baldassarri & Abascal, 2017). Field experiments produce research results with greater ecological validity, as factors and conditions that arise in real-world contexts can be reflected in such experiments. Thus, a field experiment can be an essential tool for understanding and influencing complex behaviour. However, field experiments rely on specific locations, times or target customer groups, so their results may have limited generalisation to other locations, cultures and population groups (Baldassarri & Abascal, 2017). Thus, the findings of this study should be interpreted in consideration of its specific contextual factors.

Why a restaurant?

The proportion of household expenditure allocated to out-of-home activities such as dining at restaurants has been steadily increasing in Europe (European Commission, 2023), and this trend is linked to the continued growth of the food service industry (Cook & European Commission, 2024; Eurostat, 2024). Dining spaces – particularly restaurants – are contexts in which consumers can select from a variety of food options. The configuration of these spaces is influenced by a combination of factors, including personal preferences, contextual cues, the social atmosphere and the behaviour of others (Gustafsson et al., 2006; Meiselman, 2008). Furthermore, 'eating out' is considered to be a consumption behaviour that combines social interaction with pleasurable (hedonic) experiences beyond the mere consumption of food (see Warde et al., 2020).

Food choices made at home and in dining-out settings differ. For example, individuals tend to consume greater quantities of meat, tomatoes, potatoes and salad vegetables when dining out than when eating at home (Binkley & Liu, 2019), and they utilise diverse decision-making strategies (e.g. enjoyment driven, novelty driven and

habit or familiarity driven) when making food choices at different types of restaurants (Greene et al., 2024). These differences imply that food choices can vary depending on the context and that observing consumer choice behaviour in real-world settings such as restaurants is important for gaining a more precise understanding of the factors that influence food choices. In this context, restaurants hold a distinctive position and are capable of influencing eating behaviour.

Moreover, chefs have the capacity to promote sustainable meals, given the steadily growing public influence of chefs as gastronomic experts (Fusté-Forné, 2020; Gössling & Michael Hall, 2021; Leer, 2016, 2019; Lewis & Huber, 2015; McBride & Flore, 2019; Neuman, 2018). Chefs also have the ability to produce palatable and aesthetically pleasing meals that do not rely on animal-based ingredients (Mouritsen & Styrbæk, 2020; Westling et al., 2025). Thus, the role of meal providers such as restaurants and chefs can significantly influence consumers' food choices, either directly or indirectly, contributing to the promotion of healthier and more environmentally sustainable consumption. However, only a limited number of studies on environmentally sustainable food choices have explored actual consumer behaviour in real-world restaurant settings (Greene et al., 2023).

Cues and influence on food choices

In public consumption environments such as restaurants, visual cues marking specific foods on the menu as popular choices, or external cues such as other customers' choices or the chef's recommendations, can have a significant impact on consumers' choices. For instance, Cai et al. (2009) demonstrated that indicating which foods were chosen by a majority of others could increase an individual's preference for a specific menu item. Reinholdsson et al. (2023) found no effect of the social cue of what others choose, but demonstrated that making the vegetarian category more accessible – by moving its icon to the first of 10 category icons – increased purchase from that category. Similarly, Lohmann et al. (2024) found that listing menus in descending order by sustainability, placing the lowest-carbon options first, led to orders with greater nutritional value and fewer

calories in an artificial online food-ordering setting. However, presenting information about the carbon footprint or a meat tax had no effect.

While Catarci et al. (2024) found no position effect when offering two dish options in a survey, they showed that a generally popular dish became significantly more likely to be chosen when it was both cheaper and explicitly recommended, compared with being the same price without a recommendation. Furthermore, Bacon and Krpan (2018) reported that labelling a vegetarian dish as a chef's recommendation increased the likelihood of individuals who rarely consumed vegetarian foods selecting that vegetarian dish. While using recommendations became a strategy to promote sustainable choices (Lachat et al., 2011), but their actual effect is limited. In particular, it remains unclear whether recommendations that signal what others choose differ in effectiveness from recommendations from authorities such as gastronomic experts (Bookwala et al., 2022).

These types of cues function as heuristics, enabling consumers to perceive that they are making reasonable decisions while minimising cognitive judgment. This effect is particularly pronounced for consumers who are required to make rapid decisions in dining situations (Cialdini, 2007). In a similar sense, Hamlin (2010) argued that many everyday food choices are made with low involvement; that is they involve minimal conscious deliberation and are better explained by a cue-based decision-making framework because such food choices are driven by salient situational cues or habitual responses rather than by deliberate intentions or extended information processing.

Cues and menu design as tools

The cues mentioned above can be strategically integrated into menu design and employed as a choice architecture strategy to influence food choices. In addition, menus can also influence choice by including information beyond just dish names and prices, such as details about ingredients, nutritional information and information on environmental sustainability (Behnke et al., 2024; Lo et al., 2017; McCall & Lynn, 2008). However, the effect of providing health-

related information or visually highlighting eco-friendly options on a menu seems to have a limited effect (Cadario & Chandon, 2020; Liu et al., 2025; Lohmann et al., 2024).

Nevertheless, menus have been utilised as an experimental instrument in numerous behavioural intervention strategies, consolidating their position as a core component of choice architecture. Menu design aimed towards this end can involve not only the provision of information but also the design of choice structures, the placement of visual cues and default settings (Gravert & Kurz, 2021; Lohmann et al., 2024; Reinders et al., 2024). Consequently, menu design is regarded as a practical intervention tool that can guide consumers towards sustainable food choices in the food-service context. It holds potential as a mediating factor in field experiments of this nature.

Research questions

Two main questions drove the design of this study: (1) Which is more influential in making people choose a given dish: an expert cue (chef's choice) or a social cue (guests' choice)? and (2) Are the effects of these two cues the same for different types of dishes, especially if one resembles a conventional meat dish?

Materials and methods

Participants and study design

The field experiment was conducted at a contemporary casual dining restaurant in Stockholm, Sweden, over a 4-week period in May 2024. The duration of each study condition was predetermined to be 1 week. This choice was based on previous similar studies to ensure a sufficient sample size was collected (Bookwala et al., 2022; Reinders et al., 2024) and to align with the practicalities of the restaurant's operation. As customers' visits to the restaurant were according to their own will, it was challenging to determine the exact sample size a priori. Nevertheless, a sensitivity power analysis was conducted using G*Power version 3.1 to ascertain the minimum effect size based on

the final sample size (n = 1540), which indicated the ability to detect even small effects with a power of 80% and an alpha level of 0.05.

The menu comprised exclusively vegetarian dishes, which were collaboratively designed by the restaurant chef and the research team while maintaining the restaurant's business-as-usual menu structure. Two main dishes were specifically designed with distinct features (i.e. one imitating meat and the other not) in order to test the appeal of different approaches for serving plant-based dishes, in conjunction with the effects of the cues employed in the experimental treatments. A total of four dishes were served (Figure 2), one of which was a variation of the traditional Swedish dish *Pannbiff*, using a plant-based patty made from mushrooms and peas (hereinafter referred to as the 'plant-based patty'). The second dish comprised lentils with a 'zero-waste' pesto (henceforth referred to as 'lentils'), which was based on the idea of seasonality (i.e. using seasonal ingredients) and a generally more creative approach to cuisine. The third was a soup consisting of potatoes and ramson, and the final dish was a salad, comprising salad vegetables cultivated in the basement of the restaurant, accompanied by potatoes, roasted beets and Dijon mayonnaise. The prices for the dishes were set at 185 SEK for the plant-based patty, 175 SEK for the lentils, 145 SEK for the soup and 175 SEK for the salad. The menu card presented the dishes in the following sequence: plant-based patty, lentils, soup and salad, from the top of the menu to the bottom. This sequence and composition of the menu remained constant throughout the study period.

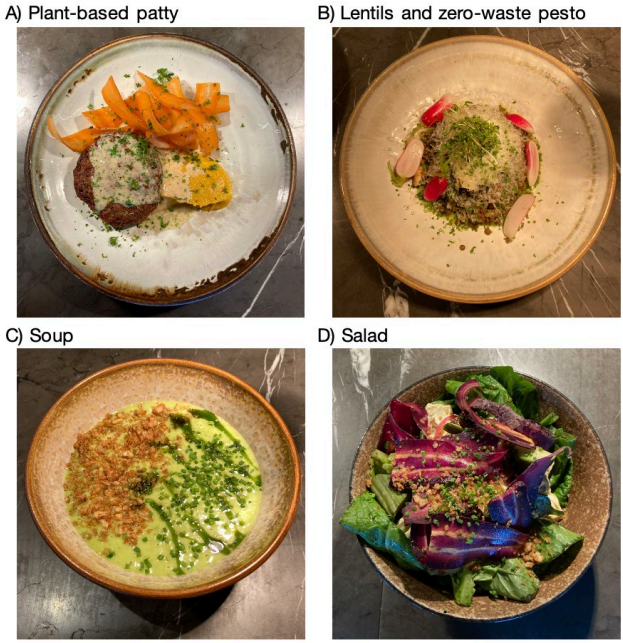

Figure 2. The four dishes served by the restaurant during the study, adapted from Paper II.

In the course of the data-collection process, walk-in restaurant customers were exposed to one of four conditions depending on the week they visited. Chefs were selected to operationalise the expert cue because of their growing public influence as gastronomic experts, which makes them likely to be perceived by customers as authorities with credible judges of taste and quality. The social cue was implemented as a descriptive popularity signal indicating others' selections, tapping into normative influences that could guide quick, low-involvement decisions. The first week was a control week: all dishes were displayed without any cues, showing only the dishes' original names. In weeks 2 and 3, an expert cue condition was applied, with the plant-based patty highlighted as the 'Chef's choice' in week 2 and the lentil dish labelled as such in week 3. In the final week, a social cue condition was applied: the lentil dish was highlighted with as the 'Guests' choice' (see Table 2).

Table 2. Experimental conditions and cues for each experiment

Week	Experimental condition	Highlighted dish	Cue
1	Control	None	None
2	Expert cue	*Pannbiff* (plant-based patty)	Chef's choice
3	Expert cue	Lentils with a 'zero-waste' pesto (lentils)	Chef's choice
4	Social cue	Lentils with a 'zero-waste' pesto (lentils)	Guests' choice

The primary outcome of the experimental treatment involved the collection of actual sales data from the restaurant, enabling an objective evaluation of the impact of cues on food choice. A survey was also conducted in parallel to gain a deeper understanding of customer backgrounds and subjective dining experiences. The survey was conducted on a voluntary basis among customers who visited the restaurant and wished to participate. Responses were collected through a QR code linked to the online survey, which was placed on each table. The survey collected socio-demographic information including age, gender, country of origin, education level, and employment status and condition, as well as dietary orientation. Customers were also asked about contextual background, including their meal companion, whether they had previously visited the restaurant, whether they had participated in this survey before (i.e. visited the restaurant more than once and participated the survey during the study period) and whether they had a museum membership. Lastly, participants' hedonic liking (overall liking, appearance, aroma, taste and texture) for the selected dish and their satisfaction with the meal experience (satisfaction with their choice of dish, perceived pleasantness of the dining experience and intention to return to the restaurant) were measured using a 5-point Likert scale.

Data analysis

In this study, a range of statistical analysis techniques were employed, given that two types of data were collected: sales data (n = 1540) and survey data (n = 524). The primary experimental effect was analysed using sales data on the frequency of selection of the four menu items according to each experimental condition (control, expert cue and social cue). To evaluate whether the distribution of menu choices differed significantly under different experimental conditions, a chi-squared test was conducted. This test is appropriate for evaluating categorical variables to determine whether the observed distributions differ significantly from what would be expected by chance (McHugh, 2013). To further explore pairwise differences following a significant result, the Marascuillo procedure was applied as a post-hoc analysis, with a significance level set at 0.05. Furthermore, the effect sizes were calculated with Cramer's V as small (0.06), medium (0.17) and large (0.29) (H.-Y. Kim, 2017).

A change in weather patterns occurred during the data-collection process, and daily temperatures were collected. The average weekly temperature was 11 °C in week 1, 22 °C in week 2, 20.2 °C in week 3 and 24.4 °C in week 4. The relationship between temperature and sales was analysed using a centred-log ratio (CLR) transformation, followed by linear regression. The daily sales proportions for the four dish categories were compositional data, so they were transformed using the CLR method to enable standard statistical analysis (Aitchison, 1982). Separate linear regression models were then fitted for each CLR-transformed component, with daily temperature as the predictor.

Survey data from customers who voluntarily responded during the experimental period were analysed using descriptive statistics followed by binary logistic regression, with two primary target dishes (the plant-based patty and the lentils) serving as the dependent variables. While binomial models do not fully capture interdependence among the four dish options, this approach offered a more focused and interpretable analysis of factors influencing the dishes of interest. Accordingly, the analysis aimed to explore the statistical relationships between various independent variables

associated with participants' dish selection (select = 1, not selected = 0). A potential confounding between experimental conditions and ambient temperature was observed. Including temperature as a covariate attenuated condition effects and widened confidence intervals – particularly for salad, which showed a positive association with temperature. To reduce collinearity and enhance interpretability, temperature was excluded from the final models for the two primary target dishes. The key independent variables included in the study were age, gender, dietary orientation (e.g. vegetarian), education level, employment status and geographic origin (e.g. country of origin). In order to ensure robust logistic regression results, a minimum of 10 events per variable was followed (Peduzzi et al., 1996). Some independent variables were merged to meet this criterion; for example, dietary orientation was grouped as 'omnivore' versus 'other', education level as 'university degree or above' versus 'other', and employment status as 'employed' versus 'other'. Six participants opted to identify as 'other' or 'prefer not to say' in response to the gender question. These six participants were excluded due to insufficient representation; therefore, the final sample size for the logistic regression was 518. The influence of each variable was reported as an odds ratio and 95% confidence interval, with a significance level set at 0.05.

To analyse the difference in participants' liking of the dishes and overall meal experience across weeks, a Kruskal-Wallis test was used. This test is appropriate for comparing more than two independent groups when the assumption of normality is violated. Following significant Kruskal–Wallis results, Dunn–Bonferroni post-hoc tests were conducted to identify specific group differences. The Bonferroni correction was applied to adjust for multiple comparisons and reduce the risk of Type I error, with a corrected significance threshold set at $p < 0.05$. Cohen's d effect sizes were calculated to assess the magnitude of observed differences between groups (Lenhard & Lenhard, 2017). The effect sizes were interpreted using conventional thresholds: no effect (0–0.1), small effect (0.2–0.4), moderate effect (0.5–0.7) and large effect (≥0.8).

Everyday life – randomised controlled trial and social network analysis (Papers III and IV)

An RCT is a robust experimental method that facilitates a causal estimation of intervention effects, making it possible to verify intervention effects under controlled conditions (J. L. Leroy et al., 2022). However, since real-life behaviour is greatly influenced by social interactions and structural conditions, it is not possible to evaluate the effectiveness of an intervention in isolation. Thus, Paper III examined the effect of an intervention in terms of whether changes would be observed in the self-reported intakes of plant-based foods relative to animal-based foods among randomised groups. Paper IV sought to explore how the effect of the intervention was disseminated and sustained throughout a network using SNA, a field of study that focuses on the relationships and interactions between individuals, groups or organisations.

Everyday meals and social influence

People's food-related behaviour is diverse, routinised and habitual and it is learned through observation, conversation and imitation. Individuals do not simply refer to the choices of others; rather, they socially construct their own behavioural justification criteria or preferences. This phenomenon extends beyond the scope of conventional 'information influence', delving into more intricate structural and cultural explanations, such as social norms. As demonstrated by numerous studies, behavioural change – including dietary choices – is considerably influenced by various forms of social influence, including descriptive norms which reflect perceptions of how common a behaviour is and signal what other people do (Centola, 2010; Goldstein et al., 2008; Harries et al., 2013; Higgs, 2015). This perspective has had a significant influence on the design of behavioural-change interventions. In the conventional approach, an intervention is designed for individual participants and single choices (i.e. not following their habits over a period of time); in contrast, the social approach considers not only who will be the target of the intervention but also who the target is connected to. In summary, social influence constitutes a fundamental theoretical basis

for research design and interpretation. It functions as both a 'parameter' variable, which changes an individual's attitude, and a 'path' through which an intervention effect spreads (Centola, 2018).

Previous studies have shown that social influence can affect eating, including whether, what, when and how much people eat (Hackel et al., 2018; Higgs, 2015; Larson & Story, 2009; Robinson et al., 2014; Ruddock et al., 2019; Vartanian et al., 2015; Zorell, 2022). Nevertheless, the extent to which the adoption of a healthier or more sustainable diet is influenced by social factors appears to be limited (Chater & Loewenstein, 2023; Chen & Antonelli, 2020). Therefore, long-term investigations of people's habits in everyday life are needed – particularly comparisons of the effects of social cues versus those of factual information, which is commonly used in contemporary society to guide food choices (e.g. dietary guidelines).

Influential individuals and people susceptible to influence

The impact of social influence is not uniform across individuals; some people demonstrate a greater capacity to influence their environment, while others exhibit a higher degree of susceptibility to external influences. This phenomenon of social influence asymmetry can be explained by a combination of factors, including position within the social network, psychological acceptance and behavioural tendency (Aral & Walker, 2012; Christakis & Fowler, 2007).

Firstly, it is evident that prominent individuals characteristically possess elevated levels of network centrality, which places them in a position to expeditiously disseminate information or behavioural norms. Such subjects have been shown to have elevated scores not only in degree centrality (the number of direct connections) but also in eigenvector centrality (the degree to which they are connected to influential people) (Borgatti, 2005; Borgatti et al., 2009). In addition, prominent individuals often act as a reference point for behavioural imitation and are likely to influence the choices of others.

On the other hand, the concept of susceptible individuals has been attributed to a multifaceted interplay of psychological and structural factors. More specifically, if an individual (an 'entity') is located in the

periphery of a network (with low centrality) or is included within the scope of a specific influencer's connection, then the influence of a prominent individual within the same network will likely have an effect on the entity. From a psychological perspective, susceptible individuals include people who demonstrate a high degree of reliance on social alignment or information search (Cialdini & Goldstein, 2004). This tendency is particularly evident in routine and high-uncertainty domains, such as making food choices, where individuals are more likely to align their choices with those of others rather than relying on their own cognitive judgment.

Research questions

This research, which comprised two sub-studies (Papers III and IV), examined the hypothesis that changes in the self-reported intakes of plant-based foods relative to animal-based foods would be observed between randomised groups. The objective was to understand the impact of different types of information on patterns of food choice. The research further tested whether the intervention treatments affected self-reported food intake, and, if so, under what conditions these effects appeared more strongly. In other words, the first sub-study investigated the relative effectiveness and working mechanisms of two approaches (social vs. fact-based information) to achieve the same dietary goal of reduced animal-based and increased plant-based foods intake (Paper III). The second sub-study sought to explore the spontaneous formation of social networks within groups of the RCT, with the aim of gaining a more comprehensive understanding of network dynamics, the potential factors that enhance such dynamics, and social influence on eating behaviour (Paper IV).

Materials and methods

Participants and study design

The RCT was conducted over a 4-month period in Sweden (mid-October 2022 to early February 2023) using a tailored mobile phone application ('the app'). The duration of the study was chosen based on previous studies (Harray et al., 2017; Kurz et al., 2015; Lally et al.,

2010; Shelton et al., 2019; Shoneye et al., 2019; Wood & Rünger, 2016), with the objective being to achieve an optimal balance between the possibility of achieving behaviour changes and the risk of attrition and declining adherence.

Participants were recruited through a variety of channels, including university campuses; social media; and interviews with the research team in newspapers, in a podcast and on public radio. The study was presented as an investigation into the roles of information and social interaction in changing food habits. The study advertisement material featured a QR code, directing interested individuals (over 18 years of age) to a screening survey. The target sample size was determined to be approximately 100 people per group – a figure arrived at following an extensive review of the extant literature on similar studies (Centola, 2010; Hunter et al., 2019; Shelton et al., 2019). Individuals who followed a specific diet for medical reasons or who exhibited symptoms of disordered eating (self-diagnosed or diagnosed by a physician) were excluded from the survey. Following the provision of written informed consent, participants who satisfied the inclusion criteria were directed to a pre-study questionnaire that collected socio-demographic information (e.g. age, gender and education level), dietary orientation and the frequency of food consumption of animal- and plant-based protein sources. After the completion of the aforementioned steps, participants were redirected to a separate website where their contact information was collected, which required them to receive an anonymised login detail to the app. At the end of the study, participants were asked to complete a post-study questionnaire that was largely the same as the pre-study, but included additional questions about participants' food habits (e.g. 'How often did you eat the main meal in a restaurant, canteen, with friends or similar? '), their study involvement (e.g. 'I actively followed what others in my group were posting') and their interpretation of the study's objective.

Initially, 328 subjects were enrolled in the study. Participants were randomly allocated to one of three groups and invited to take part in the study (see Table 3). The groups included a treatment group (fact group) that was exposed to factual information; a second treatment

group (social group) that was exposed to social information; and a control group that received no information. The information messages were delivered as pop-up messages in the app in the form of a 'weekly tip'. The factual information messages mainly encouraged the consumption of plant foods, although they also covered other health and environmental impacts related to diet, such as salt intake, types of cooking fats and organic farming. The information sources were diverse, ranging from the official Swedish dietary guidelines to country-specific estimates of food-related GHG emissions and information regarding organic farming. The social information messages were generated based on the actual food intake data from the study, reporting what others in the groups had eaten during the last week. During the first 2 weeks, the messages were pre-established, focusing on food consumption within the Swedish population. This approach was adopted due to a lack of sufficient data from participant reports to facilitate the creation of social information messages based on behaviour.

The app enabled participants to post pictures and texts about the meals they consumed (Figure 3). Participants reported their food intake in the app by selecting pre-set portion sizes from a list of categories, including legumes, grains, fruits, starch vegetables, other vegetables, meat, poultry, eggs and so on. The size of each portion was also set in the app. Participants were free to select as many portions as they wanted from the food categories to reflect their actual intake. They were also at liberty to report their food intake as frequently as they wished, but it was recommended that they made a minimum of two full-day reports per week. Although the researchers would have preferred daily reporting, this recommendation was chosen to ensure reasonable compliance and avoid participant frustration with overly structured requirements. Participants could view posts (e.g. reported meals or other pictures such as food or daily activities, with the uploading of identifiable pictures of themselves restricted) from other members within their group but not from members of other groups. A six-digit user ID was allocated upon logging in to the app, but participants could change their user ID, while maintaining anonymity. This user ID was shown when the meal was reported; however, further information related to

participants' characteristics (e.g. gender, dietary orientation, etc.) was not disclosed.

The app sent two reminders per week, based on a rolling schedule (Tuesday–Friday, Wednesday–Saturday, etc), to motivate participants to keep reporting their food intakes. However, the researchers avoided any suggestion that the participants were 'under surveillance' on specific weekdays, in order to avoid biases such as participants behaving differently on those weekdays. Participants' food intake report was displayed in the app as a 'post', similar to the format observed on social media platforms. Furthermore, participants could use the 'like' function in a manner consistent with social media platforms, so they could contribute to others' posts, in addition to commenting on and expressing interest in each other's activities. While these functions were mentioned to participants as a possibility, their use was neither encouraged nor discouraged.

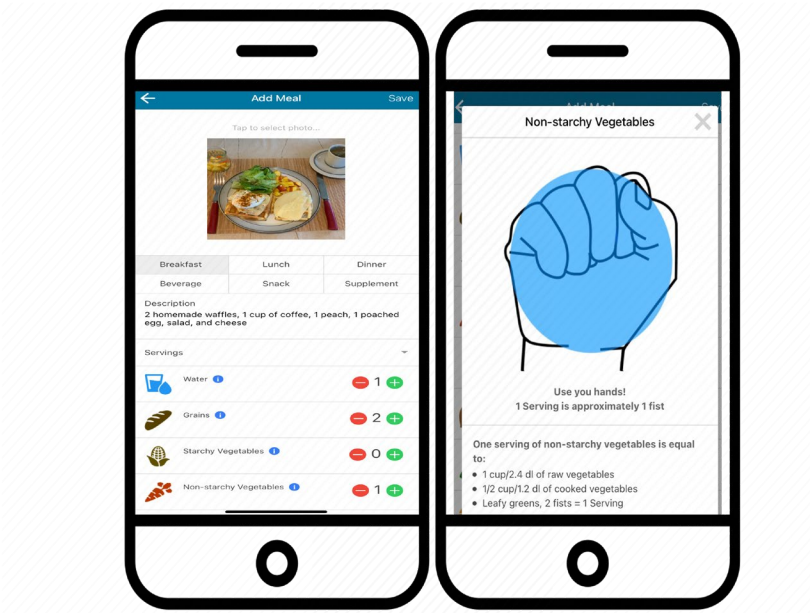

Figure 3. The food-reporting function of the app.

Table 3. Outline of the study design and participants

	Treatment		Control
	Fact	Social	
Participants			
Invited†	110	110	108
Accessed††	76	81	67
Reported†††	62	65	63
Interacted††††	45	30	43
Treatment (weekly message)	Factual information	Social information	None
Social interaction	Like '♥', comment, sharing picture		
Reminders	Reminders to report food intake (twice per week)		

Note: †'Invited' refers to participants who were invited to the study;††'accessed' refers to participants who successfully downloaded and logged into the app; †††'reported' refers to participants who reported at least one meal in the app; †††† 'interacted' refers to participants who sent or received 'likes' among the participants in each group.

Data analysis

The main outcome reported in Paper III was measured as the proportion of animal-based food portions reported (dairy products, eggs, meat, poultry and seafood) relative to the proportion of plant-based food portions (fruits, grains, legumes, starchy vegetables, non-starchy vegetables, and nuts and seeds). These were collected during the 16-week trial – with the exception of the data from week 1, due to the ongoing recruitment of participants and technical difficulties with the app. The proportion of animal-based to plant-based foods was calculated using the daily meal reports, as the proportion was less susceptible to fluctuations in reported amounts of food. For instance, if a participant reported a general decrease in food intake over the course of the study, the absolute intake of food in general could be shown to decrease. However, the proportion of animal-based food to plant-based food would remain unchanged. Furthermore, rather than

utilising raw food-intake data, the food intake of each individual participant was calculated as the sum of weekly food portions for each food category reported, divided by the number of days recorded by the same individual in each week. This was implemented to mitigate the potential for group outcomes to be disproportionately influenced by specific individuals who might contribute to the data set with a high frequency.

The study incorporated repeated measurements, as this setting allowed for free flow from the participants (not strictly regulated), which resulted in repeated measurements over time at the individual level. As a result, the data was unbalanced, since not all participants provided the same number of reports at each point in time. For instance, the number of reports varied, with some participants responding at only one point in time and others responding at all points in time. To analyse the main outcome, a mixed-model repeated-measures analysis of variance (ANOVA) with unbalanced data was employed. A traditional repeated-measures ANOVA requires a balanced assessment, with each participant providing data equally at all time points, whereas a mixed model can flexibly process missing or unbalanced measurements (Detry & Ma, 2016; Muhammad, 2023). Furthermore, employing random effects makes it possible to model heterogeneity in the initial levels or response patterns between individuals, enabling flexible estimation of time, intervention conditions and interaction effects (Detry & Ma, 2016; Muhammad, 2023). Profile analyses were also conducted to ascertain the presence of patterns and group effects. These analyses were based on data from the participants who reported consistently each week throughout the study period (factual group: $n = 10$; social group: $n = 14$; control group: $n = 12$). A profile analysis employs a range of techniques to identify, quantify and interpret the differences in score profiles among individuals or groups. This process makes it possible to examine and interpret levels or patterns of performance across multiple variables (Bulut & Desjardins, 2020). Furthermore, the consumption frequencies of meat and plant-based protein sources were analysed using paired sample *t*-tests for each group, as reported in the pre- and post-questionnaires.

SNA was used to explore the diffusion mechanism of the intervention effects and the organic network formations in Paper IV. In particular, SNA-based indicators were included in the analysis to quantitatively measure social interactions between participants and to evaluate the characteristics of network structures within the group. Social interaction was measured by collecting 'like' interactions between participants within each group during the intervention period. Since each participant was able to send 'likes' to the other participants in the group, this transmission and reception relationship formed a directed network. Specifically, incoming arrows (as shown in Figure 8) were used to denote the receipt of 'likes' and outgoing arrows were used to indicate the act of giving 'likes'. The network of each experimental group was constructed in this way, and the following main measurement indicators were analysed (Freeman, 1978; Prell, 2012):

Average degree is defined as the average of the number of ties connected to each node (i.e. participant) in the network. This indicator represents the extent to which a given participant engages in a range of interactions. A high average degree suggests a frequent occurrence of interaction.

Network density is measured as the ratio of the actual number of ties to the number of possible inter-node connections. This value represents the overall cohesion of the network; the higher the value, the denser the connection structure between participants.

Degree centrality is measured according to the number of connections (the number of incoming or outgoing edges) a particular node has. This is used to identify influential actors within the network; in other words, degree centrality illustrates the extent to which a given participant engages in a range of interactions.

In addition, a Spearman correlation test was employed to determine the relationship between the activities of receiving and giving 'likes'. Kruskal–Wallis and post-hoc Dunn–Bonferroni tests were used to compare the groups' answers from the pre- and post-study questionnaires data.

Ethical considerations

All studies in this dissertation underwent systematic considerations and procedures to ensure ethical legitimacy. All studies were conducted according to the Declaration of Helsinki (2013), and all data were collected and handled in accordance with the EU's General Data Protection Regulation (GDPR) 2016/679.

In the consumer sensory evaluation, participants were recruited through a preliminary questionnaire. Prior to their participation in the evaluation, participants were sufficiently informed of the purpose of the evaluation, the procedures, and data utilisation, and provided their written consent. The evaluation environment was designed to ensure the safety of participants with allergies or specific dietary restrictions, and participation was voluntary. Following the completion of the evaluation, participants were compensated with a 250 SEK gift card. The study was assessed for compliance with national research requirements by an internal process at RISE Research Institutes of Sweden and was approved by the Department of Material and Surface Design.

It was particularly important for consumer rights and information notices to be transparent in the restaurant field experiment, as it was conducted within an actual restaurant during its operation. The survey was designed to be completed voluntarily by customers, and survey responses were de-identified and anonymous. Moreover, the use of a QR code allowed diners to decide for themselves whether to participate or not. All participants who answered the survey provided their informed consent. No financial remuneration was provided; however, following their completion of the survey, participants were offered a complimentary cup of coffee or tea. The analysis of sales data was conducted in an aggregated manner, ensuring the anonymity of individual customers. This assessment was undertaken in accordance with national research requirements within an internal process at the School of Hospitality, Culinary Arts and Meal Science at Örebro University in Sweden.

In order to comply with the requirements of the RCT, it was essential to implement particularly strict privacy measures. Consequently, the

mobile phone application used for data collection provided the study participants with a comprehensive explanation of the methodology for data collection and utilisation. All analyses were processed in units of de-identified nodes, and the results of the visualisations were reported in an anonymised format so that specific individuals could not be identified. The participants did not receive any monetary compensation. However, in week 11, it was announced that a gift would be offered as a token of gratitude. Participants who remained actively involved until the end of the study were given a voucher for two meat-alternative products available at supermarkets in Sweden. An application for this study was submitted to the Swedish Ethical Review Authority, which deemed the study exempt from ethical review (No. 2022-02646-01). Written informed consent was obtained from all participants.

Findings

All the studies presented in this dissertation were conducted in Sweden. While the aims of each study varied, the participants' demographic characteristics appear to be fairly similar (see Table 3). In each study, the majority of participants (64%–79%) were female, and a significant share (56%–82%) of participants had completed higher education. The mean age differed slightly across studies; the consumer sensory study (Paper I) had the youngest participant group, and the field experiment (Paper II) had the oldest group. Regarding dietary orientation, more than half of the participants identified as omnivores (55%–75% across the studies). Notably, Paper I had the highest proportion of individuals following meat-reduction diets (45%), which was to be expected, as the study recruited participants based on their MA.

The subsections that follow respectively present the detailed demographic characteristics of the participants, aligned with each study's specific aims, along with the corresponding findings.

Table 4. Summary of the demographic information for each paper

	Paper I	Paper II	Paper III	Paper IV
N	99	524	328	118
Gender				
Female	66 (66%)	334 (64%)	258 (79%)	90 (76%)
Male	33 (33%)	184 (35%)	70 (21%)	28 (24%)
Other	0 (0%)	1 (0.2%)	0 (0%)	0 (0%)
Prefer not to say	0 (0%)	5 (1%)	0 (0%)	0 (0%)
Age: mean (SD)	38(±12)	49 (±16)	44 (±13)	42 (±11)
Education				
School not completed	0 (0%)	1 (0.2%)	0 (0.0%)	0 (0.0%)
Primary	2 (2%)	2 (0.4%)	1 (0.3%)	0 (0.0%)
Secondary school education	25 (25%)	42 (8%)	53 (16%)	19 (16%)
Post-secondary education	16 (16%)	51 (10%)	26 (8%)	6 (5%)
College/university education	53 (53%)	318 (61%)	230 (70%)	86 (73%)
Post-graduate education	3 (3%)	110 (21.0%)	18 (5%)	7 (6%)
Dietary orientation				
Omnivore	55 (55%)	328 (63%)	242 (74%)	88 (75%)
Flexitarian	10 (10%)	128 (24%)	45 (14%)	16 (14%)
Pescatarian	8 (8%)	28 (5%)	11 (3%)	4 (3%)
Vegetarian	17 (17%)	26 (5%)	14 (4%)	4 (3%)
Vegan	9 (9%)	3 (1%)	13 (4%)	4 (3%)
Others	0 (0%)	11 (2%)	3 (1%)	2 (2%)

Note: The categories presented in the table reflect the shared demographic variable identified across the individual studies. The percentages represent proportion within each study.

Products – Paper I

This study explored the relationship between consumers' level of MA and their sensory perceptions, preferences and ideal attributes of PBMAs. Based on MA scoring, consumers were grouped into either an LMA (n = 45) or HMA group (n = 54), where each group exhibited distinct consumption patterns and dietary orientations. The LMA group included a wider spectrum of meat-excluding dietary orientations, including flexitarian (15%), pescatarian (15%), vegetarian (32%) and vegan (17%). Conversely, members of the HMA group predominantly identified themselves as omnivores (96%). This distinction was evident in participants' consumption patterns of PBMAs and meat. A substantial proportion of LMA consumers (61%) reported never consuming meat, and 43% consumed PBMAs at least once per week. In contrast, HMA consumers consumed meat at least once per week, with 67% of them adhering to this frequency; the majority (91%) rarely incorporated PBMAs into their diet.

In comparison with LMA consumers, HMA consumers exhibited significantly lower mean scores for products' hedonic attributes across seven commercially available minced PBMAs, specifically in the dimensions of overall, aroma and taste (all $p < 0.05$), with a small effect size ($d < 0.2$). However, both MA groups showed similar preferences, generally favouring soy- and pea-based products over those made from grey pea and oat. Notably, both MA groups gave one grey-pea-based product the lowest liking for appearance, while its aroma and taste were rated similarly to those of the most-liked products.

These patterns were further elucidated through PCA, which projected the products based on sensory attributes measured using the RATA scale (Figure 4). The analysis demonstrates that both MA groups discriminated products similarly, with preferred products clustering together and being characterised by sensory properties such as broth flavour and taste, fried onion flavour and taste, umami, meaty taste, and juicy and oily texture. These properties positively correlate with hedonic attributes. Conversely, less-liked products were characterised by sensory properties such as bitterness, cereal taste, grainy texture and mealy texture, all of which negatively correlated with hedonic

attributes. Moreover, both MA groups projected their ideal products similarly. This overall similarity was confirmed through MFA, which yielded an RV coefficient of 0.98, indicating a high degree of alignment between the attribute matrices of the products and the ideal products based on consumers' MA levels.

Although the consumers exhibited similar preferences and characterised the products and their ideal product with sensory properties in a similar manner, regardless of MA level, differences were observed in intensity ratings. Specifically, the LMA group rated 13 out of 38 attributes with a higher intensity compared with the HMA group during product evaluations ($p < 0.05$), with small effect sizes ($d < 0.3$). Moreover, when assessing the sensory profile of the ideal product, LMA consumers significantly rated six attributes higher than HMA consumers ($p < 0.05$), with medium and small effect sizes ($d < 0.4$). To further explore clustering patterns in the attribute intensities and consumers' perceptions of their ideal product, AHC was conducted separately for each MA group. While both groups exhibited similar clustering patterns, key differences were observed: LMA consumers preferred a higher intensity of umami taste in their ideal products, whereas HMA consumers favoured a more moderate level. Additionally, attributes such as fibrous appearance and texture, grainy appearance and texture, and red colour were perceived differently across MA groups. LMA consumers placed these attributes in the low-intensity cluster for their ideal product profile, while HMA consumers indicated them as moderate intensity.

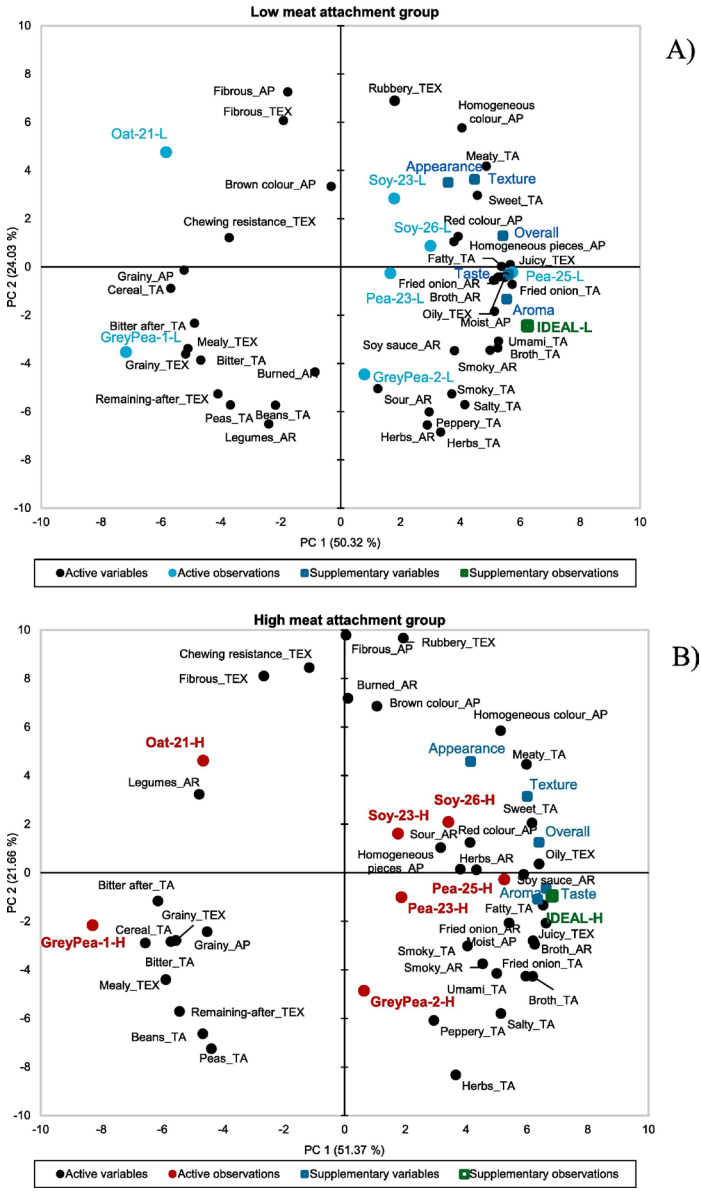

Figure 4. PCA biplot of attributes and PBMAs for (A) the LMA group and (B) the HMA group. (L: LMA group; H: HMA group; AP: appearance; AR: aroma; TA: taste; TEX: texture; Supplementary variables: hedonic attributes; Supplementary observation: ideal product). Adapted from Paper I (A. Kim et al., 2024), license under CC BY 4.0.

The aforementioned differences were not clearly captured by the dimensionality-reduction data-analysis techniques of PCA and MFA, which prioritise the projection of dominant patterns and global structures. To explore more nuanced variations in the sensory attributes associated with different MA levels, a modified penalty analysis was conducted separately for each MA group and sample. This approach enabled the identification of attribute-level sensitivities by quantifying of the impact of being above or below an ideal level of consumer preference; thus, it offered a more targeted approach for evaluating specific sensory drivers of consumer response. The results suggest that MA levels may influence the perception and preferred intensity of certain sensory attributes, which may drive consumers' preferences for each PBMA (Figure 5). For instance, soy-26 was the most-liked sample across both MA groups. However, LMA consumers – despite projecting their ideal product and evaluating products similarly to HMA consumers – reported that insufficient aroma and taste of fried onions, along with a lack of moisture, negatively affected their overall liking of soy-26 (Figure 5A). In contrast, HMA consumers identified excessive grainy texture as a key factor contributing to their dislike of the same most-liked product (Figure 5B).

These findings highlight the crucial role of sensory properties in shaping consumer preferences for PBMAs. The consumer's MA level also affected how different attributes were perceived and recognised, influencing overall liking across both the LMA and HMA groups.

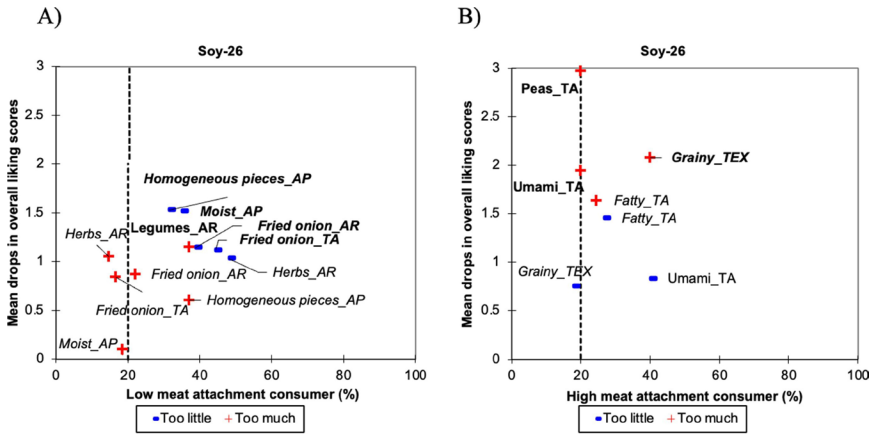

Figure 5. Penalty analysis on soy-26, based on the ideal product profile, shown for (A) the LMA group and (B) the HMA group. (**bold**: significance in mean drop; *italics*: significance in penalty; dashed line: 20% of consumers; AP: appearance; AR: aroma; TA: taste; TEX: texture). Adapted from Paper I (A. Kim et al., 2024), license under CC BY 4.0.

Restaurant – Paper II

This study aimed to evaluate the impact of different claims, expert-based cues (e.g. 'chef's recommendations') and social cues (derived from other guests) presented on a restaurant menu on customer dish choice in an á la carte restaurant setting. The effects of these cues were examined across different types of dishes, particularly vegetarian options; one that mimicked a conventional meat-based dish called *pannbiff* (a plant-based patty) and another that did not (lentils).

During the 4-week study period, a total of 1540 dishes were sold (Figure 6). The plant-based patty was the most popular choice over time, accounting for 214 (42%), 128 (41%), 143 (36%) and 119 (37%) of sales over the 4 weeks, respectively. A non-statistically significant difference was observed between weeks, indicating that the 'chef's choice' cue did not influence the selection of this dish. The lentil was one of the least-popular options during the first week (control week)

but subsequently became the second-most popular dish across the following weeks, accounting for 98 (19%), 74 (24%), 110 (28%) and 80 (25%) of the sales over the 4 weeks, respectively. In particular, when the dish was labelled as the 'chef's choice', a significant increase in its sales proportion ($x^2 = 8.50$, $df = 3$, $p = 0.037$) with a small effect size (Cramer's $V = 0.09$) was observed compared with the control week.

Unexpected and non-targeted changes in the sales proportions of soup and salad were also observed. A significant decrease in soup sales proportion ($x^2 = 20.05$, $df = 3$, $p = 0.000$) with a small effect size (Cramer's $V = 0.15$) was seen, particularly between the first and second weeks. A significant increase in salad sales proportion ($x^2 = 14.87$, $df = 3$, $p = 0.002$) with a small effect size (Cramer's $V = 0.13$) was observed, most notably between the first week and the second week and again in the fourth week. These shifts may be associated with the weather changes observed during the study period, as a significant positive trend was found between rising ambient temperatures and increased salad sales ($\beta = 0.03$, $R^2 = 0.31$, $p = 0.011$), but no significant relationship was identified between temperature and the sales of the plant-based patty or lentils.

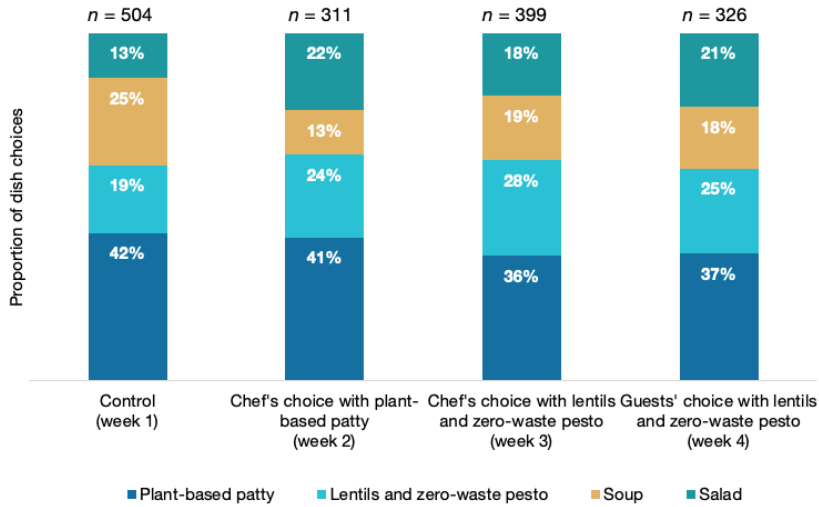

Figure 6. Weekly sales distribution of four dishes (100% stacked column chart). (Each bar represents a specific week, with segments colour-coded to indicate the relative proportion of each dish's sales within that week). Adapted from Paper II (A. Kim et al., 2025), license under CC BY 4.0.

To gain a more comprehensive understanding of the factors associated with customers' dish choices, the survey data – including sociodemographic details, dietary orientation and other variables – was analysed using binomial logistic regression, with separate assessments conducted for the plant-based patty and lentils. The proportion of dishes ordered by the survey respondents closely matched the overall sales data, indicating that the survey sample was nearly representative of the broader customer population. Although only vegetarian dishes were available, the plant-based patty mimicking a conventional meat-based dish was the most popular. The socio-demographic patterns in the plant-based patty's selection mirrored trends in meat-based dish preferences. For instance, men were significantly more likely to choose the plant-based patty ($p < 0.001$, OR = 3.09, 95% CI = 2.08–4.64) but less inclined to opt for lentils ($p < 0.001$, OR = 0.39, 95% CI = 0.23–0.65) in comparison with women. Additionally, customers without a university degree were less

likely to select lentils compared with those having at least a university degree ($p = 0.002$, OR = 0.30, 95% CI = 0.14–0.61).

Lastly, the hedonic evaluation of the dishes and meal experience ratings indicated that the customers found the dishes they selected to be enjoyable. This was evidenced by the fact that all the hedonic attributes received a rating greater than 4.1 on a 5-point scale. Of all the dishes, the plant-based patty received the lowest rating in terms of taste ($p = 0.007$), with a small effect size ($d = 0.27$). Nevertheless, the experimental conditions did not appear to influence the consumers' liking of the dishes. The findings also revealed no significant differences in meal experience, as measured by satisfaction with the selected dish, perceived pleasantness of the dining experience, and intention to return to the restaurant, regardless of the dish or experimental condition.

Everyday life – Papers III and IV

The 4-month RCT was conducted using a mobile phone application that tracked food intake in real-life settings and facilitated the observation of social dynamics, including potential social influence through 'like' interactions on food reports. The findings related to the specific aims of the sub-studies were reported separately in Papers III and IV.

Paper III examined the impact of the intervention on food choice, with a focus on whether different types of information sources (i.e. fact-based or social-norm-based sources) would influence changes in self-reported intakes of plant-based foods relative to animal-based foods. The analysis was based on food-intake data from 237 participants who reported at least one meal via the app. The participants were grouped as follows: 79 participants were in the factual group, 83 in the social group and 75 in the control group. The demographic profile of the participants in Paper III indicates that they were predominantly female (76%) and highly educated (78%), with a mean age of 42 years (20–74 years). Additionally, the majority identified as omnivores (73%), while the remaining participants

reported being flexitarian (14%), pescatarian (4%), vegetarian (5%) and vegan (4%). These dietary patterns were reflected in the frequency of the participants' animal-based protein consumption, as more than half (51%) of the participants consumed animal-based protein sources more than five times per week, while only 10% reported never consuming it. A significant proportion (56%) also reported substituting meat with plant-based protein sources such as legumes and pulses on a weekly basis. Overall, the characteristics of the participants showed similar trends across the three groups.

Although no significant changes were observed in the overall consumption proportions of animal-based foods versus plant-based foods across the groups (Figure 7), weekly fluctuations in the absolute intake of animal-based foods ($F(14, 1058.6) = 2.029$, $p = 0.013$) and plant-based foods ($F(14, 1053.8) = 2.227$, $p = 0.006$) were observed. Furthermore, the profile analysis captured group-level differences in average plant-based food intake ($F(2, 33) = 4.185$, $p = 0.024$), with participants in the factual group reporting higher intake than those in the social and control groups. In addition, the exploratory analysis comparing the frequencies of meat and plant-based food consumption from the pre- and post-questionnaires indicated a decrease in the frequency of meat consumption among the social group. In particular, reported meat consumption decreased from 'three to four times a week' to 'once or twice a week' (4.2 and 3.8; $p = 0.042$). Despite the observed temporal dynamics and group-level differences, no substantial long-term changes in dietary behaviour were detected within or across groups.

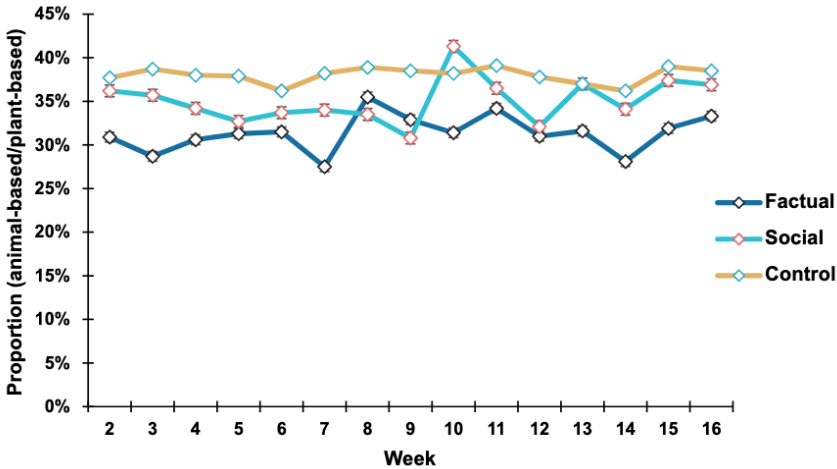

Figure 7. Proportion of animal-based vs. plant-based foods consumption over time (± standard error, SE). Adapted from Paper III (Zorell et al., 2024), licensed under CC BY 4.0.

Paper IV explored the dynamics of social interaction and the potential dissemination of influence through social activities (i.e. the act of 'liking' each other's food reports). The exploratory SNA focused on the network formations within each group, exploring their associations with changes in self-reported food intake and identifying potential factors influencing network formation. Thus, the data from the 118 participants who either received or sent 'likes' were used, including 45 participants in the factual group, 30 in the social group and 43 in the control group. The participant profiles in Paper IV were largely consistent with those reported in Paper III, reflecting similar demographic characteristics across studies. However, somewhat more distinctive dietary orientations were observed, particularly in relation to meat consumption: 33% of participants in the factual group reported in the pre-questionnaire that they were either reducing or eliminating meat from their diets, compared with 16% in the social group and 23% in the control group. This trend was partially reflected by the food intake reported over the study period. The control group consumed a relatively higher proportion of animal-based foods versus plant-based foods than both the factual and social

groups ($F(2, 116.8) = 4.9$, $p = 0.009$). Additionally, a significant group-level difference was observed in plant-based food consumption ($F(2, 106.6) = 3.9$, $p = 0.023$), with the participants in the factual group reporting a comparatively higher intake of plant-based foods than those in the control group. Nevertheless, no significant changes in overall food intake were detected within or across groups through the study period, suggesting that the presence or absence of social interactions did not exert a substantial influence on consumption patterns.

However, a notable divergence in social interaction patterns emerged across the groups. In particular, the group that received factual information was found to be the most active (i.e. sending and receiving 'likes') in comparison with the other groups (Figure 8). Ironically, the group that received social reinforcement showed almost no activity throughout the study. The network measures indicated that the factual group exhibited a high degree of network connectivity, with an average degree of 30.11, indicating that each participant engaged in approximately 30 'like' interactions, both as sender and recipient. The network density of 0.68 indicated that 68% of all possible connections between participants were present in the factual group. Whilst a direct comparison between the groups should be approached with caution, given the impact of varying network sizes on network measures, the overall patterns showed that the factual group was somewhat more active than the social group (average degree: 2.13; network density: 0.07) and control group (average degree: 4.53; network density: 0.11).

Furthermore, participants with a higher degree of centrality – that is, those more actively engaged in sending, receiving or exchanging 'likes' – were present in each group. Again, the factual group included several participants with higher engagement in social interactions than the other group members. The social group showed one dominant node, indicating limited overall engagement, while the control group had more socially active participants than the social group, albeit still fewer than the factual group. A strong correlation was observed in the factual group between the number of 'likes' sent

and those received ($r(43) = 0.65, p < 0.0001$) – a pattern that was not present in the social or control groups.

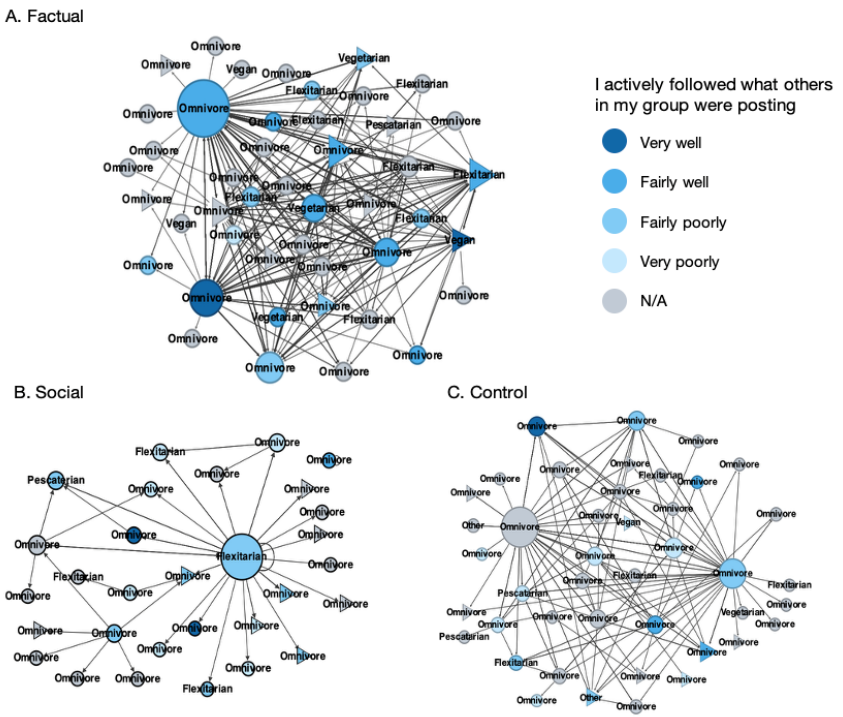

Figure 8. Visualisation of networks by each group based on 'likes' over time. (The size of each node is based on the degree, with a greater number of activities corresponding to a larger node. The shape of the nodes is based on gender, with circles indicating female participants and triangles indicating male participants). Adapted from Paper IV.

General discussion

The findings of in this dissertation collectively highlight the complexity of influencing people's dietary behaviour with the aim of addressing environmental sustainability and health. Each study offers unique insights into how individuals respond to sensory stimuli, social information and different forms of external cues in food-related decisions. The first study demonstrates that consumers' preference for products that closely replicate the sensory experience of conventional meat remains dominant, regardless of MA. The findings from the other studies confirm that most single-level strategies, including social cues and factual information, have limited effects on food-consumption behaviour, underscoring the necessity for multi-level strategies that simultaneously consider psychological, social and situational factors. That said, an expert cue did have a significant effect in promoting consumers' choice of a plant-based, non-meat-mimicking dish. Aside from these findings, the dissertation contributes to the dialogue on factors influencing dietary behaviour with a few key takeaways, described below.

One of these key takeaways is the importance of contextual framing. For example, in Paper I, PBMAs received lower hedonic ratings among consumers with HMA, yet both HMA and LMA consumers desired meat-likeness in their ideal product, albeit with some variation in the ideal intensities of sensory properties. This preference for meat-likeness observed at the product level can also be extended across broader culinary practices, suggesting a systematic influence on the preparation and consumption patterns of plant-based protein sources. As shown in Paper II, a vegetarian dish mimicking a traditional meat dish gained greater popularity in a real restaurant setting compared with one that did not. This finding suggests that – beyond hedonic preference for meat-likeness – a 'meat-centric' gastronomic logic is also followed in vegetarian formats. However, it was found that consumer choice could be influenced in the context of a less-popular, non-meat-mimicking vegetarian dish by the recommendation of a gastronomic authority (i.e. a chef). On the other hand, a social cue (i.e. other guests' choices) had a limited impact on consumer choice behaviour.

This limited effect of social influence was further reflected in Paper III's 16-week longitudinal study within the everyday life settings, where the proportion of plant-based to animal-based food intake did not change significantly across the groups exposed to social information, factual information or no information at all. However, as noted in Paper IV, the participants in different groups exhibited varying degrees of engagement in terms of social interaction activities: those who received factual information exhibited a higher level of engagement than those receiving social or no information.

Hence, engagement strategies may need to be tailored depending on the platform, audience and medium. In particular, strategic design should account for how individuals vary in their responsiveness to hedonic and social factors, recognising that people may have different sensory preferences based on their psychographics (i.e. MA) and may be more affected by influential individuals than by broad, generalised social cues. The following discussion explores the relationship between hedonic and social factors and these factors' impact on food choices.

The impact of hedonic factors on food choices

Two of the studies in this dissertation (Papers I and II) examined how consumers' hedonic responses to and sensory preferences towards plant-based foods vary depending on the context. As mentioned earlier, three themes were identified in this dissertation: Product, Restaurant, and Everyday life. In the Product theme (Paper I), participants' aroma and taste preferences and overall liking of PBMAs were found to vary significantly according to MA level. Notably, the HMA group exhibited a tendency to give lower score ratings on both the sensory intensity and hedonic scales than the LMA group. This tendency was also observed for the sensory attribute of intensity in the ideal product. In particular, the attributes frequently used to recreate a meaty flavour and mask any 'off' flavours, such as umami and smoky (Fiorentini et al., 2020), were assigned lower scores in the HMA group's ideal product profile than in the LMA group's. These results could be related to the dietary orientations and familiarity with/usage of PBMAs exhibited by the MA groups. The prevailing

self-reported dietary orientations among individuals in the LMA group involved the exclusion or reduction of meat consumption, with a significant proportion of these individuals (43%) consuming PBMAs every week. On the other hand, most of the individuals in the HMA group identified themselves as omnivores, and they rarely consumed PBMAs on a regular basis. Frequent exposure to and experience with such products may contribute to familiarity, thereby forming the foundation of sensory expectations and the ability to identify sensory attributes (Bitnes et al., 2007; Rabin & Cain, 1986). Consumers' usage, acceptance and perception of the appropriateness of the products have been suggested to be associated with product familiarity (Giacalone & Jaeger, 2016). Thus, HMA consumers who never or seldom use PBMAs may have more negative attitudes towards them, along with higher expectations regarding their taste, in comparison with LMA consumers. These results align with previous findings that the sensory acceptance of PBMAs is closely associated with consumers' attitude towards meat or usage of PBMAs (Cordelle et al., 2022; Elzerman et al., 2011; Hoek et al., 2011, 2013; Pointke et al., 2022). In addition, individuals who are reducing their meat consumption may perceive PBMAs as 'treats' (Kerslake et al., 2022), which could be linked to the results observed in Paper I regarding the higher ratings for sensory attributes reminiscent of meat given by the LMA group.

Despite the observed variations between the MA groups, a comparable trend was evident in the preference of samples and the projection of samples based on their sensory properties. In both groups, soy- and pea-based products were more favourably received than samples derived from grey pea and oat. This result may be due to the fact that grey pea and oat proteins are relatively recent additions to the PBMA market, indicating that their potential as protein sources has yet to be fully explored (Singh et al., 2021; Westling et al., 2021; Yang et al., 2023). In contrast, soy protein has well-established functional properties, such as gelation and fibre-forming abilities, which are crucial in the development of textures and structures in PBMAs (Zhang et al., 2021). Pea protein is also gaining attention for its functional applications (Yuliarti et al., 2021). Therefore, PBMA products based on soy and pea protein are likely to be more familiar

to consumers, as these are the most commonly used protein sources in the PBMA market (Lindberg et al., 2025).

Products seasoned only with salt were the least liked, possibly because the sole addition of salt failed to mask undesirable sensory properties. On the other hand, products that were highly seasoned with flavour and spice agents were more popular, with the seasonings likely enhancing products' desirable sensory properties while masking undesirable ones (Fiorentini et al., 2020). PBMA texture also plays an important role in determining consumer preferences, as do other sensory attributes such as aroma and taste. In particular, a PBMA's similarity to conventional meat is a key factor in its acceptance (Elzerman et al., 2011; Fiorentini et al., 2020; Giacalone et al., 2022). Discussions on the sensory properties of PBMAs are continually raised, and this aspect is considered one of the key factors in consumer acceptance (Aschemann-Witzel et al., 2021; Röös et al., 2022; Szenderák et al., 2022). In Paper I, the importance of PBMAs' sensory properties was reconfirmed by the observation that consumers had a clearly expressed preference for their ideal PBMAs to mimic meat-like sensory properties such as a meaty taste and juicy and chewy textures, while retaining low levels of characteristics associated with an 'off' flavour and taste and certain textures.

The significance of these hedonic aspects is more pronounced when PBMAs are presented in the form of familiar dishes, such as burger patties (Sogari et al., 2023) or Bolognese sauces (Niimi, Sörensen, et al., 2022) or when they are served with white sauce (Cordelle et al., 2022). The literature indicates that PBMAs could achieve a higher level of consumer preference than conventional meat. In other words, PBMAs have the potential to gain a competitive edge over conventional meat products if their unpleasurable sensory attributes can be successfully masked.

The relative stability of hedonic satisfaction was confirmed in the restaurant theme (Paper II), which was conducted in a real-life restaurant setting. All the dishes offered in the experiment were vegetarian. Although most of the customers who responded to the survey did not identify as vegetarian, they reported a high level of

preference for and satisfaction with the dishes they selected. Moreover, no significant differences were observed in meal experience indicators such as perceived pleasantness of the dining experience and intention to return in the future, according to the type of dish or the experimental conditions (chef's choice or guests' choice cues). While all the dishes were rated highly in hedonics, the consumers' most popular choice over the study period was the dish that resembled a conventional meat-based dish, showing that 'meat-centric' gastronomic logic is still followed in the vegetarian form. As meat has long been considered a core part of a 'proper' meal in Western society (Mäkelä & Niva, 2019; Niva & Mäkelä, 2020), it can be seen that the popularity of the plant-based patty simply followed from the popularity of its conventional meat form. Studies show that there is a tendency to choose meat dishes when eating out (Biermann & Rau, 2020; Ritzel & Mann, 2023) and that the selection of meat dishes is closely tied to the regional origin of the cuisine. For example, in a study from three English cities, dishes influenced by North American or European cuisines were more likely to feature red meat compared with those rooted in East Asian cuisine (Neuman et al., 2020). The demographic patterns frequently discussed in the context of meat versus vegetarian dishes are also applicable to a vegetarian dish mimicking a conventional meat dish. The prevailing tendencies for men to opt for meat options (Sobal, 2005) and for women and people with a higher educational background to select vegetarian options (Rosenfeld, 2018; Ruby, 2012) were observed in consumers' selection of meat-mimicking and non-meat-mimicking vegetarian dishes.

A synthesis of the findings from Papers I and II indicates that the sensory acceptance and pleasure satisfaction of plant-based foods necessitate a differentiation strategy tailored to consumer characteristics, alongside an approach that considers the overall quality of the consumption experience (Forsberg et al., 2025; Giacalone, 2025). At the level of the product itself, it is possible to implement customised strategies according to psychological variables such as MA. In an actual dining environment, basic taste quality and pleasant experiences themselves can be key factors in eliciting consumers' willingness to revisit the restaurant and evaluate

vegetarian dishes positively. In addition, providing plant-based dishes that resemble conventional meat-based dishes by using PBMAs could ease the transition for individuals struggling to reduce their meat consumption. Consequently, the hedonic factor can function as a pragmatic motivator for the daily acceptance of plant-based foods, extending beyond the individual's sensory response. This finding provides strategic implications for both product developers and professionals in the food service industry.

The impact of social factors on food choices

This dissertation investigated the ways in which external cues and social reinforcement influence food choices and dietary changes in diverse social contexts, whilst also evaluating the efficacy of interventions in real-life settings. More specifically, the integration of a restaurant environment (Paper II), the tracking of daily life-based eating habits (Paper III) and the analysis of a social network (Paper IV) enabled the derivation of a sophisticated understanding of the working mechanism of external cues on food choices.

In Paper II, a vegetarian dish resembling a well-known conventional meat dish had a high level of popularity, regardless of the presence or absence of external cues. As mentioned earlier, this could stem from the popularity of the original meat dish, which carried over to its vegetarian version, or from the dish's placement at the top of the menu – a factor shown in previous research to influence consumer choice (Deek et al., 2022). Nevertheless, in the case of a less-popular dish with no resemblance to a conventional meat dish, positioned second from the top of the menu, an expert-based cue (i.e. chef's choice) increased participants' selection of the dish. This result suggests that expert endorsement may exert a stronger influence on consumer choice than menu placement alone for a less-popular dish, whereas for a dish that is already popular and placed at the top of the menu, the expert cue appears to have no additional impact. In addition, as has been demonstrated before, a less-preferred food can be made more appealing through external cues that influence decision-making, such as the label 'Dish of the Day' (Saulais et al., 2019) or a recommendation from a known and trusted gastronomic

authority (Fusté-Forné, 2020; Rodrigues et al., 2023). This is particularly relevant in Sweden and other Nordic countries, where chefs are increasingly recognised as high-status gastronomic authorities (Leer, 2016; Neuman, 2018). Their endorsements could carry considerable influence on consumers' choices and increase the appeal of dishes that might otherwise be overlooked.

On the other hand, a social cue (i.e. guests' choice) showed no significant effect. The ambiguity of social cues' impact can be seen in the inconsistent findings across the literature (Bookwala et al., 2022; Cai et al., 2009; Reinholdsson et al., 2023). The limited influence of social cues on food choice was also observed in Paper III. An intervention that incorporated factual and social information into daily life did not demonstrate a substantial impact on long-term dietary modifications in general. More specifically, the intake pattern remained relatively constant in all groups. This result could be because people hold strong personal prior preferences when it comes to their food choices, which can moderate potential treatment effects (Reinholdsson et al., 2023). Individuals tend to be more inclined to follow others when situations or options are uncertain (Cruwys et al., 2015; Venema et al., 2020), which may not be the case in ordering food at a restaurant. In addition, changing someone's behaviour through social reinforcement requires a complex contagion process; that is, behavioural shifts come with repeated exposures to a trusted or familiar person, or a sufficiently strong and relevant signal of social endorsement (Centola, 2018; Centola & Macy, 2007). Therefore, in the restaurant context where customers encountered external cues on a single occasion when ordering from a menu, a cue from an influential figure (i.e. a recognised gastronomic expert) could have a greater influence on food choices than cues from anonymous others. In the everyday life context, where participants were repeatedly exposed to social cues, these cues may have been too infrequent or ambiguous to alter eating behaviour. The null effect observed from the factual message was expected, as the message closely mirrored the type of communication commonly employed by public health agencies in public campaigns. Such campaigns can help to increase awareness, but their efficacy in changing actual behaviour seems limited (Wakefield et al., 2010). Therefore, the fragmentary

information provided – whether factual or social – may not have been sufficiently potent to induce continuous and systematic dietary changes.

The results of the SNA (Paper IV) provide insights into interactional patterns around food practices under social-media-like conditions. The group that received social information had a low frequency of social interactions (e.g. 'like' exchanges) throughout the study, and the network density and average degree of connection in that group were relatively low. In contrast, the group that received the factual information showed the most active interaction. The demographic characteristics across the study groups were similar, yet the most active group (i.e. the factual group) showed somewhat more diverse dietary orientations. This dietary diversity may have fostered greater motivation and engagement in social interactions. Participants who followed meat-reducing or eliminating diets might have felt aligned with what they perceived to be the 'right' dietary choices, which in turn may have increased their engagement and led to more frequent interactions within the group. Participants who were particularly active (i.e. higher degree centrality) in the factual group had a variety of dietary orientations, unlike those in the social group (only one flexitarian participant) and the control group (a few omnivore participants). This finding suggests that, in order to keep an organically developed network alive, interactions should arise through multiple members in the network, rather than in a single direction; however, there is a need for at least some individuals that can actively stimulate interactions through their activities (Banerjee et al., 2019; Dubois & Gaffney, 2014; Freelon et al., 2020; Jungherr, 2014; Metzger et al., 2010). The diversity of dietary orientation in the factual group could have contributed to more dynamic engagement during interactions within a food-related context.

In short, these studies show that social cues and norms must go beyond mere message presentation in order to influence food choices and dietary changes. The effectiveness of social information is mediated by the hedonic nature of the food itself, the persistence of context, the identity of the informant, and the strength of position and interaction within the social network; thus, it can only lead to

substantial behavioural changes under certain conditions. Therefore, food policies or campaigns aiming to address health and environmental concerns require strategic designs that fully consider these contextual consistency and structural conditions (Chater & Loewenstein, 2023).

Methodological reflections

This dissertation employed a multi-method approach, combining quantitative and behavioural techniques to study food choice in various situations, including everyday life. The use of sensory analysis enabled the identification of subtle preference differences based on individual MA levels. The restaurant field experiment made it possible to examine choice architecture within a real commercial setting, increasing the ecological validity of the results compared with those of laboratory-based experiments. The integration of the RCT with SNA represents a novel methodological contribution, enabling the mapping of both direct and indirect social influences on eating behaviour. However, each method also posed specific challenges.

Reliability and validity

Consumer sensory studies are generally highly controlled, as researchers typically follow a set of standardised procedures, such as proper preparations of materials, clear explanation of sensory scales and attributes, and randomisation of the product presentation (see Moskowitz, 2008). The study conducted in Paper I utilised a HUT conditions, which might cast doubt on whether it was fully controlled, compared with laboratory test conditions. Although all participants received identical tasting packages with detailed instructions and a defined list of attributes, and although the evaluations were done in randomised order with valid scales to minimise influencing factors, the ambient conditions under which the participants conducted the tasting could not be controlled. However, a previous study has shown that the consumers answered relatively reliably in both a central-location test and an HUT (Niimi, Collier, et al., 2022).

In contrast, the field experiment (Paper II) benefited from realism but involved uncontrollable variables such as customer demographics, mood and meteorological factors (i.e. weather), which may have influenced the results. In general, in real-world research design, it is imperative to align the *ideal* with the *viable*. For example, in Paper II, it was not possible to randomly assign participants to all experimental conditions, as the participants were walk-in customers, and the experiment was conducted in an operating commercial restaurant. These limitations could have been mitigated in a number of ways. For instance, customers on the same day could have been randomly exposed to all the experimental conditions (cf. Cai et al., 2009); alternatively, the conditions could have been varied across days (cf. Reinholdsson et al., 2023). If possible, the duration and place of intervention could have been diversified, thereby expanding the spectrum of participant composition and field environments. While such an approach might have increased the robustness of the results, research in real-world commercial settings requires a balance between ideal research design and practical constraints. For instance, restaurants are obliged to offer specific menus for extended periods during an experiment period, which can result in a strain on resources such as manpower and logistics.

Using an RCT with a mobile phone application offered a rich and participatory interface, allowing Papers III and IV to have controlled conditions that facilitated a robust experimental intervention while making it possible to follow actual everyday dietary behaviour over an extended period of time. However, although the study design allowed for both controlled intervention conditions and relatively high freedom in the collection of participants' food intakes, it failed to sufficiently engage the participants throughout the study, resulting in uneven engagement across treatment groups. Another point related to the validity of the RCT is that food intake was measured using pre-set portion sizes from a list of food categories (e.g. legumes, grains, fruits, starch vegetables, other vegetables, meat, poultry, eggs, etc.). While this approach allowed for consistency in data collection, it also introduced limitations. Individuals may estimate portion sizes differently, and because the data collection relied on manual logging, particularly when recording meals with multiple components or

composite dishes, the specific amounts of each food item might not have been accurately captured (See Chen et al., 2019). To mitigate this problem, participants were provided with examples and visual guides for hand-based portion measurement; still, each participant might have interpreted them differently, and it is possible that participants did not consistently refer to the visual guides each time they logged their meals. Therefore, it was necessary to handle the food intake data with caution. Moreover, participation decreased over time, and the collected data were also imbalanced. To address these issues, the food intake data were handled as a proportion. The food categories were merged into animal- versus plant-based foods, since the aim of the study was to investigate the possibility of influencing eating behaviour in general, rather than the choice of a specific food category.

The study aimed to capture real-world eating habits, which involve a diverse range of foods rather than a narrow focus on a single item. However, it is conceivable that an alternative study could have employed a similar design while concentrating more on specific categories such as whole grains, legumes, red meat and so forth. In future studies, focusing on a single particular food item alongside a more explicit message about its consumption may yield clearer and more direct results.

Causality and possible bias

In Paper I, the sample selection exclusively comprised PBMAs. During the recruitment process, it was mentioned that participants would evaluate PBMAs, not types of plant protein sources. This may have influenced the participants' responses, particularly those of participants with HMA, as these individuals may have been predisposed to favour conventional meat over PBMAs, which may have shaped their sensory evaluations independently of the actual product attributes. In addition, the voluntary nature of participation introduced a risk of selection bias, as individuals with greater curiosity or interest in PBMAs may have been more inclined to take part (for a similar discussion see Haynes & Robinson, 2019). Such predispositions complicate causal interpretation, making it difficult

to determine whether the observed preferences were driven by the sensory properties of the PBMAs or by the participants' pre-existing beliefs and attitudes.

However, the main aim of Paper I was to identify which sensory attributes were associated with PBMA preferences and whether the association between the attributes and preference differed based on the MA levels. Therefore, the study was designed to lead to a better understanding of the association between MA level and sensory attributes and product preferences, rather than to investigate which specific attributes are associated with consumer preference for each product. In addition, the samples used in Paper I were products that were commercially available in Sweden at the time of study; thus, consumers' prior knowledge that they would taste PBMAs did not differ much from a real-world situation (i.e. when consumers see PBMAs in the supermarket and purchase and consume them). It was imperative to maintain a delicate balance between the potential influence of participant bias and the ethical conduct of the research in order to ensure the recruitment of a wide range of MA participants.

The field experiment was intended to identify the causal effects of external cues on the selection of specific dishes. However, as mentioned above, because the study was conducted in a real environment, strict control and randomisation of experimental conditions were not feasible. This may have limited the possibility of causal inference. In particular, with regard to the analysis of sales data, it was not possible to identify multiple visits by the same customers during the study period. Similarly, it was impossible to rule out uncontrollable factors that may have affected customer choice, such as weather conditions and foot traffic volume. Therefore, while the results of the study reflect the trends observed in real commercial environments, causal interpretation should be approached with caution, taking into account these design constraints and potential biases.

The RCT design employed in this dissertation provided a robust methodological foundation for identifying the causality of the intervention treatment. The use of randomisation has been

demonstrated to increase the internal validity of causal reasoning by minimising systematic differences and preventing the possibility of contamination of treatment across each group (J. L. Leroy et al., 2022). Also, the anonymity of the participants was maintained throughout the study. As a result, socio-demographic characteristics could not be identified within the app environment, which helped reduce the risk of social homophily influencing the treatment effect. However, this anonymity also limited the ability to explore how homophily may have helped to shape network dynamics. While the study was designed to isolate interactions within the app, the possibility that the participants interacted with each other outside the study conditions (i.e. beyond the app environment) cannot be completely ruled out. In fact, the post-study questionnaire data (data not shown) suggested that some participants may have encountered each other outside the app environment, which could potentially result in spill-over or indirect effects. Even so, it remained highly uncertain whether these few instances of external interaction meaningfully influenced the overall results, and such effects cannot be quantified or conclusively assessed within the scope of the current study.

Generalisation and representation

It is important to note that all the studies included in this dissertation were conducted in Sweden. The socio-demographic patterns and dietary orientations observed among the participants reflected relatively similar patterns reported in broader population studies in Sweden, particularly in relation to plant-based food consumption. More specifically, in this research, women, younger individuals and those with a higher education demonstrated a more pronounced tendency toward plant-based food preferences, in line with national trends (Ax et al., 2016; Röös et al., 2022). This alignment increases the likelihood that the study environments reasonably represented the Swedish consumer culture and market. The materials used in the consumer sensory study and the RCT were provided exclusively in Swedish, limiting the scope of the studies to participants who could comprehend and articulate themselves in Swedish. In the case of the field experiment, however, the study materials were provided in both

Swedish and English, allowing participants from more diverse linguistic backgrounds to participate. This approach held the potential to increase the linguistic inclusiveness of the sample, ensuring a more comprehensive reflection of cultural diversity within a certain country (or contexts). Nevertheless, the geographical location of all studies limits the generalisation of their results to other countries – or even to other regions within Sweden with different economies and communities (e.g. urban vs. rural, university city vs. agricultural city vs. industrial city). Moreover, although linguistic expansion could help to capture participants with different cultural backgrounds, it does not deviate from the framework of the country's sociocultural context. Providing materials only in Swedish and English still excluded non-Swedish-speaking individuals without English proficiency. Consequently, further multilateral and multicultural comparative studies are required to facilitate generalisations between countries.

In both the consumer sensory study and the field experiment, meat products were not included as a direct control. This choice was intentionally made during the study design phase. In the case of the consumer sensory study, the focus of the experiment was to ascertain the relative differences between participants' opinions on PBMAs and to identify the sensory properties of the ideal product favoured by consumers. In other words, the focus was on deriving the properties of an ideal PBMA that consumers would perceive as an *alternative* to meat, rather than a direct *substitute*. To this end, the samples were selected based on plant protein from various raw materials to reflect a wide range of sensory properties. Furthermore, MA was utilised as a consumer-segmentation instrument to analyse the variation in the sensory evaluation according to MA level. In the field experiment, only vegetarian menu options were provided in order to eliminate the possibility that diet orientation would guide the choice rather than the cues. That is, consumers who eat meat would likely choose a meat dish if available, while vegetarians would automatically rule out a meat dish. As a result, no conclusion could have been drawn about the selection of a vegetarian dish versus a meat dish. Nevertheless, the study still provided a foundation for a general discussion about transforming 'meat-centric' habits by including a vegetarian version

of a traditional meat-based dish, along with a vegetarian dish that did not mimic a meat-based dish. This foundation may help extend the discourse on animal- and plant-based food consumption. In addition, the study was conducted at a restaurant with a specific profile (i.e. it is known for its pro-environmental actions and is located at a museum in Stockholm). Thus, the restaurant clientele may have comprised individuals who were generally more conscious of sustainability issues, which might limit the generalisability of the findings to broader populations with diverse sociocultural backgrounds.

In summary, despite the possible drawbacks outlined above, this dissertation demonstrates methodological strengths that contribute to its robustness and relevance within the Swedish context. Its mixed-methods approach enabled a comprehensive examination of food choices from both perceptual and behavioural perspectives. Paper I's use of sensory analysis made it possible to identify subtle preference differences based on individual MA levels, while the restaurant-based field experiment in Paper II enabled an examination of choice architecture within an actual commercial setting, supporting the ecological validity of the results. The novel integration of the RCT with SNA allowed direct and indirect social influences on eating behaviour to be mapped; in addition, the mobile phone application in the RCT offered a rich and participatory interface, permitting controlled conditions that facilitated a robust experimental intervention.

That said, cautious interpretation of the outcomes – particularly in terms of generalisation – is necessary, particularly given the differences between the studies' context and a market environment in which meat products are included. Subsequent studies should implement multiple comparison group designs incorporating meat in order to increase the external validity of the results and augment the findings' generalisability across diverse consumption contexts.

Concluding remarks

There is no ‘silver bullet’ capable of instantly altering people's food choices, as the latter are based on a variety of intertwined factors. However, this dissertation adopted various methodological approaches, including a consumer sensory study, field experiment and RCT, to explore behavioural change towards healthier and more environmentally sustainable food choices, particularly in terms of reducing meat consumption and increasing the acceptance of plant-based foods. These approaches were chosen to determine how individuals’ choices related to hedonic and social factors and ultimately how these factors could influence eating behaviour. The dissertation focused on three themes related to common arenas in which food choices are made: Products, Restaurants and Everyday life.

The key implications emerging from this dissertation are as follows. Firstly, it was shown that PBMA preference at the sensory level is not solely explained by product characteristics but is also significantly influenced by an individual’s MA level. This finding suggests that consumer-segmentation strategies are needed to increase the acceptability of PBMAs. Secondly, the field experiment broadened the current understanding of the external cues that influence food choices in the real world. In particular, a less-popular dish gained more attention when recommended by a trusted gastronomic authority (a chef). Notably, the experiment also showed that the logic of meat-centric meals can be applied to plant-based protein sources. These findings increase academic understanding of the sociocultural acceptability of plant-based protein sources, as well as the development of strategies to encourage plant-based food choices. Thirdly, no clear influence of social cues was observed in both the restaurant and everyday contexts. Therefore, while generic social cues may raise awareness and influence behaviour (e.g. in terms of reusing towels or downloading songs), they appear to be insufficient in generating lasting shifts in eating behaviour without other reinforcement, such as more engaging strategies or the involvement of authoritative and pro-social individuals. This finding suggests that

expectations regarding the potential of 'social influence' to bring about substantial eating behaviour change should be tempered.

Lastly, the possibility of social reinforcement and its indirect effect on eating behaviour was investigated by integrating an RCT with SNA. This approach provides a new methodological framework that explains behavioural changes in digital environments, contributing to the design of practical strategies for promoting behavioural change. Still, the findings from both the RCT and the field experiment suggest that social influence operates less through general peer behaviour and more through the actions of specific influential individuals.

All in all, the findings of this dissertation suggest that it is difficult for a single-factor-focused approach to bring about significant changes in eating behaviour, as food choices are influenced by numerous factors operating at different levels. Therefore, a multidimensional perspective is needed to facilitate a comprehensive understanding of food choices, taking into account psychological, social and situational factors in an integrated manner.

Scientific and societal contributions

This dissertation makes a multi-layered contribution to both scientific knowledge and practical application. Firstly, from an empirical perspective, it demonstrates how sensory preference for plant-based products is significantly modulated by MA, suggesting new segmentation strategies for product development. The identification of diverse consumer demands underscores the need for both the food and hospitality industries to adopt more nuanced approaches in catering to varying preferences. Such efforts could play a critical role in reducing meat consumption and promoting the adoption of plant-based foods. Secondly, in terms of methodology, the integration of the RCT with SNA in the context of food behaviour represents a novel application, particularly in linking digital interaction data with behavioural outcomes. Thirdly, in practical terms, this dissertation offers actionable insights for chefs, restaurants and public health communicators on how expert framing and meal design can influence consumer acceptance of plant-based meals. Finally, from a

societal perspective, it provides evidence to inform policies aiming to promote sustainable diets, supporting a shift towards food environments that nudge individuals gently but effectively in the direction of healthier choices. However, it also highlights the limitations of relying exclusively on soft interventions. To achieve meaningful and lasting change, such approaches could be complemented by stronger policy measures (e.g. economic incentives and disincentives) that can reinforce and accelerate the transition.

Future directions

Food choice is both deeply personal and intricately embedded within broader frameworks; thus, other factors not addressed in this dissertation may offer further insight into the complexities of dietary behaviour and its implications for environmental sustainability and public health. Expanding the diversity of research populations would increase the generalisability and relevance of findings across different societal groups. For instance, individuals from low-socioeconomic backgrounds may have different constraints and priorities when making food choices in comparison with consumers from higher socioeconomic backgrounds. Investigating how hedonic preferences and social influences operate within these contexts can reveal barriers and motivators that differ from those in more affluent groups. This line of enquiry is imperative for the formulation of inclusive strategies that do not inadvertently reinforce dietary inequalities.

The younger generation is navigating a food environment saturated with digital media, shifting norms and cross-cultural experiences. Their openness to innovation and their heightened environmental awareness position them as key agents of dietary transformation. Future research would be beneficial to explore how sensory appeal and peer influence interact within youth culture to shape sustainable eating habits. Furthermore, conducting research in regions where meat is less central to traditional diets would be helpful, as such contexts may reveal different hedonic baselines and social dynamics that challenge Western-centric assumptions about meat alternatives and dietary change.

By incorporating these varied perspectives, future research can progress towards a more holistic and equitable understanding of food system transformation – one that reflects the lived realities of diverse populations and fosters culturally resonant pathways to sustainability.

Sammanfattning på svenska

Samspelet mellan produktion och konsumtion av mat är nära kopplat till flera av våra mest angelägna utmaningar i samhället, så som miljöproblem och hälsa. Därför behöver dagens livsmedelssystem förändras för att återspegla såväl ekologiska som sociala och psykologiska utmaningar. Våra matvanor behöver förändras vilket är svårt eftersom de är vanemässiga och sker ofta på rutin, men de är också föränderliga över tid och är tydligt kopplade till plats.

Den här avhandlingen fokuserar på vilken betydelse hedoniska och sociala faktorer har för människors matvanor i samspelet mellan individ och samhälle. Mer specifikt handlar det om individers upplevelse, gillande och konsumtion av växtbaserad mat med fokus på betydelsen av individuella och kontextuella faktorer, som effekten av socialt inflytande och betydelsen av information från auktoriteter i offentliga miljöer där mat konsumeras.

Syfte

Det övergripande syftet med avhandlingen var att undersöka hur hedoniska och sociala faktorer kunde påverka konsumenters beteende mot mer hälsosamma och miljömässigt hållbara livsmedelsval. Fokus var att minska konsumtionen av animaliebaserade produkter till förmån för växtbaserade. Avhandlingen är uppbyggd kring tre sammanlänkade teman: produkten, restaurangen och vardagslivet, som var och en återspeglar olika nivåer av påverkan för beslut om livsmedel. Varje tema studerades genom en kombination av olika metodologiska tillvägagångssätt, såsom sensorisk bedömning, fältexperiment på restaurang och studier om hur sociala nätverk påverkar enskilda individers matval:

- Produkten (Artikel I): Studien undersökte konsumenter som har en stark eller svag relation till kött och vilken betydelse det kunde ha för deras sensoriska uppfattning och preferens för växtbaserade köttalternativ.

- Restaurangen (Artikel II): Studien undersökte i vilken utsträckning expertbaserade rekommendationer som, ”kockens val”, respektive socialt baserade rekommendationer, ”gästens val”, presenterade på en meny, påverkade gästernas val och acceptans av maträtter i en restaurangkontext.
- Vardagslivet (Artikel III och IV): Studierna undersökte hur olika informationskällor, faktabaserade eller sociala-norm-baserade, påverkade konsumtion av växtbaserad mat i förhållande till animaliebaserad mat. För att förstå hur sociala interaktioner kunde uppstå och dess potentiella inflytande på val av mat användes explorativ nätverksanalys.

Resultat och slutsats

Generellt visar resultaten att det finns behov av strategier på flera nivåer i samhället för att förändra matvanor. Studie I visade att konsumenters preferenser för växtbaserade köttalternativ skiljde sig åt beroende på om de hade en stark eller svag relation till kött. För konsumenter med stark relation till kött var preferensen hög för köttalternativ som liknade konventionella köttprodukter. I studie II föredrog restauranggäster konsekvent en vegetarisk version av maträtten ’pannbiff’, i synnerhet manliga gäster, gäster födda i Sverige och gäster med lägre utbildningsnivå. Det tyder på att även om menyn var vegetarisk så styrdes valet av maträtter av en köttcentrerad gastronomisk logik. Genom att lägga till en expertbaserad rekommendation, kockens val, på menyn ökade populariteten av en vegetarisk maträtt som inte imiterade kött (en linsgryta). En socialt baserad rekommendation som gästens val påverkade inte maträtternas popularitet.

Resultat från studie III och IV visade att varken faktabaserad eller social information var tillräckligt kraftfullt för att stimulera förändrade matvanor i vardagslivet. För att skapa varaktiga förändringar kan social förstärkning kräva förtroende, identitetsanpassning och upprepad exponering inom nätverk. Insikter från studierna III och IV, tillsammans med resultaten från studie II, kan tyda på att sociala influenser handlar mer om hur

särskilt inflytelserika individer kan påverka matval jämfört med signaler från generella och anonyma källor.

Resultaten från de fyra studierna bidrog till en ökad förståelse av de komplexa drivkrafter och hinder som kan påverka förändringar av matvanor.

Acknowledgements

I would like to express my deepest appreciation to everyone I met and who supported me throughout the course of my PhD journey. I was lucky in many ways during this journey, as I crossed paths with so many generous, inspiring and encouraging individuals along the way. This journey would not have been possible without the support of the incredible network of care and collaboration that surrounded me – academically, professionally and personally. Their guidance, kindness and belief in me gave me the strength and motivation to overcome challenges and celebrate milestones.

The web of relationships I was luckiest to encounter during this journey was my incredible team of supervisors. Whenever I mention that I had six supervisors, people respond with surprise (and sometimes worried expressions), but it was nothing short of a privilege for me. I was truly fortunate to have each of you guiding me through this journey. To my main supervisor, Åsa Öström, thank you for giving me the opportunity to begin this PhD journey. Your unwavering encouragement and belief in me made all the difference. I always felt that you created a space where ideas could be explored freely and vulnerabilities could be shared without hesitation. Your consistent support empowered me to express my ideas with confidence and helped me turn them into reality. To Nicklas Neuman, I am deeply grateful for your invaluable support throughout this journey. Your sharp insights and thoughtful guidance brought depth to my work. I also greatly appreciated the warm welcome during my visits to Uppsala, as well as the many eye-opening conversations that broadened my perspective and enriched my thinking. Thank you to Carolin Zorell for welcoming me so warmly and for your structured guidance, which helped me articulate the critical discussions swirling in my head. Your clarity and support were instrumental in shaping my thinking. Your guidance not only deepened my academic insight but also made me feel genuinely encouraged and inspired. To Jun Niimi, I am so grateful for your constant support and for all the enriching visits to Gothenburg, where I conducted the very first study. Those early steps were both exciting and daunting. Your critical perspective consistently

challenged me to refine my thinking, while your practical advice helped me navigate the complexities of research with confidence. A heartfelt thank you to Mihaela Mihnea for your thoughtful check-ins and joyful meetings – especially with Jimena and Toby – that brought comfort and light during stormy times. Whether through a kind word, a shared laugh or simply your presence, you reminded me that I was not alone in this process. Your support extended beyond the academic realm, and for that, I am sincerely grateful. Finally, to Stina Engelheart, thank you for your openness, your steady support and your insightful reflections throughout this journey. Your ability to listen deeply and offer thoughtful perspectives helped me to see things from a new angle. Whether through a quiet moment of reassurance or a well-timed question that sparked deeper thinking, your support of this journey was both subtle and profound, and I am truly grateful for it.

I would like to extend my sincere thanks to my mid- and final-seminar opponents – Mari Sandell, Johan Swahn, Carl-Johan Lagerkvist and Jonatan Leer – for your thoughtful critiques and constructive feedback. Your insights helped shape the critical structure of this dissertation and challenged me to refine my arguments with greater precision and depth. I am truly grateful for the time and care you invested in engaging with my work.

I also want to thank all my colleagues at the School of Hospitality, Culinary Arts and Meal Science for the warm welcome and for always including me in both academic and social settings. Your openness and collegial spirit created a supportive environment that made me feel at home from the very beginning.

I would like to express my sincere appreciation to all the individuals and institutions I had the privilege of working with throughout my PhD journey. Your contributions – which included data collection, analysis and simply by sharing your time, expertise and insight – enriched this dissertation in countless ways. To the PAN Sweden research centre, thank you for providing a vibrant and intellectually stimulating environment. It was there that I met my enthusiastic fellow PhD students, Jakob and Annalena, whose energy and

curiosity were truly inspiring; Jaquline, who successfully defended her thesis while I was writing mine; and Mathias, who provided thoughtful engagement. Special thanks to Iuri Baptista, a postdoctoral researcher and my colleague, affectionately known as the 'master of chocolate', who brought sweet insight to and added a delightful touch to my work. I am especially grateful to all members of PAN Sweden for valuable opportunities, for inspiring meetings and for creating a space where I could connect with so many remarkable and inspirational individuals. A special thank you to Anders Högberg and Karin Arkbåge for your generous support and genuine interest in my work. And to Dirk Repsilber, thank you for helping me navigate the statistical swamp. I also extend my thanks to those who supported the studies. Delmat AB kindly provided one of the samples, which was essential to the research. Paul Svensson, thank you for opening the door to conduct the field experiment at Fotografiska. I'm deeply grateful to all the staff and chefs at Fotografiska for welcoming me so warmly and supporting the data-collection process. Your cooperation and kindness made the experience both productive and memorable.

Beyond the boundaries of my PhD work, I am deeply grateful to the communities and individuals who enriched this journey in unexpected and meaningful ways. To all members of NEOLAiA, especially the dedicated team at Örebro University and the SAG members, thank you for fostering opportunities to learn from and alongside such a dynamic and welcoming community. Your openness, collaboration and shared enthusiasm made every encounter both enriching and memorable. To the LiFT coordinators and fellow PhD students, thank you for your energy, your insight and the enriching experience we shared at courses and conferences. Special thanks to my LiFT mentor, Karin Jonsson, for the thoughtful conversations and for opening the door to visit the Paulig group – an opportunity that added a valuable dimension to professional development. I also extend my heartfelt thanks to Chung Yung Jetty Lee, my mentor from GCUA 2030. Our conversations were not only comforting but also profoundly encouraging. Your insights and thoughtful reflections helped me see my work in a broader context and reminded me of the importance of staying true to my values throughout this journey.

Last but not least, to my family and friends: thank you for being my anchor throughout this journey. Simon, my love, meeting you has been one of the luckiest and most meaningful moments of my journey in Sweden. Your presence reminded me of what truly matters and gave me strength when I needed it most. I am also sincerely grateful to your family for enriching my life in Sweden with their kindness and warmth.

Junko さん、Akira さん、いつも本当にありがとうございます。お二人のご支援と励ましに心より感謝申し上げます。

한국에 있는 친구들, 주희, 원정이, 성희, 유지 언니, 수미 언니, 멀리 떨어져 있지만 늘 한결같이 서로를 응원하며 곁을 지켜줘서 진심으로 고마워. 핀란드에서 만난 든든한 가족 같은 기용이, 수미 언니, 승훈 오빠, 훈한 오빠. 핀란드에서의 소중한 시간들이 스웨덴에서도 잘 지낼 수 있도록 큰 버팀목이 되어주었어. 각자 자리에서 언제나 열심히 하는 모습이 늘 내게 큰 용기를 주었어. 가족이자 친구인 우리 언니 김명선, 서로 타지에서 힘든 순간마다 든든히 곁을 지켜줘서 고마워. 파리에 갈 때마다 늘 반겨줘서 고마운, 니콜라, 빅터 그리고 융근 오빠. 앞으로도 잘 부탁해.

마지막으로, 사랑하는 엄마와 아빠. 언제나 제 선택을 존중해 주고 묵묵히 지지해 주셔서 감사합니다. 두 분의 끝없는 사랑과 믿음이 있었기에 제가 이 길을 끝까지 걸어올 수 있었습니다. 진심으로 사랑합니다.

Completing this dissertation has been both challenging and rewarding, and I am truly thankful to everyone who walked this path with me. I carry forward not just the knowledge gained but also the relationships and memories that shaped this chapter of my life. Thank you, from the bottom of my heart.

References

Abdi, H., Williams, L. J., & Valentin, D. (2013). Multiple factor analysis: Principal component analysis for multitable and multiblock data sets. *WIREs Computational Statistics*, *5*(2), 149–179. https://doi.org/10.1002/wics.1246

Aitchison, J. (1982). The statistical analysis of compositional data. *Journal of the Royal Statistical Society*, *44*(2), 139–177.

Aral, S., & Walker, D. (2012). Identifying influential and susceptible members of social networks. *Science*, *337*(6092), 337–341. https://doi.org/10.1126/science.1215842

Armelagos, G. J. (2014). Brain evolution, the determinates of food choice, and the omnivore's dilemma. *Critical Reviews in Food Science and Nutrition*, *54*(10), 1330–1341. https://doi.org/10.1080/10408398.2011.635817

Aschemann-Witzel, J., Ares, G., Thøgersen, J., & Monteleone, E. (2019). A sense of sustainability? – How sensory consumer science can contribute to sustainable development of the food sector. *Trends in Food Science & Technology*, *90*, 180–186. https://doi.org/10.1016/j.tifs.2019.02.021

Aschemann-Witzel, J., Gantriis, R. F., Fraga, P., & Perez-Cueto, F. J. A. (2021). Plant-based food and protein trend from a business perspective: Markets, consumers, and the challenges and opportunities in the future. *Critical Reviews in Food Science and Nutrition*, *61*(18), 3119–3128. https://doi.org/10.1080/10408398.2020.1793730

Ax, E., Warensjö Lemming, E., Becker, W., Andersson, A., Lindroos, A. K., Cederholm, T., Sjögren, P., & Fung, T. T. (2016). Dietary patterns in Swedish adults: Results from a national dietary survey. *British Journal of Nutrition*, *115*(1), 95–104. https://doi.org/10.1017/S0007114515004110

Bacon, L., & Krpan, D. (2018). (Not) eating for the environment: The impact of restaurant menu design on vegetarian food choice. *Appetite*, *125*, 190–200. https://doi.org/10.1016/j.appet.2018.02.006

Baldassarri, D., & Abascal, M. (2017). Field experiments across the social sciences. *Annual Review of Sociology*, *43*(1), 41–73. https://doi.org/10.1146/annurev-soc-073014-112445

Banerjee, A., Chandrasekhar, A. G., Duflo, E., & Jackson, M. O. (2019). Using gossips to spread information: Theory and evidence from two randomized controlled trials. *The Review of Economic Studies*, *86*(6), 2453–2490. https://doi.org/10.1093/restud/rdz008

Baptista, I., Garnett, E., & Öström, Å. (2025). How can consumer science help the foodservice industry replace meat? A critical review. *Appetite*, *207*, 107861. https://doi.org/10.1016/j.appet.2025.107861

Behnke, C., Jung, S., & Bai, Y. (2024). Writing restaurant menu descriptions: The influence of word choice on consumer behavior. *International Journal of Hospitality Management*, *123*, 103923. https://doi.org/10.1016/j.ijhm.2024.103923

Biermann, G., & Rau, H. (2020). The meaning of meat: (Un)sustainable eating practices at home and out of home. *Appetite*, *153*, 104730. https://doi.org/10.1016/j.appet.2020.104730

Binkley, J. K., & Liu, Y. (2019). Food at home and away from home: Commodity composition, nutrition differences, and differences in consumers. *Agricultural and Resource Economics Review*, *48*(02), 221–252. https://doi.org/10.1017/age.2019.1

Bitnes, J., Martens, H., Ueland, Ø., & Martens, M. (2007). Longitudinal study of taste identification of sensory panellists: Effect of ageing, experience and exposure. *Food Quality and Preference*, *18*(2), 230–241. https://doi.org/10.1016/j.foodqual.2005.11.003

Blomhoff, R., Andersen, R., Arnesen, E. K., Christensen, J. J., Eneroth, H., Erkkola, M., Gudanaviciene, I., Halldórsson, Þ. I., Høyer-Lund, A., Lemming, E. W., Meltzer, H. M., Pitsi, T., Schwab, U., Siksna, I., Þórsdóttir, I., & Trolle, E. (2023). *Nordic Nutrition Recommendations 2023: Integrating Environmental Aspects* (Vol. 1–2023:003). Nordisk Ministerråd; DiVA. https://doi.org/10.6027/nord2023-003

Boesveldt, S., & de Graaf, K. (2017). The differential role of smell and taste for eating behavior. *Perception*, *46*(3–4), 307–319. https://doi.org/10.1177/0301006616685576

Bookwala, K., Gallemore, C., & Gómez-Miñambres, J. (2022). The influence of food recommendations: Evidence from a randomized field experiment. *Economic Inquiry*, *60*(4), 1898–1910. https://doi.org/10.1111/ecin.13106

Borgatti, S. P. (2005). Centrality and network flow. *Social Networks*, *27*(1), 55–71. https://doi.org/10.1016/j.socnet.2004.11.008

Borgatti, S. P., Mehra, A., Brass, D. J., & Labianca, G. (2009). Network analysis in the social sciences. *Science*, *323*(5916), 892–895. https://doi.org/10.1126/science.1165821

Breslin, P. A. S. (2013). An evolutionary perspective on food and human taste. *Current Biology*, *23*(9), R409–R418. https://doi.org/10.1016/j.cub.2013.04.010

Bulut, O., & Desjardins, C. D. (2020). *Profile analysis of multivariate data: A brief introduction to the profileR Package*. Center for Open Science. https://doi.org/10.31234/osf.io/sgy8m

Cadario, R., & Chandon, P. (2020). Which healthy eating nudges work best? A meta-analysis of field experiments. *Marketing Science*, *39*(3), 465–486. https://doi.org/10.1287/mksc.2018.1128

Cai, H., Chen, Y., & Fang, H. (2009). Observational learning: Evidence from a randomized natural field experiment. *American Economic Review*, *99*(3), 864–882.

Catarci, D., Laasner Vogt, L., & Reijnen, E. (2024). Online food choices: When do "recommended by" labels work? *Foods*, *13*(6), 928. https://doi.org/10.3390/foods13060928

Centola, D. (2010). The spread of behavior in an online social network experiment. *Science*, *329*(5996), 1194–1197. https://doi.org/10.1126/science.1185231

Centola, D. (2011). An experimental study of homophily in the adoption of health behavior. *Science*, *334*(6060), 1269–1272. https://doi.org/10.1126/science.1207055

Centola, D. (2018). *How behavior spreads: The science of complex contagions*. Princeton University Press.

Centola, D., & Macy, M. (2007). Complex contagions and the weakness of long ties. *American Journal of Sociology*, *113*(3), 702–734. https://doi.org/10.1086/521848

Chater, N., & Loewenstein, G. (2023). The i-frame and the s-frame: How focusing on individual-level solutions has led behavioral public policy astray. *Behavioral and Brain Sciences*, *46*, e147. https://doi.org/10.1017/S0140525X22002023

Chen, J., Berkman, W., Bardouh, M., Ng, C. Y. K., & Allman-Farinelli, M. (2019). The use of a food logging app in a naturalistic setting fails to provide accurate measurements of nutrients and poses usability challenges. *Nutrition*, *57*, 208–216. https://doi.org/10.1016/j.nut.2018.05.003

Chen, J., & Rosenthal, A. (2015). Food texture and structure. In J. Chen & A. Rosenthal (eds.), *Modifying food texture* (pp. 3–24). https://doi.org/10.1016/b978-1-78242-333-1.00001-2

Chen, P.-J., & Antonelli, M. (2020). Conceptual models of food choice: influential factors related to foods, individual differences, and society. *Foods*, *9*(12), 1898. https://doi.org/10.3390/foods9121898

Christakis, N. A., & Fowler, J. H. (2007). The spread of obesity in a large social network over 32 years. *The New England Journal of Medicine*, *357*(4), 370–379.

Christakis, N. A., & Fowler, J. H. (2013). Social contagion theory: Examining dynamic social networks and human behavior. *Statistics in Medicine*, *32*(4), 556–577. https://doi.org/10.1002/sim.5408

Cialdini, R. B. (2007). *Influence: The psychology of persuasion* (Rev. ed.; Collins Business Essentials, 1st ed.). Harper Collins.

Cialdini, R. B., & Goldstein, N. J. (2004). Social influence: Compliance and conformity. *Annual Review of Psychology*, *55*(1), 591–621. https://doi.org/10.1146/annurev.psych.55.090902.142015

Cialdini, R. B., Kallgren, C. A., & Reno, R. R. (1991). A focus theory of normative conduct: A theoretical refinement and reevaluation of the role of norms in human behavior. In *Advances in Experimental Social Psychology* (Vol. 24, pp. 201–234). Elsevier. https://doi.org/10.1016/S0065-2601(08)60330-5

Circus, V. E., & Robison, R. (2019). Exploring perceptions of sustainable proteins and meat attachment. *British Food Journal*, *121*(2), 533–545. https://doi.org/10.1108/BFJ-01-2018-0025

Clark, M. A., Springmann, M., Hill, J., & Tilman, D. (2019). Multiple health and environmental impacts of foods. *Proceedings of the National Academy of Sciences*, *116*(46), 23357–23362. https://doi.org/10.1073/pnas.1906908116

Collier, E. S., Oberrauter, L.-M., Normann, A., Norman, C., Svensson, M., Niimi, J., & Bergman, P. (2021). Identifying barriers to decreasing meat consumption and increasing acceptance of meat substitutes among Swedish consumers. *Appetite*, *167*, 105643. https://doi.org/10.1016/j.appet.2021.105643

Connors, M., Bisogni, C. A., Sobal, J., & Devine, C. M. (2001). Managing values in personal food systems. *Appetite*, *36*(3), 189–200. https://doi.org/10.1006/appe.2001.0400

Cook, E. & European Commission (2024). *Key figures on the European food chain: 2023 edition*. Publications Office of the European Union. https://doi.org/10.2785/265789

Cordelle, S., Redl, A., & Schlich, P. (2022). Sensory acceptability of new plant protein meat substitutes. *Food Quality and Preference*, *98*, 104508. https://doi.org/10.1016/j.foodqual.2021.104508

Crippa, M., Solazzo, E., Guizzardi, D., Monforti-Ferrario, F., Tubiello, F. N., & Leip, A. (2021). Food systems are responsible for a third of global anthropogenic GHG emissions. *Nature Food*, *2*(3), 198–209. https://doi.org/10.1038/s43016-021-00225-9

Cruwys, T., Bevelander, K. E., & Hermans, R. C. J. (2015). Social modeling of eating: A review of when and why social influence affects food intake and choice. *Appetite*, *86*, 3–18. https://doi.org/10.1016/j.appet.2014.08.035

Deek, M. R., Kemps, E., Prichard, I., & Tiggemann, M. (2022). The effect of a healthy food cue on choices from an online fast-food menu. *Eating Behaviors*, *45*, 101632. https://doi.org/10.1016/j.eatbeh.2022.101632

Dekkers, B. L., Boom, R. M., & Van Der Goot, A. J. (2018). Structuring processes for meat analogues. *Trends in Food Science & Technology*, *81*, 25–36. https://doi.org/10.1016/j.tifs.2018.08.011

Delwiche, J. F. (2012). You eat with your eyes first. *Physiology & Behavior*, *107*(4), 502–504. https://doi.org/10.1016/j.physbeh.2012.07.007

Detry, M. A., & Ma, Y. (2016). Analyzing repeated measurements using mixed models. *JAMA*, *315*(4), 407. https://doi.org/10.1001/jama.2015.19394

Deutsch, M., & Gerard, H. B. (1955). A study of normative and informational social influences upon individual judgment. *The Journal of Abnormal and Social Psychology*, *51*(3), 629–636. https://doi.org/10.1037/h0046408

Ding, J., Xia, Z., Geiger, N., Ye, J., Zhang, C., Constantino, S., & Nielsen, K. (2025). *A meta-analysis of the real-world impact of sustainability labeling on consumer choices* [Pre-print]. https://doi.org/10.21203/rs.3.rs-6557928/v1

Drewnowski, A., & Gomez-Carneros, C. (2000). Bitter taste, phytonutrients, and the consumer: A review. *The American Journal of Clinical Nutrition*, *72*(6), 1424–1435. https://doi.org/10.1093/ajcn/72.6.1424

Dubois, E., & Gaffney, D. (2014). The multiple facets of influence: Identifying political influentials and opinion leaders on Twitter. *American Behavioral Scientist*, *58*(10), 1260–1277. https://doi.org/10.1177/0002764214527088

Ejelöv, E., Nässén, J., Matti, S., Elinder, L. S., & Larsson, J. (2025). Public and political acceptability of a food tax shift – An experiment with policy framing and revenue use. *Food Policy*, *130*, 102772. https://doi.org/10.1016/j.foodpol.2024.102772

Elzerman, J. E., Hoek, A. C., Van Boekel, M. A. J. S., & Luning, P. A. (2011). Consumer acceptance and appropriateness of meat substitutes in a meal context. *Food Quality and Preference*, *22*(3), 233–240. https://doi.org/10.1016/j.foodqual.2010.10.006

Emirbayer, M., & Goodwin, J. (1994). Network analysis, culture, and the problem of agency. *American Journal of Sociology*, *99*(6), 1411–1454. https://doi.org/10.1086/230450

European Commission: Eurostat. (2023). *Key figures on Europe – 2023 edition*. Publications Office of the European Union. https://doi.org/10.2785/494153

Eurostat. (2024). *Businesses in the accommodation and food services sector*. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Businesses_in_the_accommodation_and_food_services_sector

FAO. (2020). *Fruit and vegetables – Your dietary essentials* [Background paper]. FAO. https://doi.org/10.4060/cb2395en

Fessler, D. M. T., Arguello, A. P., Mekdara, J. M., & Macias, R. (2003). Disgust sensitivity and meat consumption: A test of an emotivist account of moral vegetarianism. *Appetite*, *41*(1), 31–41. https://doi.org/10.1016/S0195-6663(03)00037-0

Fiddes, N. (2004). *Meat: A natural symbol*. Taylor and Francis.

Fiorentini, M., Kinchla, A. J., & Nolden, A. A. (2020). Role of sensory evaluation in consumer acceptance of plant-based meat analogs and meat extenders: A scoping review. *Foods*, *9*(9), 1334. https://doi.org/10.3390/foods9091334

Fischler, C. (1988). Food, self and identity. *Social Science Information*, *27*(2), 275–292. https://doi.org/10.1177/053901888027002005

Forsberg, S., Olsson, V., Johansson, M., & Wendin, K. (2025). A question of choice: Trend-sensitive Swedish consumer attitudes toward plant-based meat analogues. *Gastronomy*, *3*(3), 16. https://doi.org/10.3390/gastronomy3030016

Freelon, D., Marwick, A., & Kreiss, D. (2020). False equivalencies: Online activism from left to right. *Science*, *369*(6508), 1197–1201. https://doi.org/10.1126/science.abb2428

Freeman, L. C. (1978). Centrality in social networks conceptual clarification. *Social Networks*, *1*(3), 215–239. https://doi.org/10.1016/0378-8733(78)90021-7

Fusté-Forné, F. (2020). Star chefs and the table: From restaurant to home-based culinary experiences. *Journal of Culinary Science & Technology*, *18*(3), 192–200. https://doi.org/10.1080/15428052.2018.1563933

Garber Jr., L. L., Hyatt, E. M., & Starr Jr., R. G. (2000). The effects of food color on perceived flavor. *Journal of Marketing Theory and Practice*, *8*(4), 59–72. https://doi.org/10.1080/10696679.2000.11501880

Garnett, E. E., Balmford, A., Sandbrook, C., Pilling, M. A., & Marteau, T. M. (2019). Impact of increasing vegetarian availability on meal selection and sales in cafeterias. *Proceedings of the National Academy of Sciences*, *116*(42), 20923–20929. https://doi.org/10.1073/pnas.1907207116

Garnett, T. (2011). Where are the best opportunities for reducing greenhouse gas emissions in the food system (including the food chain)? *Food Policy*, *36*, S23–S32. https://doi.org/10.1016/j.foodpol.2010.10.010

Giacalone, D. (2025). "Grilling the myths": Uncomfortable truths and promising paths in consumer research on plant-based alternatives. *Food Quality and Preference*, *129*, 105500. https://doi.org/10.1016/j.foodqual.2025.105500

Giacalone, D., Clausen, M. P., & Jaeger, S. R. (2022). Understanding barriers to consumption of plant-based foods and beverages: Insights from sensory and consumer science. *Current Opinion in Food Science*, *48*, 100919. https://doi.org/10.1016/j.cofs.2022.100919

Giacalone, D., & Jaeger, S. R. (2016). Better the devil you know? How product familiarity affects usage versatility of foods and beverages.

Journal of Economic Psychology, *55*, 120–138. https://doi.org/10.1016/j.joep.2016.02.005

Gligorić, K., White, R. W., Kiciman, E., Horvitz, E., Chiolero, A., & West, R. (2021). Formation of social ties influences food choice: A campus-wide longitudinal study. *Proceedings of the ACM on Human-Computer Interaction*, *5*(CSCW1), 1–25. https://doi.org/10.1145/3449297

Godfray, H. C. J., Aveyard, P., Garnett, T., Hall, J. W., Key, T. J., Lorimer, J., Pierrehumbert, R. T., Scarborough, P., Springmann, M., & Jebb, S. A. (2018). Meat consumption, health, and the environment. *Science*, *361*(6399), eaam5324. https://doi.org/10.1126/science.aam5324

Goldstein, N. J., Cialdini, R. B., & Griskevicius, V. (2008). A Room with a viewpoint: Using social norms to motivate environmental conservation in hotels. *Journal of Consumer Research*, *35*(3), 472–482. https://doi.org/10.1086/586910

Gössling, S., & Michael Hall, C. (2021). *The sustainable chef: The environment in culinary arts, restaurants, and hospitality* (1st ed.). Routledge. https://doi.org/10.4324/9781315187488

Graça, J., Calheiros, M. M., & Oliveira, A. (2015). Attached to meat? (Un)Willingness and intentions to adopt a more plant-based diet. *Appetite*, *95*, 113–125. https://doi.org/10.1016/j.appet.2015.06.024

Graça, J., Oliveira, A., & Calheiros, M. M. (2015). Meat, beyond the plate. Data-driven hypotheses for understanding consumer willingness to adopt a more plant-based diet. *Appetite*, *90*, 80–90. https://doi.org/10.1016/j.appet.2015.02.037

Grasso, S., Rondoni, A., Bari, R., Smith, R., & Mansilla, N. (2022). Effect of information on consumers' sensory evaluation of beef, plant-based and hybrid beef burgers. *Food Quality and Preference*, *96*, 104417. https://doi.org/10.1016/j.foodqual.2021.104417

Gravert, C., & Kurz, V. (2021). Nudging à la carte: A field experiment on climate-friendly food choice. *Behavioural Public Policy*, *5*(3), 378–395. https://doi.org/10.1017/bpp.2019.11

Greene, D., Nguyen, M., & Dolnicar, S. (2023). How to entice restaurant patrons to order low-emissions meals? A meta-analysis and research agenda. *Appetite*, *188*, 106612. https://doi.org/10.1016/j.appet.2023.106612

Greene, D., Nguyen, M., & Dolnicar, S. (2024). How do you choose your meal when you dine out? A mixed methods study in consumer food-choice strategies in the restaurant context. *Appetite*, 107683. https://doi.org/10.1016/j.appet.2024.107683

Gustafsson, I., Öström, Å., Johansson, J., & Mossberg, L. (2006). The Five Aspects Meal Model: A tool for developing meal services in restaurants. *Journal of Foodservice*, *17*(2), 84–93. https://doi.org/10.1111/j.1745-4506.2006.00023.x

Hackel, L. M., Coppin, G., Wohl, M. J. A., & Van Bavel, J. J. (2018). From groups to grits: Social identity shapes evaluations of food pleasantness. *Journal of Experimental Social Psychology*, *74*, 270–280. https://doi.org/10.1016/j.jesp.2017.09.007

Harray, A. J., Boushey, C. J., Pollard, C. M., Panizza, C. E., Delp, E. J., Dhaliwal, S. S., & Kerr, D. A. (2017). Perception *v*. actual intakes of junk food and sugar-sweetened beverages in Australian young adults: Assessed using the mobile food record. *Public Health Nutrition*, *20*(13), 2300–2307. https://doi.org/10.1017/s1368980017000702

Harries, T., Rettie, R., Studley, M., Burchell, K., & Chambers, S. (2013). Is social norms marketing effective?: A case study in domestic electricity consumption. *European Journal of Marketing, 47*(9), 1458–1475. https://doi.org/10.1108/EJM-10-2011-0568

Haynes, A., & Robinson, E. (2019). Who are we testing? Self-selection bias in laboratory-based eating behaviour studies. *Appetite*, *141*, 104330. https://doi.org/10.1016/j.appet.2019.104330

Hazley, D., & Kearney, J. M. (2024). Consumer perceptions of healthy and sustainable eating. *Proceedings of the Nutrition Society*, *83*(4), 254–262. https://doi.org/10.1017/S0029665124004853

He, J., Evans, N. M., Liu, H., & Shao, S. (2020). A review of research on plant-based meat alternatives: Driving forces, history,

manufacturing, and consumer attitudes. *Comprehensive Reviews in Food Science and Food Safety*, *19*(5), 2639–2656. https://doi.org/10.1111/1541-4337.12610

Hejazi, J., Amiri, R., Nozarian, S., Tavasolian, R., & Rahimlou, M. (2024). Genetic determinants of food preferences: A systematic review of observational studies. *BMC Nutrition*, *10*(1), 24. https://doi.org/10.1186/s40795-024-00828-y

Higgs, S. (2015). Social norms and their influence on eating behaviours. *Appetite*, *86*, 38–44. https://doi.org/10.1016/j.appet.2014.10.021

Higgs, S., & Thomas, J. (2016). Social influences on eating. *Current Opinion in Behavioral Sciences*, *9*, 1–6. https://doi.org/10.1016/j.cobeha.2015.10.005

Hirschman, E. C., & Holbrook, M. B. (1982). Hedonic consumption: Emerging concepts, methods and propositions. *Journal of Marketing*, *46*(3), 92–101. https://doi.org/10.1177/002224298204600314

Hoek, A. C., Elzerman, J. E., Hageman, R., Kok, F. J., Luning, P. A., & Graaf, C. D. (2013). Are meat substitutes liked better over time? A repeated in-home use test with meat substitutes or meat in meals. *Food Quality and Preference*, *28*(1), 253–263. https://doi.org/10.1016/j.foodqual.2012.07.002

Hoek, A. C., Luning, P. A., Weijzen, P., Engels, W., Kok, F. J., & De Graaf, C. (2011). Replacement of meat by meat substitutes. A survey on person- and product-related factors in consumer acceptance. *Appetite*, *56*(3), 662–673. https://doi.org/10.1016/j.appet.2011.02.001

Hunter, R. F., De La Haye, K., Murray, J. M., Badham, J., Valente, T. W., Clarke, M., & Kee, F. (2019). Social network interventions for health behaviours and outcomes: A systematic review and meta-analysis. *PLOS Medicine*, *16*(9), e1002890. https://doi.org/10.1371/journal.pmed.1002890

Institute for Health Metrics and Evaluation. (n.d). *What risk factors drive the most death and disability combined?* https://www.healthdata.org/sweden

Jaeger, S. R., Meiselman, H. L., & Giacalone, D. (2025). Sensory and consumer science: A complex, expanding, and interdisciplinary field of science. *Food Quality and Preference*, *122*, 105298. https://doi.org/10.1016/j.foodqual.2024.105298

Jungherr, A. (2014). Twitter in politics: A comprehensive literature review. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.2402443

Jungsberg, L., Berlina, A., Ormstrup Vestergård, L., Guðmundsdóttir, H., & Ueland, Ø. (2024). *Policy tools for sustainable and healthy eating: Enabling a food transition in the Nordic countries*. Nordic Council of Ministers. https://doi.org/10.6027/nord2024-007

Kerslake, E., Kemper, J. A., & Conroy, D. (2022). What's your beef with meat substitutes? Exploring barriers and facilitators for meat substitutes in omnivores, vegetarians, and vegans. *Appetite*, *170*, 105864. https://doi.org/10.1016/j.appet.2021.105864

Ketelings, L., Havermans, R. C., Kremers, S. P. J., & De Boer, A. (2023). How different dimensions shape the definition of meat alternative products: A scoping review of evidence between 2000 and 2021. *Current Developments in Nutrition*, *7*(7), 101960. https://doi.org/10.1016/j.cdnut.2023.101960

Kim, A., Öström, Å., Mihnea, M., & Niimi, J. (2024). Consumers' attachment to meat: Association between sensory properties and preferences for plant-based meat alternatives. *Food Quality and Preference*, *116*, 105134. https://doi.org/10.1016/j.foodqual.2024.105134

Kim, H.-Y. (2017). Statistical notes for clinical researchers: Chi-squared test and Fisher's exact test. *Restorative Dentistry & Endodontics*, *42*(2), 152. https://doi.org/10.5395/rde.2017.42.2.152

Köster, E. P. (2009). Diversity in the determinants of food choice: A psychological perspective. *Food Quality and Preference*, *20*(2), 70–82. https://doi.org/10.1016/j.foodqual.2007.11.002

Kurz, T., Gardner, B., Verplanken, B., & Abraham, C. (2015). Habitual behaviors or patterns of practice? Explaining and changing repetitive climate-relevant actions. *WIREs Climate Change*, *6*(1), 113–128. https://doi.org/10.1002/wcc.327

Lachat, C., Naska, A., Trichopoulou, A., Engeset, D., Fairgrieve, A., Marques, H. Á., & Kolsteren, P. (2011). Essential actions for caterers to promote healthy eating out among European consumers: Results from a participatory stakeholder analysis in the HECTOR project. *Public Health Nutrition*, *14*(2), 193–202. https://doi.org/10.1017/S1368980010002387

Lally, P., Van Jaarsveld, C. H. M., Potts, H. W. W., & Wardle, J. (2010). How are habits formed: Modelling habit formation in the real world. *European Journal of Social Psychology*, *40*(6), 998–1009. https://doi.org/10.1002/ejsp.674

Larson, N., & Story, M. (2009). A review of environmental influences on food choices. *Annals of Behavioral Medicine*, *38*(SUPPL.), 56–73. https://doi.org/10.1007/s12160-009-9120-9

Leer, J. (2016). The rise and fall of the New Nordic Cuisine. *Journal of Aesthetics & Culture*, *8*(1), 33494. https://doi.org/10.3402/jac.v8.33494

Leer, J. (2019). New Nordic men: Cooking, masculinity and Nordicness in René Redzepi's *Noma* and Claus Meyer's *Almanak*. *Food, Culture & Society*, *22*(3), 316–333. https://doi.org/10.1080/15528014.2019.1582250

Leigh Gibson, E. (2006). Emotional influences on food choice: Sensory, physiological and psychological pathways. *Physiology & Behavior*, *89*(1), 53–61. https://doi.org/10.1016/j.physbeh.2006.01.024

Lenhard, W., & Lenhard, A. (2017). *Computation of effect sizes* [Dataset, unpublished]. https://doi.org/10.13140/RG.2.2.17823.92329

Lentz, G., Connelly, S., Mirosa, M., & Jowett, T. (2018). Gauging attitudes and behaviours: Meat consumption and potential

reduction. *Appetite*, *127*, 230–241. https://doi.org/10.1016/j.appet.2018.04.015

Leroy, F., Smith, N. W., Adesogan, A. T., Beal, T., Iannotti, L., Moughan, P. J., & Mann, N. (2023). The role of meat in the human diet: Evolutionary aspects and nutritional value. *Animal Frontiers*, *13*(2), 11–18. https://doi.org/10.1093/af/vfac093

Leroy, J. L., Frongillo, E. A., Kase, B. E., Alonso, S., Chen, M., Dohoo, I., Huybregts, L., Kadiyala, S., & Saville, N. M. (2022). Strengthening causal inference from randomised controlled trials of complex interventions. *BMJ Global Health*, *7*(6), e008597. https://doi.org/10.1136/bmjgh-2022-008597

Lewis, T., & Huber, A. (2015). A revolution in an eggcup?: Supermarket wars, celebrity chefs and ethical consumption. *Food, Culture & Society*, *18*(2), 289–307. https://doi.org/10.2752/175174415X14190821960798

Liem, D. G., Miremadi, F., & Keast, R. S. J. (2011). Reducing sodium in foods: The effect on flavor. *Nutrients*, *3*(6), 694–711. https://doi.org/10.3390/nu3060694

Lindberg, L., Woodside, J. V., Fitzgerald, H., Campbell, N., Vogan, H., Kelly, C., Robinson, M., & Nugent, A. P. (2025). Plant-based meat alternatives on the island of Ireland: Changes in the market and comparisons with conventional meat. *Foods*, *14*(5), 903. https://doi.org/10.3390/foods14050903

Liu, H., Hu, Z., Song, Q., Xu, J., Mai, S., & Zhu, Z. (2025). Traffic light labels and dietary behavior change: A randomized clinical trial. *JAMA Network Open*, *8*(5), e2510894. https://doi.org/10.1001/jamanetworkopen.2025.10894

Livsmedelsverket. (2025). *Grönsaker, frukt och bär*. https://www.livsmedelsverket.se/matvanor-halsa--miljo/kostrad/kostrad-vuxna/gronsaker-frukt-och-bar/

Lo, A., King, B., & Mackenzie, M. (2017). Restaurant customers' attitude toward sustainability and nutritional menu labels. *Journal of Hospitality Marketing & Management*, *26*(8), 846–867. https://doi.org/10.1080/19368623.2017.1326865

Lohmann, P. M., Gsottbauer, E., Farrington, J., Human, S., & Reisch, L. A. (2024). Choice architecture promotes sustainable choices in online food-delivery apps. *PNAS Nexus*, *3*(10), pgae422. https://doi.org/10.1093/pnasnexus/pgae422

Mäkelä, J., & Niva, M. (2019). The meal as the proper context for food and drinks. In H. L. Meiselman (ed.), *Context* (pp. 191–207). Elsevier. https://doi.org/10.1016/B978-0-12-814495-4.00009-X

Marteau, T. M. (2017). Towards environmentally sustainable human behaviour: Targeting non-conscious and conscious processes for effective and acceptable policies. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*, *375*(2095), 20160371. https://doi.org/10.1098/rsta.2016.0371

Marteau, T. M., Hollands, G. J., & Fletcher, P. C. (2012). Changing human behavior to prevent disease: The importance of targeting automatic processes. *Science*, *337*(6101), 1492–1495. https://doi.org/10.1126/science.1226918

Martens, M. (1999). A philosophy for sensory science. *Food Quality and Preference*, *10*(4–5), 233–244. https://doi.org/10.1016/S0950-3293(99)00024-5

McBride, A. E., & Flore, R. (2019). The changing role of the chef: A dialogue. *International Journal of Gastronomy and Food Science*, *17*, 100157. https://doi.org/10.1016/j.ijgfs.2019.100157

McCall, M., & Lynn, A. (2008). The effects of restaurant menu item descriptions on perceptions of quality, price, and purchase intention. *Journal of Foodservice Business Research*, *11*(4), 439–445. https://doi.org/10.1080/15378020802519850

McCrickerd, K., & Forde, C. G. (2016). Sensory influences on food intake control: Moving beyond palatability. *Obesity Reviews*, *17*(1), 18–29. https://doi.org/10.1111/obr.12340

McHugh, M. L. (2013). The Chi-square test of independence. *Biochemia Medica*, *23*(2), 143–149. https://doi.org/10.11613/BM.2013.018

Meiselman, H. L. (2008). Dimensions of the meal. *Journal of Foodservice*, *19*(1), 13–21. https://doi.org/10.1111/j.1745-4506.2008.00076.x

Metzger, M. J., Flanagin, A. J., & Medders, R. B. (2010). Social and heuristic approaches to credibility evaluation online. *Journal of Communication*, *60*(3), 413–439. https://doi.org/10.1111/j.1460-2466.2010.01488.x

Meullenet, J.-F., Xiong, R., & Findlay, C. J. (2007). *Multivariate and probabilistic analyses of sensory science problems*. John Wiley & Sons. http://ebookcentral.proquest.com/lib/universitetsbiblioteket-ebooks/detail.action?docID=468622

Meyners, M., Jaeger, S. R., & Ares, G. (2016). On the analysis of rate-all-that-apply (RATA) data. *Food Quality and Preference*, *49*, 1–10. https://doi.org/10.1016/j.foodqual.2015.11.003

Michel, F., Hartmann, C., & Siegrist, M. (2021). Consumers' associations, perceptions and acceptance of meat and plant-based meat alternatives. *Food Quality and Preference*, *87*, 104063. https://doi.org/10.1016/j.foodqual.2020.104063

Moskowitz, H. R. (with Gacula, M. C., Muñoz, A. M., Alejandra, M., Gacula, J. C. M., & Muñoz, A. M.). (2008). *Viewpoints and controversies in sensory science and consumer product testing* (1st ed.). John Wiley & Sons.

Mouritsen, O. G., & Styrbæk, K. (2020). Design and 'umamification' of vegetable dishes for sustainable eating. I*nternational Journal of Food Design*, *5*(1), 9–42. https://doi.org/10.1386/ijfd_00008_1

Muhammad, L. N. (2023). Guidelines for repeated measures statistical analysis approaches with basic science research considerations. *Journal of Clinical Investigation*, *133*(11). https://doi.org/10.1172/jci171058

Murray, C. J. L., Aravkin, A. Y., Zheng, P., Abbafati, C., Abbas, K. M., Abbasi-Kangevari, M., Abd-Allah, F., Abdelalim, A., Abdollahi, M., Abdollahpour, I., Abegaz, K. H., Abolhassani, H., Aboyans, V., Abreu, L. G., Abrigo, M. R. M., Abualhasan, A., Abu-Raddad, L. J., Abushouk, A. I., Adabi, M., … Lim, S. S. (2020). Global burden of

87 risk factors in 204 countries and territories, 1990–2019: A systematic analysis for the Global Burden of Disease Study 2019. *The Lancet*, *396*(10258), 1223–1249. https://doi.org/10.1016/S0140-6736(20)30752-2

Næs, T., Tomic, O., Endrizzi, I., & Varela, P. (2021). Principal components analysis of descriptive sensory data: Reflections, challenges, and suggestions. *Journal of Sensory Studies*, *36*(5), e12692. https://doi.org/10.1111/joss.12692

Nahm, F. S. (2016). Nonparametric statistical tests for the continuous data: The basic concept and the practical use. *Korean Journal of Anesthesiology*, *69*(1), 8–14. https://doi.org/10.4097/kjae.2016.69.1.8

Neuman, N. (2018). An imagined culinary community: Stories of morality and masculinity in "Sweden – the new culinary nation". *Scandinavian Journal of Hospitality and Tourism*, *18*(2), 149–162. https://doi.org/10.1080/15022250.2017.1338616

Neuman, N. (2024). Commensal attraction: Eating together as a social tool. *Journal for the Theory of Social Behaviour*, *54*(4), 556–570. https://doi.org/10.1111/jtsb.12431

Neuman, N., Mylan, J., & Paddock, J. (2020). Exploring (non-)meat eating and "translated cuisines" out of home: Evidence from three English cities. *International Journal of Consumer Studies*, *44*(1), 25–32. https://doi.org/10.1111/ijcs.12542

Newman, M. E. J. (2016). *Networks: An introduction* (Reprinted). Oxford University Press.

Niimi, J., Collier, E. S., Oberrauter, L.-M., Sörensen, V., Norman, C., Normann, A., Bendtsen, M., & Bergman, P. (2022). Sample discrimination through profiling with rate all that apply (RATA) using consumers is similar between home use test (HUT) and central location test (CLT). *Food Quality and Preference*, *95*, 104377. https://doi.org/10.1016/j.foodqual.2021.104377

Niimi, J., Sörensen, V., Mihnea, M., Valentin, D., Bergman, P., & Collier, E. S. (2022). Does cooking ability affect consumer perception and appreciation of plant-based protein in Bolognese

sauces? *Food Quality and Preference*, *99*, 104563. https://doi.org/10.1016/j.foodqual.2022.104563

Niva, M., & Mäkelä, J. (2020). Meals in Western Eating and Drinking. In H. L. Meiselman (ed.), *The handbook of eating and drinking: Interdisciplinary perspectives*. Springer International Publishing.

Nolan, J. M., Schultz, P. W., Cialdini, R. B., Goldstein, N. J., & Griskevicius, V. (2008). Normative social influence is underdetected. *Personality and Social Psychology Bulletin*, *34*(7), 913–923. https://doi.org/10.1177/0146167208316691

Nomura, H., John, P., & Cotterill, S. (2011). The use of feedback to enhance environmental outcomes: A randomized controlled trial of a food waste scheme. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.1760859

OECD/FAO. (2023). *OECD-FAO agricultural outlook 2023–2032*. OECD Publishing. https://doi.org/10.1787/08801ab7-en

Onwezen, M. C., Bouwman, E. P., Reinders, M. J., & Dagevos, H. (2021). A systematic review on consumer acceptance of alternative proteins: Pulses, algae, insects, plant-based meat alternatives, and cultured meat. *Appetite*, *159*, 105058. https://doi.org/10.1016/j.appet.2020.105058

Oppermann, A. K. L., De Graaf, C., Scholten, E., Stieger, M., & Piqueras-Fiszman, B. (2017). Comparison of rate-all-that-apply (RATA) and descriptive sensory analysis (DA) of model double emulsions with subtle perceptual differences. *Food Quality and Preference*, *56*, 55–68. https://doi.org/10.1016/j.foodqual.2016.09.010

Pachucki, M. A., Jacques, P. F., & Christakis, N. A. (2011). Social network concordance in food choice among spouses, friends, and siblings. *American Journal of Public Health*, *101*(11), 2170–2177. https://doi.org/10.2105/AJPH.2011.300282

Pagliarini, E., Proserpio, C., Spinelli, S., Lavelli, V., Laureati, M., Arena, E., Di Monaco, R., Menghi, L., Gallina Toschi, T., Braghieri, A., Torri, L., Monteleone, E., & Dinnella, C. (2021). The role of sour and bitter perception in liking, familiarity and choice

for phenol-rich plant-based foods. *Food Quality and Preference*, *93*, 104250. https://doi.org/10.1016/j.foodqual.2021.104250

Peduzzi, P., Concato, J., Kemper, E., Holford, T. R., & Feinstein, A. R. (1996). A simulation study of the number of events per variable in logistic regression analysis. *Journal of Clinical Epidemiology*, *49*(12), 1373–1379. https://doi.org/10.1016/S0895-4356(96)00236-3

Piazza, J., Ruby, M. B., Loughnan, S., Luong, M., Kulik, J., Watkins, H. M., & Seigerman, M. (2015). Rationalizing meat consumption. The 4Ns. *Appetite*, *91*, 114–128. https://doi.org/10.1016/j.appet.2015.04.011

Plaehn, D. (2013). What's the real penalty in penalty analysis? *Food Quality and Preference*, *28*(2), 456–469. https://doi.org/10.1016/j.foodqual.2012.11.009

Pointke, M., Ohlau, M., Risius, A., & Pawelzik, E. (2022). Plant-based only: Investigating consumers' sensory perception, motivation, and knowledge of different plant-based alternative products on the market. *Foods*, *11*(15), 2339. https://doi.org/10.3390/foods11152339

Pollard, J., Kirk, S. F. L., & Cade, J. E. (2002). Factors affecting food choice in relation to fruit and vegetable intake: A review. *Nutrition Research Reviews*, *15*(2), 373–387. https://doi.org/10.1079/nrr200244

Poore, J., & Nemecek, T. (2018). Reducing food's environmental impacts through producers and consumers. *Science*, *360*(6392), 987–992. https://doi.org/10.1126/science.aaq0216

Prell, C. (2012). *Social network analysis: History, theory and methodology*. Sage Publications Ltd.

Rabin, M. D., & Cain, W. S. (1986). Determinants of measured olfactory sensitivity. *Perception & Psychophysics*, *39*(4), 281–286. https://doi.org/10.3758/BF03204936

Reese, G., Loew, K., & Steffgen, G. (2014). A towel less: Social norms enhance pro-environmental behavior in hotels. *The Journal of Social Psychology*, *154*(2), 97–100. https://doi.org/10.1080/00224545.2013.855623

Reid, C. A., Green, J. D., Buchmaier, S., McSween, D. K., Wildschut, T., & Sedikides, C. (2023). Food-evoked nostalgia. *Cognition and Emotion*, *37*(1), 34–48. https://doi.org/10.1080/02699931.2022.2142525

Reid, C. A., Green, J. D., Wildschut, T., & Sedikides, C. (2015). Scent-evoked nostalgia. *Memory*, *23*(2), 157–166. https://doi.org/10.1080/09658211.2013.876048

Reinders, M. J., Bouwman, E. P., & Onwezen, M. C. (2024). Reducing meat consumption in restaurants: Exploring the default mechanism in a surprise menu, combined with effort and price incentives. *Journal of Environmental Psychology*, *98*, 102402. https://doi.org/10.1016/j.jenvp.2024.102402

Reinholdsson, T., Hedesström, M., Ejelöv, E., Hansla, A., Bergquist, M., Svenfelt, Å., & Nilsson, A. (2023). Nudging green food: The effects of a hedonic cue, menu position, a warm-glow cue, and a descriptive norm. *Journal of Consumer Behaviour*, *22*(3), 557–568. https://doi.org/10.1002/cb.2129

Ritchie, H., Rosado, P., & Roser, M. (2019). *Meat and dairy production* [Online]. https://ourworldindata.org/meat-production

Ritzel, C., & Mann, S. (2023). Exploring heterogeneity in meat consumption and eating out by using a latent class model. *British Food Journal*, *125*(1), 132–144. https://doi.org/10.1108/BFJ-11-2021-1183

Robinson, E., Thomas, J., Aveyard, P., & Higgs, S. (2014). What everyone else is eating: A systematic review and meta-analysis of the effect of informational eating norms on eating behavior. *Journal of the Academy of Nutrition and Dietetics*, *114*(3), 414–429. https://doi.org/10.1016/j.jand.2013.11.009

Rodrigues, P., Brochado, A., Sousa, A., Borges, A. P., & Barbosa, I. (2023). What's on the menu? How celebrity chef brands create happiness. *European Journal of Marketing*, *57*(9), 2513–2543. https://doi.org/10.1108/EJM-12-2021-0988

Röös, E., Carlsson, G., Ferawati, F., Hefni, M., Stephan, A., Tidåker, P., & Witthöft, C. (2020). Less meat, more legumes: Prospects and

challenges in the transition toward sustainable diets in Sweden. *Renewable Agriculture and Food Systems*, *35*(2), 192–205. https://doi.org/10.1017/S1742170518000443

Röös, E., De Groote, A., & Stephan, A. (2022). Meat tastes good, legumes are healthy and meat substitutes are still strange – The practice of protein consumption among Swedish consumers. *Appetite*, *174*, 106002. https://doi.org/10.1016/j.appet.2022.106002

Röös, E., Larsson, J., Sahlin, K. R., Jonell, M., Lindahl, T., André, E., Säll, S., Harring, N., & Persson, M. (2021). *Policy options for sustainable food consumption – Review and recommendations for Sweden*. Chalmers University of Technology.

Röös, E., Sundberg, C., Tidåker, P., Strid, I., & Hansson, P.-A. (2013). Can carbon footprint serve as an indicator of the environmental impact of meat production? *Ecological Indicators*, *24*, 573–581. https://doi.org/10.1016/j.ecolind.2012.08.004

Rockström, J., Thilsted, S. H., Willett, W. C., Gordon, L. J., Herrero, M., Hicks, C. C., Mason-D'Croz, D., Rao, N., Springmann, M., Wright, E. C., Agustina, R., Bajaj, S., Bunge, A. C., Carducci, B., Conti, C., Covic, N., Fanzo, J., Forouhi, N. G., Gibson, M. F., … DeClerck, F. (2025). The EAT–Lancet Commission on healthy, sustainable, and just food systems. The Lancet, 406(10512), 1625–1700. https://doi.org/10.1016/S0140-6736(25)01201-2

Rosenfeld, D. L. (2018). The psychology of vegetarianism: Recent advances and future directions. *Appetite*, *131*, 125–138. https://doi.org/10.1016/j.appet.2018.09.011

Rozin, P., Haidt, J., & McCauley, C. R. (1999). Disgust: The Body and Soul Emotion. In T. Dalgleish, M. J. Power (eds.), *Handbook of cognition and emotion* (1st ed., pp. 429–445). Wiley. https://doi.org/10.1002/0470013494.ch21

Ruby, M. B. (2012). Vegetarianism. A blossoming field of study. *Appetite*, *58*(1), 141–150. https://doi.org/10.1016/j.appet.2011.09.019

Ruddock, H. K., Brunstrom, J. M., Vartanian, L. R., & Higgs, S. (2019). A systematic review and meta-analysis of the social

facilitation of eating. *American Journal of Clinical Nutrition*, *110*(4), 842–861. https://doi.org/10.1093/ajcn/nqz155

Sabaté, J., & Soret, S. (2014). Sustainability of plant-based diets: Back to the future. *The American Journal of Clinical Nutrition*, *100*, 476S-482S. https://doi.org/10.3945/ajcn.113.071522

Saulais, L., Massey, C., Perez-Cueto, F. J. A., Appleton, K. M., Dinnella, C., Monteleone, E., Depezay, L., Hartwell, H., & Giboreau, A. (2019). When are "dish of the day" nudges most effective to increase vegetable selection? *Food Policy*, *85*, 15–27. https://doi.org/10.1016/j.foodpol.2019.04.003

Shelton, R. C., Lee, M., Brotzman, L. E., Crookes, D. M., Jandorf, L., Erwin, D., & Gage-Bouchard, E. A. (2019). Use of social network analysis in the development, dissemination, implementation, and sustainability of health behavior interventions for adults: A systematic review. *Social Science & Medicine*, *220*, 81–101. https://doi.org/10.1016/j.socscimed.2018.10.013

Shoneye, C., Dhaliwal, S., Pollard, C., Boushey, C., Delp, E., Harray, A., Howat, P., Hutchesson, M., Rollo, M., Zhu, F., Wright, J., Pratt, I., Jancey, J., Halse, R., Scott, J., Mullan, B., Collins, C., & Kerr, D. (2019). Image-based dietary assessment and tailored feedback using mobile technology: Mediating behavior change in young adults. *Nutrients*, *11*(2), 435. https://doi.org/10.3390/nu11020435

Silventoinen, K., & Konttinen, H. (2020). Obesity and eating behavior from the perspective of twin and genetic research. *Neuroscience & Biobehavioral Reviews*, *109*, 150–165. https://doi.org/10.1016/j.neubiorev.2019.12.012

Singh, M., Trivedi, N., Enamala, M. K., Kuppam, C., Parikh, P., Nikolova, M. P., & Chavali, M. (2021). Plant-based meat analogue (PBMA) as a sustainable food: A concise review. *European Food Research and Technology*, *247*(10), 2499–2526. https://doi.org/10.1007/s00217-021-03810-1

Slade, P. (2018). If you build it, will they eat it? Consumer preferences for plant-based and cultured meat burgers. *Appetite*, *125*, 428–437. https://doi.org/10.1016/j.appet.2018.02.030

Smith, A. D., Fildes, A., Cooke, L., Herle, M., Shakeshaft, N., Plomin, R., & Llewellyn, C. (2016). Genetic and environmental influences on food preferences in adolescence. *The American Journal of Clinical Nutrition*, *104*(2), 446–453. https://doi.org/10.3945/ajcn.116.133983

Smith, K. P., & Christakis, N. A. (2008). Social networks and health. *Annual Review of Sociology*, *34*(1), 405–429. https://doi.org/10.1146/annurev.soc.34.040507.134601

Sobal, J. (2005). Men, meat, and marriage: Models of masculinity. *Food and Foodways*, *13*(1–2), 135–158. https://doi.org/10.1080/07409710590915409

Sogari, G., Caputo, V., Joshua Petterson, A., Mora, C., & Boukid, F. (2023). A sensory study on consumer valuation for plant-based meat alternatives: What is liked and disliked the most? *Food Research International*, *169*, 112813. https://doi.org/10.1016/j.foodres.2023.112813

Sørensen, L. B., Møller, P., Flint, A., Martens, M., & Raben, A. (2003). Effect of sensory perception of foods on appetite and food intake: A review of studies on humans. *International Journal of Obesity*, *27*(10), 1152–1166. https://doi.org/10.1038/sj.ijo.0802391

Springmann, M., Clark, M. A., Rayner, M., Scarborough, P., & Webb, P. (2021). The global and regional costs of healthy and sustainable dietary patterns: A modelling study. *The Lancet Planetary Health*, *5*(11), e797–e807. https://doi.org/10.1016/S2542-5196(21)00251-5

Springmann, M., Godfray, H. C. J., Rayner, M., & Scarborough, P. (2016). Analysis and valuation of the health and climate change cobenefits of dietary change. *Proceedings of the National Academy of Sciences*, *113*(15), 4146–4151. https://doi.org/10.1073/pnas.1523119113

Story, M., Kaphingst, K. M., Robinson-O'Brien, R., & Glanz, K. (2008). Creating healthy food and eating environments: Policy and

environmental approaches. *Annual Review of Public Health*, *29*(1), 253–272. https://doi.org/10.1146/annurev.publhealth.29.020907.090926

Swedish Board of Agriculture. (2025). *Consumption of meat*. https://jordbruksverket.se/mat-och-drycker/hallbar-produktion-och-konsumtion-av-mat/konsumtion-av-kott

Szenderák, J., Fróna, D., & Rákos, M. (2022). Consumer acceptance of plant-based meat substitutes: A narrative review. *Foods*, *11*(9), 1274. https://doi.org/10.3390/foods11091274

Tan, N. P.-J., Graça, J., & Hopwood, C. J. (2025). Familiarity and satisfaction with plant-based meat alternatives around the world. *Future Foods*, *11*, 100597. https://doi.org/10.1016/j.fufo.2025.100597

Tellström, R. (2024). *Varje tugga är en tanke: Svensk matkultur under 800 år* (Första utgåvan). Natur & kultur.

Thaler, R. H., & Sunstein, C. R. (2021). *Nudge: The final edition*. Penguin.

Vandenbroele, J., Vermeir, I., Geuens, M., Slabbinck, H., & Van Kerckhove, A. (2020). Nudging to get our food choices on a sustainable track. *Proceedings of the Nutrition Society*, *79*(1), 133–146. https://doi.org/10.1017/S0029665119000971

Vartanian, L. R., Herman, C. P., & Wansink, B. (2008). Are we aware of the external factors that influence our food intake? *Health Psychology*, *27*(5), 533–538. https://doi.org/10.1037/0278-6133.27.5.533

Vartanian, L. R., Spanos, S., Herman, C. P., & Polivy, J. (2015). Modeling of food intake: A meta-analytic review. *Social Influence*, *10*(3), 119–136. https://doi.org/10.1080/15534510.2015.1008037

Velema, E., Vyth, E. L., Hoekstra, T., & Steenhuis, I. H. (2018). Nudging and social marketing techniques encourage employees to make healthier food choices: A randomized controlled trial in 30 worksite cafeterias in the Netherlands. *The American Journal of*

Clinical Nutrition, *107*(2), 236–246. https://doi.org/10.1093/ajcn/nqx045

Venema, T. A. G., Kroese, F. M., Benjamins, J. S., & De Ridder, D. T. D. (2020). When in doubt, follow the crowd? Responsiveness to social proof nudges in the absence of clear preferences. *Frontiers in Psychology*, *11*, 1385. https://doi.org/10.3389/fpsyg.2020.01385

Vidal, L., Ares, G., Hedderley, D. I., Meyners, M., & Jaeger, S. R. (2018). Comparison of rate-all-that-apply (RATA) and check-all-that-apply (CATA) questions across seven consumer studies. *Food Quality and Preference*, *67*, 49–58. https://doi.org/10.1016/j.foodqual.2016.12.013

Vural, Y., Ferriday, D., & Rogers, P. J. (2023). Consumers' attitudes towards alternatives to conventional meat products: Expectations about taste and satisfaction, and the role of disgust. *Appetite*, *181*, 106394. https://doi.org/10.1016/j.appet.2022.106394

Wakefield, M. A., Loken, B., & Hornik, R. C. (2010). Use of mass media campaigns to change health behaviour. *Lancet*, *376*(9748), 1261–1271. https://doi.org/10.1016/S0140-6736(10)60809-4

Warde, A. (2016). *The practice of eating*. Polity Press.

Warde, A., Paddock, J., & Whillans, J. (2020). *The social significance of dining out: A study of continuity and change*. Manchester University Press. http://ebookcentral.proquest.com/lib/universitetsbiblioteket-ebooks/detail.action?docID=6198947

Westling, M., Wennström, S., & Öström, Å. (2021). A recipe development process model designed to support a crop's sensory qualities. *International Journal of Food Design*, *6*(1), 3–26. https://doi.org/10.1386/ijfd_00022_1

Westling, M., Baptista, I., Kim, A., Engelheart, S., Berg, P., & Öström, Å. (2025). Cooks as collaborative creators and evaluators: An iterative sensory-driven workshop to create vegetarian dishes. *International Journal of Food Design*, *10*(1), 87–108. https://doi.org/10.1386/ijfd_00079_1

Wood, W., & Rünger, D. (2016). Psychology of habit. *Annual Review of Psychology*, *67*(1), 289–314. https://doi.org/10.1146/annurev-psych-122414-033417

Xu, X., Sharma, P., Shu, S., Lin, T.-S., Ciais, P., Tubiello, F. N., Smith, P., Campbell, N., & Jain, A. K. (2021). Global greenhouse gas emissions from animal-based foods are twice those of plant-based foods. *Nature Food*, *2*(9), 724–732. https://doi.org/10.1038/s43016-021-00358-x

Yamaguchi, S., & Ninomiya, K. (2000). Umami and food palatability. *The Journal of Nutrition*, *130*(4), 921S-926S. https://doi.org/10.1093/jn/130.4.921s

Yang, Z., Xie, C., Bao, Y., Liu, F., Wang, H., & Wang, Y. (2023). Oat: Current state and challenges in plant-based food applications. *Trends in Food Science & Technology*, *134*, 56–71. https://doi.org/10.1016/j.tifs.2023.02.017

Yuliarti, O., Kiat Kovis, T. J., & Yi, N. J. (2021). Structuring the meat analogue by using plant-based derived composites. *Journal of Food Engineering*, *288*, 110138. https://doi.org/10.1016/j.jfoodeng.2020.110138

Zhang, T., Dou, W., Zhang, X., Zhao, Y., Zhang, Y., Jiang, L., & Sui, X. (2021). The development history and recent updates on soy protein-based meat alternatives. *Trends in Food Science & Technology*, *109*, 702–710. https://doi.org/10.1016/j.tifs.2021.01.060

Zorell, C. V., Kim, A., & Neuman, N. (2024). Studying factual versus social cues as triggers of change in food behaviour. *Journal of Nutritional Science*, *13*, e88. https://doi.org/10.1017/jns.2024.82

Zorell, C. V. (2022). Central persons in sustainable (food) consumption. *International Journal of Environmental Research and Public Health*, *19*, 3139. https://doi.org/10.3390/ijerph19053139

Appendix: Meat Attachment Questionnaire

	Original items	Swedish items
Hedonism		
H1.	To eat meat is one of the good pleasures in life.	*Att äta kött är ett av livets goda nöjen.*
H2.	I love meals with meat.	*Jag älskar måltider med kött.*
H3.	I'm a big fan of meat.	*Jag är ett stort fan av kött.*
H4.	A good steak is without comparison.	*Inget kan jämföras med en god biff.*
Affinity		
A1*.	By eating meat I'm reminded of the death and suffering of animals.	*Genom att äta kött påminns jag om djurs död och lidande.*
A2*.	To eat meat is disrespectful towards life and the environment.	*Att äta kött är respektlöst mot liv och miljö.*
A3*.	I feel bad when I think of eating meat.	*Jag mår dåligt när jag tänker på att äta kött.*
A4*.	Meat reminds me of diseases.	*Kött påminner mig om sjukdomar.*
Entitlement		
E1.	To eat meat is an unquestionable right of every person.	*Att äta kött är en obestridlig rättighet för varje människa.*
E2.	According to our position in the food chain, we have the right to eat meat.	*Vår position i näringskedjan ger oss rätt att äta kött.*

E3.	Eating meat is a natural and undisputable practice.	*Att äta kött är en naturlig och obestridlig praxis.*
Dependence		
D1.	I don't picture myself without eating meat regularly.	*Jag kan inte föreställa mig själv att inte äta kött regelbundet*
D2.	If I couldn't eat meat I would feel weak.	*Om jag inte kunde äta kött skulle jag känna mig svag*
D3*.	I would feel fine with a meatless diet.	*Jag skulle vara okej med en köttfri diet.*
D4.	If I was forced to stop eating meat I would feel sad.	*Om jag tvingades sluta äta kött skulle jag känna mig ledsen*
D5.	Meat is irreplaceable in my diet.	*Kött är oersättligt i min kost.*

Note: * indicates reverse-scored items.

Publications *in the series*
Örebro Studies in Culinary Arts and Meal Science

1. Nygren, Tobias. *Sensory Evaluation and Consumer Preference of Wine and Food Combinations. Influences of Tasting Techniques*. 2004
2. Jonsson, Inger M. *Family Meal Experiences. Perspectives on practical knowledge, learning and culture*. 2004
3. Ahlgren, Mia K. *Ready meal consumpion – when, where, why, and by whom?* Academic essay. 2004
4. Hansen, Kai V. *Restaurant Meal Experiences from Customers' Perspectives – A Grounded Theory Approach*. 2005
5. Tellström, Richard. *The construction of food and meal culture for political and commercial ends: EU-summits, rural businesses and World Exhibitions*. 2006
6. Prim, Mia. *Ready meals from the consumers' perspective – attitudes, beliefs, contexts and appropriateness*. 2007
7. Rapp, Erika. *Sensory, attitudinal, and contextual aspects of the meal. Health implications and connections with risk factors for coronary heart disease and obesity*. 2008
8. Walter, Ute. *Drivers of customers' service experiences. A customer perspective on co-creation of restaurant services, focusing on interactions, processes and activities*. 2011
9. Swahn, Johan. *If I can taste it, I want it… Sensory Marketing in Grocery Retail Stores*. 2011
10. Wellton, Lotte. *Improved Meal Offerings in Tourist Destinations Provided by Professional Practitioners*. Academic essay. 2015
11. Magnusson Sporre, Cecilia. *Måltidsgörarens utmaningar: Komplexiteten i det medvetna måltidsgörandet*. 2015
12. Wellton, Lotte. *Making Meals in Restaurants - Daily Practices and Professional Ideals*. 2017
13. Nilsen, B. Bente. *Growth of schoolchildren. Studies of somatic growth and deviant growth patterns such as weight loss and obesity and aspects of intake of breakfast and food items*. 2018

14. Scander, Henrik. *Food and beverage combinations – Sommeliers' perspectives and consumer patterns in Sweden.* 2019

15. Eriksson, Lars. *Att gestalta måltider – mise en place, dukning och servering. En metodstudie i servitörens hantverkskunnande.* 2021

16. Jonsson, Ann-Sofie. *The "ity" factor in hospital meals. Performing, experiencing, and understanding hospitality within the hospital frame.* 2021

17. Westling, Magnus. *Sensory qualities and culinary utility of produce – a path towards sustainable gastronomy.* 2022

18. Hult, Kajsa. *Hipster Hospitality and Beyond. Exploring dining room professionals in contemporary restaurants.* 2024

19. Kim, Ansung. *Seeds of change for plant-based food consumption. Products, restaurants and everyday life.* 2025