D1.2
Built food environment typology

Document ID	D1.2 Built food environment typology
Due date	30.10.2023
Delivery date	18.10.2023
Dissemination level	Public
Document version	Final (FV)

This project is funded by the European Union under Grant Agreement No. 101083961. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or European Research Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

Funded by the European Union

like-a-pro.eu

GENERAL INFORMATION	
Acronym	LIKE-A-PRO
Title	From niche to mainstream - alternative proteins for everybody and everywhere
Grant Agreement Number	101083961
Call	HORIZON-CL6-2022-FARM2FORK-01
Project coordinator	ASOCIACION PARA LA INVESTIGACION DESARROLLO E INNOVACION DEL SECTOR AGROALIMENTARIO - AIDISA (CTIC-CITA)
Work Package	WP1 -Determinants of choosing alternative proteins by consumers
Lead Beneficiary	SWPS

AUTHOR(S) AND CONTRIBUTORS	
Name:	Organisation:
Hanna Zaleskiewicz, Aleksandra Luszczynska (authors)	SWPS
Project partners (contributors): Ewa Kulis, Maria Siwa, Zofia Szczuka, Anna Banik	SWPS
Project partners (contributors): Francesca Grossi, Arlind Xielili	CSCP
Project partners (contributors): Bjørn Tore Nystrand	MOREFORSKING
Project partners (contributors): Antonella Samoggia	UNIBO
Project partners (contributors): Polymeros Chrysochou, Toula Perrea	ACG

PEER REVIEWS		
	Date:	Name:
Review 1	4.10.2023	Athanasios Krystallis (ACG)
Review 2	4.10.2023	Morena Silvestrini (CTIC-CITA)
Approval coordinator	18.10.2023	Morena Silvestrini (CTIC-CITA)

DOCUMENT HISTORY			
Version:	Date:	Modifications:	Author:
V1	04.10.2023	First draft	Hanna Zaleskiewicz, Aleksandra Luszczynska (SWPS)
Rev1	11.10.2023	Review 1	Athanasios Krystallis (ACG)
Rev2	10.10.2023	Review 2	Morena Silvestrini (CTIC-CITA)
FV	17.10.2023	Final version	Hanna Zaleskiewicz, Aleksandra Luszczynska (SWPS)

Table of contents

List of figures

List of tables

List of annexes

List of abbreviations

APF – Alternative protein foods
AL - Aleksandra Luszczynska (co-author)
BTN - Bjørn Tore Nystrand (co-author)
CICI – the Context and Implementation for Complex Interventions Framework
EK - Ewa Kulis (co-author)
EU – European Union
FAO – Food and Agriculture Organization of the United Nations
FG - Francesca Grossi (co-author)
HZ – Hanna Zaleskiewicz (co-author)
MS – Maria Siwa (co-author)
ORE – Open Research Europe Database
PC - Polymeros Chrysochou (co-author)
PRISMA - Preferred Reporting Items for Systematic Reviews and Meta-Analyses
TP - Toula Perrea (co-author)
ZS – Zofia Szczuka (co-author)

Executive summary

Deliverable 2.2. reports findings of two systematic reviews that:

- synthesize evidence for the built environment and propose a typology of built environment structures (e.g., supermarkets, groceries, restaurants) and their characteristics that hinder or promote consumers' choices of alternative protein food (APF) (Study 1);
- synthesize evidence for links between the geographical environment features (countries, regions, urbanization, locality) and consumer choices of APF (Study 2).

In particular, in Study 1 we expand the built food environment typology proposed by Downs et al. (2020) to identify structures of built food environment (e.g., supermarkets, groceries, farmer's markets, restaurants, schools, online vendors, etc.) and determinants that act as barriers or facilitators of APF consumers' choices, operating these structures. In Study 2 we explore: (a) differences and similarities between European countries, (b) differences and similarities within the regions of European countries, (c) differences between rural and urban areas, (d) the associations between the "local" attribute of the product and the consumer choice indicators.

Methods: A systematic review (PROSPERO database preregistration; no. CRD42023388700) was conducted in 13 databases of peer-reviewed journals. In Study 1, a total of 31 papers (36 original studies) were analyzed. In Study 2, a total of 29 original studies were included. Risk of bias was evaluated with Joanna Briggs Institute quality evaluation tools.

Results: The findings of Study 1 indicate that perceived and actual availability is a common determinant, operating across the structures of built environment. The results also indicated several determinants that are associated with consumers' choices of APF in specific types of build food environment: (a) food supply chain-related determinants, such as the ways food is presented in produce sections (supermarkets), (b) consumer-related determinants, such as habits of green and specialty shopping (groceries), and (c) a mismatch between retailers actions and consumer preferences, such as retailers making APF available in one type of environment (e-commerce), and consumers' preference for availability of APF in supermarkets and groceries. Moreover, a determinant, operating within one type of the built food environment may form different associations with consumers' choice, depending on the APF type (e.g., social norms referring to masculinity as a barrier for plant-based APF choices in restaurants, but not a barrier for insect-based APF in restaurants).
Results of Study 2 suggest that across European countries, the levels of intention to eat, try, and buy APF are moderate to low-to-moderate. Overall, different patterns for consumers preferences were observed in Northern Europe, Southern Europe and Eastern Europe. In particular, the main differences refer to consumers' choices of insect-based APF in Scandinavian countries, compared to Italy. Denmark emerges as an example of a Scandinavian country "in transformation" in terms of increasing sustainability awareness, trends for meat intake reduction, and improving (yet still low) intake of protein-rich plants. In contrast, Poland emerges as an example of an Eastern-European country "in stagnation", with low levels of knowledge and low readiness to shift dietary patterns towards higher plant-based APF intake. Our findings do not support rural-urban differences, but suggest that the environments (cities or regions) in Europe, which are more "cosmopolitan" may be characterized by higher APF choices. Finally, perceiving an APF product as local may increase the likelihood of APF choice by European consumers.

Conclusions: Study 1 proposes an extension of a built food environment typology matching built environment structures (supermarkets, other retail structures, farmer's markets, restaurants, schools, and online vendors) and evidence-based barriers to and facilitators for APF choices, operating in respective structures. The findings provide insights which could be used by food chain actors to increase APF uptake, by developing new strategies, policies and actions that address barriers and facilitators operating in specific structures of built environment.

Study 2 review provides evidence for the importance of the geographical dimension when considering APF choices. The geographically defined European units (countries, regions, cities, etc.) exhibit diverse cultural, political, and economic characteristics, which in turn shape consumer health behaviors, including APF preferences. These geographical differences contribute to health inequalities between countries or regions. In light of these variations, understanding characteristics of food environments and food systems that are facilitating or hindering APF consumption represents the initial step toward reducing disparities and, in turn, promoting better health for all.

1. Study 1: Types of Built Food Environment and Their Characteristics Associated with Alternative Food Protein Choices by Consumers: Systematic Review and Evidence-Based Typology

1.1 Introduction

As highlighted by the EAT-Lancet Commission Report (EAT, 2019), the role of food in shaping human health and environmental sustainability is pivotal. The key dietary shift, securing healthier societies and more sustainable food production, can be achieved by reducing the consumption of animal-based proteins and incorporating alternative protein sources in the diet (EAT, 2019). Alternative protein food (APF) products encompass a wide range of protein concentrates derived from various sources such as insects, krill, microbial biomass, mushrooms, fungi, and plants such as pea or rapeseed (cf. Grossmann & Weiss, 2021; LIKE-A-PRO, 2022). Compared to traditional animal-based proteins, alternative protein sources offer several advantages, particularly in terms of environmental sustainability and compliance with national dietary recommendations (Salter & Lopez-Viso, 2021). It is important to note that the term "alternative protein" typically refers to proteins sourced ensuring a lower environmental impact than traditional protein sources (e.g., beef, pork, poultry, animal dairy). This definition excludes cultured meat due to ongoing debate about the environmental benefits of its production (Grossmann & Weiss, 2021).

1.2 Approaches and Typologies of Food Environment

The concept of "food environment" is usually applied to investigate linkages among the built environment, dietary choices, and their consequences for human health and the natural environment. Specifically, the term "food environment" may be broadly defined and include both physical environment and sociocultural, political, and media-related factors (Glanz et al., 2005). This first group of approaches draws from socio-ecological models of human behavior, which propose the existence of multiple layers of individual differences, built and social factors, as well as policy factors that influence dietary choices (Bronferbrenner, 1979; the Centers for Disease Control and Prevention, 1977). In contrast, other approaches argue that the consideration of cultural, societal, political, individual, and physical environmental factors represents a more comprehensive view of the complex food system. In this perspective, the physical or built food environment represents one of the layers of the complex food systems (Downs et al., 2020). Consequently, the second group of theoretical approaches to the food environment focuses on one layer of factors, referring to either the physical environment (Downs et al., 2020; McKinnon et al., 2009) or the policy environment (Pineda et al., 2022; Vandevijvere et al., 2015). These approaches have been developed as a result of systematic reviews of empirical evidence and consultations with stakeholders who operate within the physical and political aspects of the food environment.

Approaches focusing on the physical food environment exhibit some similarities. For example, McKinnon et al. (2009) categorized physical food environments into the following types: the food store environment, restaurant food environment, school food environment, and worksite food environment (e.g., cafeterias, vending, snack shops). This typology was further expanded by Lytle & Sokol (2017), to incorporate additional categories such as the home food environment, the macro food environment (national food supply), and other public and non-public food environment facilities. A recent food environment typology proposed by Downs et al. (2020) considers both formal built food environment structures, such as supermarkets, hypermarkets, other retailers, farmer markets, restaurants, institution and public procurement settings, mobile vendors, and online vendors, as well as informal environmental structures like wet markets. Furthermore, the typology by Downs et al. (2020) also

addresses physical structures in wild food environments (e.g., seas, rivers) and cultivated environments (e.g., fields, orchards).

1.3 Characteristics of the Built Food Environment

Physical food environment approaches also propose a list of characteristics for the different types of structures within the food environment. These characteristics can be assessed to offer a more comprehensive understanding of each physical structure. For example, the characteristics may encompass: food supply analysis, geographical analysis, menu analysis, nutrient analysis, receipt analysis, or sales analysis (see the typologies by McKinnon et al., 2007 and Lytle & Sokol, 2017). These serve to describe the number and density of respective structures, the availability of certain foods in the respective structures, the composition of available foods, and the actual purchases. The typology by Downs et al. (2020) proposes that the characteristics of the food environment should include: food availability, food affordability, convenience (e.g., easy to reach by public transport), promotion and quality (e.g., labeling, menu composition), and sustainability (e.g., levels of food waste or food miles).

The main aims of developing the food environment models or taxonomies are to guide research in identifying structures where specific food choices take place (e.g., Downs et al., 2020; Pineda et al., 2022). The food environment taxonomies usually focus on built environment structures, because built environment plays a pivotal role in shaping consumer food choices (Downs et al., 2020; Pineda et al., 2022). The built food environment taxonomies should provide evidence for characteristics of built environment that either facilitate or hinder dietary shifts. Taxonomies accounting for facilitators and barriers operating in respective structures of built environment may help to develop evidence-based food promotion and retail strategies aiming at an increase the intake of APF. Therefore, besides listing the potentially relevant types of structures in the built environmental, it is essential to understand the characteristics that are specific for respective structures and to identifying entry points for modifying the environmental structures to promote the acceleration of healthy and sustainable choices of alternative protein products.

1.4 Evidence for the Characteristics of Food Environment Associated with (Alternative) Protein Choices

Existing systematic reviews have primarily explored dietary choices in the characteristics or food promotion strategies (e.g., recipe design, product labeling, sensory characteristics of APF), without addressing the effect the structures of built environment may play in the context of transitioning towards healthier and more sustainable food choices. For example, a review of 18 intervention studies investigated micro-environment characteristics associated with reducing meat consumption (Bianchi et al., 2018). Strategies such as reducing meat portion sizes, alternating sensory characteristics of meat and meat alternatives, and providing meat-free options were associated with meat intake reduction. Notably, making meat alternatives available showed evidence of a sustained effect (Bianchi et al., 2018). Similarly, Stiles et al. (2022) conducted a review on the effectiveness of intervention strategies aimed at decreasing animal protein food and/or increase plant protein food in food service settings. These “micro-environmental” strategies included several approaches, such as menu redesign (increasing the availability of non-meat proteins on the menu), recipe redesign, service redesign (e.g., changing serving locations and types of serving containers for improved sustainability), menu labeling (e.g., using terms such as: ‘mouthwatering’ or ‘climate choice’), and prompts at the point of sale such as ’dish of the day’ or ‘popular choice.’ Menu offer redesign, highlighting the availability of plant-based meat alternatives, demonstrated the most significant effects (Stiles et al., 2022).

Findings from both reviews (Bianchi et al., 2018; Stiles et al., 2022) are consistent, indicating that an increase in availability is a facilitator of changes in protein intake (meat reduction and/or higher plant protein intake). However, these reviews do not provide insights into whether these effects apply across different types of

built environments (e.g., school canteens, restaurants, supermarkets) or if certain strategies are more impactful in specific settings (e.g., restaurants vs. supermarkets). Furthermore, these reviews do not delve into the barriers that may hinder the transition towards the uptake of APF. Additionally, it remains unclear whether the findings obtained in the systematic reviews of environmental strategies (Bianchi et al., 2018; Stiles et al., 2022) are specific to reducing meat intake and increasing the consumption of "plant-based meat alternatives," or if they can be generalized to the intake of other APF products, such as insect-based APF.

Differences in the intake and acceptability of insect-based APF between developed (mostly Western) countries and countries in Latin America, Southeast Asia, and Africa have been well documented (Kim et al., 2019). Consumers in the latter countries often consume insects collected in wild, uncultivated areas, which contrasts policy-regulated industrial production and retail of insect-based APF in Western countries (Delgado et al., 2022). Consequently, the built food environment and its characteristics related to intake of APF may vary across continents. In this study, we focus on built food environments in developed (Western) countries and their impact on consumer choices regarding APF, including plant-based and insect-based types.

1.5 Study 1 Aims

Using the methods of the systematic review, this study aims to identify the characteristics of the types of built food environments that may act as either barriers or facilitators for consumers' dietary choices of APF products. In particular, we investigated the following types of built food environments (a) informal market food environments (wet markets, street vendors, kiosks, mobile vendors) and (b) formal market food environments (supermarkets, hypermarkets, retailers, farmer's markets, restaurants, institutions, and public procurement, mobile vendors, online vendors; [cf. Downs et al., 2020]). Additionally, the study seeks to explore any organizational, social, or other structural/design characteristics of the types of built food environments that have been tested for their associations with consumer choices of APF. Based on the results of the review, the study aims to complement the typology by Downs et al. (2020) and propose an evidence-based typology of structures of the built food environment where APF consumer choices take place and the barriers/facilitators for APF choices that operate in these structures. In particular, we aim are to broaden the typology by Downs et al. (2020) by identifying and including the evidence-based entry points for modifying these build environmental structures to promote the acceleration of healthy and sustainable choices of alternative protein products.

2. Methods of Study 1

2.1 Materials and General Procedures

This study was conducted following the guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (Page et al., 2021). The findings presented are part of a broader systematic review, which was registered with the PROSPERO database under the registration number #CRD42023388700. The overarching goal of this systematic review is to identify the physical environment characteristics related to consumers' choices of APF.

2.2 Search Strategy

We conducted a systematic search of 11 databases of peer-reviewed journals (Academic Search Ultimate, PsycInfo, PsycArticles Business Source Ultimate, Agricola, GreenFILE, Health Source: Nursing Academic Edition, SocINDEX, MEDLINE, MasterFILE Premier, Academic Research Source eJournals), accessed through the EBSCO platform. These databases are multidisciplinary and address fields of economics and business, agriculture, medical sciences, and social sciences. The primary search was followed by separate searches in 2 additional databases, Web of Science and SCOPUS. Our search included documents and articles published up to March 2023.

The search strategy adopted includes three groups of keywords: (1) *alternative protein food* (e.g., "seaweed*" OR "alga*" OR "insect*" OR "lupin*" OR "dry pea*" OR "chickpea*" OR "cow pea*" OR "pigeon pea*" OR lentil* OR "meat alternative*" OR "meat substitute*" OR "plant-based meat*" OR "meat analogue*"OR "rapeseed kernel protein" OR "mealworm protein" OR "krill protein" OR "microbial protein" OR "cultivated mushroom protein" OR "fermented fungal protein" OR "pea protein" OR "meat analogue*"); (2) *physical built environment* (e.g., "home" OR "shop*" OR "retail*" OR "cater*" OR "restaurant*" OR "supermarket" OR "hotel*" OR "farmer market*" OR "grocer*" OR "vendor" OR "kiosk" OR "food environment*" OR "school*" OR "public institution*" OR "food vend*" OR "built environment" OR "physical environment" OR "food procurement" OR "accommodation" OR "neighborhood*" OR "food outlet*" OR "food store*" OR "workplace" OR "transport" OR "architectur*" OR "menu design" OR "canteen" OR "in-store design" OR "point of sale" OR "fast-food store*" OR "fast-casual") and (3) *consumer or behavior-related* (e.g., "intake" OR "food" OR "consume*" OR "eat" OR "sale" OR "purchase" OR "buy*" OR "sell*"). These keywords were selected using existing reviews on APF (Biasini et al., 2021; Mancini et al., 2019; Nguyen et al., 2022) and the food environment typology by Downs et al. (2020). Furthermore, the keywords were consulted with researchers from the fields of consumer sciences, food sciences, and nutrition from the LIKE-A-PRO consortium. As this review aims as eliciting any organizational, social, or other structural/design characteristics that may form either a barrier or facilitator of the APF by consumers, the search string did not include any keywords referring to the characteristics of the built environment.

For this review, a broad and inclusive search strategy was employed using multiple keywords that represented the factors under investigation. Basic operators [AND, OR] were applied, and no specific limits were imposed. The feasibility of the string was pretested across the databases before the search was initiated. This approach aimed to capture a wide range of relevant articles across the databases. However, it also increased the number of identified entries and thus minimize the likelihood of excluding relevant documents during the initial stages of screening.

To ensure the robustness of the search, we also performed manual searches of references within full text of original studies assessed for inclusion. In addition, we performed complementary non-systematic searches in Google Scholar using the same keywords as those used in the databases. Finally, we searched the CORDIS and Open Research Europe (ORE) databases for open peer-revised documents publishing results of European Union's Horizon2020 and Horizon Europe research projects, using 'alternative protein' keywords. Modifications to the keywords were applied to fit the character limits (up to 50 characters length) imposed by CORDIS and ORE.

2.3 Inclusion and Exclusion Criteria

The following inclusion criteria were applied: (1) peer-reviewed English-language original quantitative or qualitative studies, (2) studies addressing alternative protein-based food, including proteins that are land or sea plant-based, fungi-based, bacteria-based, or based on any other alternative protein sources, such as krill, as well as combinations of meat- and plant-based proteins; and (3) studies investigating built and/or physical environment structures, based on the built food environment typology by Downs et al. (2020) where European consumers made their choices regarding alternative protein-based food. Original studies were included if (4) they discussed any type of links between the characteristics of the food environment and any (a) indicators of consumers' choices, such as perceived display/ways of food exposition in the built environment, intention to buy, intention to eat, actual intake, actual sales; (b) indicators of the availability in the respective food environment

The exclusion criteria were: (1) documents that did not report any original data, such as reviews or position papers, (2) dissertations, protocols, conference materials, and book chapters, (3) studies focusing solely on reducing meat intake without investigating how proteins will be supplemented in diet by APF products; (4) studies focusing on increasing intake of fruit and/or vegetable, without specific data on plant-based protein sources, (5) studies solely addressing physical environment in Asia or Africa, or South America, entailing locally collected wild-living insects and their local consumption or local retail (European built environment or an European consumer choices were not studied), (6) studies involving novel food without an indication that the

food is made of/with alternative protein sources, e.g., novel drinks based on sea buckthorn, collection/sales of wild forest mushrooms, (7) studies addressing consumers' choices on alternatively grown beef, poultry or pork meat (e.g., laboratory based, in-vitro grown), without any alternative proteins added, (8) studies focusing on geographical factors, such as between-country or between region differences, (9) studies investigating APF as supplements or animal feed.

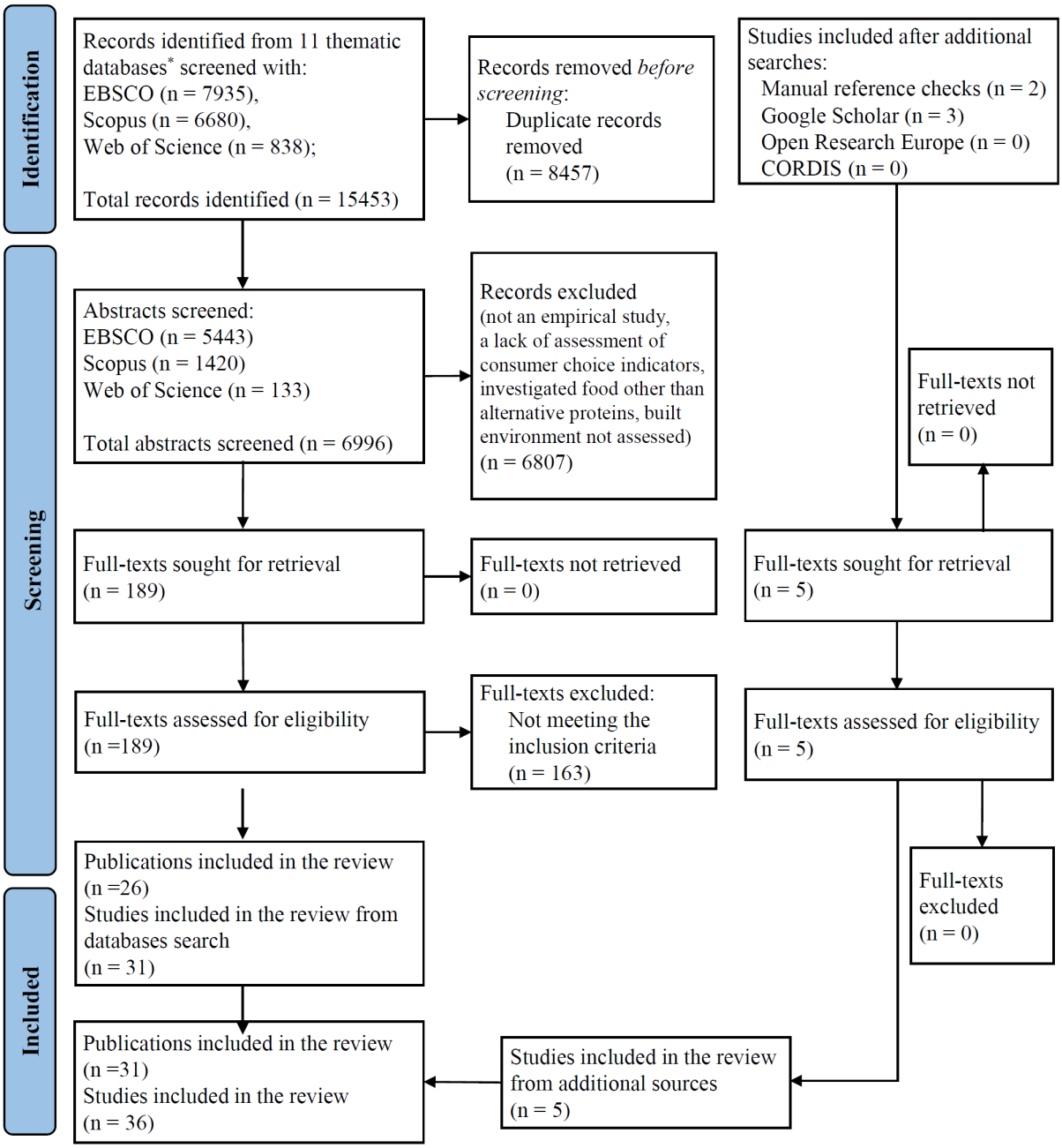
2.4 Data Collection and Extraction

Figure 1 illustrates the data selection process. The databases were independently searched by three researchers (HZ, EK, MS), and the searches were unsystematically checked by the fourth researcher (AL). The initial search yielded k = 7,935 records obtained in searches of 11 databases using the EBSCO search engine, k = 838 in Web of Science, and k = 6,680 in Scopus. All abstracts were screened by two researchers (randomly assigned from a group of 5 researchers, HZ, EK, ZS, MS, AB) to elicit potentially relevant studies. Any conflicts regarding the inclusion of a document were resolved through discussions with a fourth researcher (AL). Next, three researchers (AL and two researchers randomly assigned from a group of 5: HZ, EK, ZS, MS, AB) independently read the full-text versions of the articles and determined their match with the inclusion criteria. Additional searches for original peer-reviewed studies were conducted through screening references of articles evaluated for the inclusions (conducted by two reviewers independently (PC and TP), Google Scholar searches (conducted independently by HZ and AL), as well as searches of the CORDIS database and Open Research Europe database (conducted by AL).

Overall, the search process and evaluation of all studies resulted in the inclusion of 31 publications reporting 36 independent studies (see Figure 1). Two articles (Weinrich & Elshiewy, 2019; Weinrich & Elshiewy, 2023) reported findings from the same study, and only the newest publication was included (Weinrich & Elshiewy, 2023). We included two studies (study 1 & 2) reported in a publication by Vandenbroele et al. (2021), three studies (study 1, 2, & 3) reported by Motoki et al., (2022), and three studies reported by Baker et al. (2016) (study 1, 2 & 3).

To address the study objectives, the following data were extracted: studied population characteristics, the country of data collection, the design of the original study and the type of methods used to collect data, the time span when data were collected, the type of alternative proteins investigated, the type of the built environment and its characteristics, the indicators of the consumers' choices, key results.

Data extraction and coding were conducted by two researchers (HZ and AL). Any disagreements during these stages were resolved by consensus method (searching for possible rating errors, followed by a discussion and an arbitration by a third researcher, AB (Higgins et al., 2022).



*Academic Search Ultimate, PsycInfo, PsycArticles Business Source Ultimate, Agricola, GreenFILE, Health Source: Nursing Academic Edition, SocINDEX, MEDLINE, MasterFILE Premier, Academic Research Source eJournals

Figure 1. The manuscript flow in Study 1.

2.5 Data Coding, Analysis and Synthesis

Data retrieved from each original study were coded according to four categories: (1) the type of alternative protein food products, (2) the type of built food environment structure, (3) the characteristic of the built food environment that was related to consumers' choices of alternative proteins, and (4) the type of consumer choice indicator.

The t*ypes of alternative protein products* were coded into the following categories, based on protein sources (Grossman & Weiss, 2021): (1) food developed with land or sea plant-based protein, including food developed with microalgae-based proteins, (2) food including or made of insect-based protein (any type of insects

used in the production of food). Within plant-based alternative proteins, we distinguish a specific sub-category of food developed with a combination of plant-based proteins and meat. These products were categorized as plant-meat hybrid foods, including food developed by combining meat products (pork, beef, poultry) with plant protein sources, with a proportion of 50-50% or 25-75% of respective types of sources; (3) food including or made of various types of alternative proteins, including plant-based, insect-based and other types of alternative protein sources, such as krill, bacteria, or fungi.

The *types of structures of built food environment* were coded using Downs et al. (2020) typology, distinguishing between informal market food environments (mobile vendors, wet markets, kiosks, street vendors) and formal market food environments (supermarkets, hypermarkets, mobile vendors, online vendors, other food retailers/groceries, institutions/public procurement, restaurants, farmer markets).

Where available, we coded the *specific characteristics of the type of food environment*, referring to: the ways the food was exposed in the setting, including, e.g., in the menu, on shelves, side to side versus separately from meat-based protein products; the methods used by the retailers/restaurateurs to promote food from alternative protein sources in a specific food environment; and the social food environment, such as presence of other/specific people in the environment.

The *consumer choice indicators* included three types of variables commonly used in research on behavior determinants, such as the theory of planned behavior (Ajzen & Schmidt, 2020) or social cognitive theory (Luszczynska & Schwarzer, 2020), namely (1) attitudes towards/perceptions of the physical and social environment or the food product itself (i.e., its attractiveness, approval, acceptance, appropriateness), (2) intentions to act, and (3) the actual behavior performance. The indicators of relevant attitudes or perceptions included: acceptability of foods, perceived availability of foods, consumers' approval or liking of food, and preference for the point of sale (or the type of environment where the food is sold). According to behavior change theories, attitudes, beliefs, and perceptions may refer to the consumers themselves (e.g., perceived capabilities, skills, or emotions). These types of perceptions, not referring to the physical environment directly, were not considered an indicator of consumers' choices but rather an individual characteristic of a consumer that determines other consumer choice indicators and, therefore, excluded. The separation of perceptions of/beliefs about the environment from beliefs/perceptions of oneself is used in theoretical approaches focusing on environmental versus individual determinants of other human behaviors (c.f., the model of four domains of active living; Sallis et al., 2006). The intentions to act included intention to eat (e.g., see behavior change models such as TPB, Ajzen & Schmidt, 2020), intention/willingness to pay, and intention/willingness to buy (e.g., Lu & Hsee, 2019). The actual behaviors included: the actual consumption of the food in the study location, the actual purchase by a consumer, sales of a product in the study location/food environment type, and visiting the location selling the alternative protein food products.

Table 1 presents descriptive information about the included studies and the coded variables, providing an overview of the type of environmental structures, consumer choice indicators, and the type of APF studied.

2.6 Risk of Bias and Quality Assessment

The methodological quality and risk of bias in the included studies were assessed using the Critical Appraisal Tools (Joanna Briggs Institute, 2023) for both cross-sectional studies and qualitative studies. These tools are appropriate for evaluating both qualitative and quantitative cross-sectional studies (no observational longitudinal studies were included, $k = 6$ manuscripts reported experimental studies). Each study was evaluated based on eight criteria, and an overall quality evaluation (good, fair, or poor) For details see table S1, Annex 1. The obtained overall scores are reported in Table 1.

The methodological quality (risk of bias) of included publications and respective studies was assessed by two pairs of independent reviewers (PC and TP or AB and MS). Studies were scored according to the critical appraisal questions (Yes = 2 –the criterion met completely, No = 0 – the criterion was not met, Unclear = 1 – some information on the criterion was provided but there was no complete clarity or information was inadequate in

order to make a judgement. The disagreements were resolved in discussion or by involving the third researcher (AL). The overall risk of bias for the included studies was determined using the following cutoffs: low risk of bias – at least 70% of answers were 'yes', moderate – 50 to 69% of answers were 'yes', and high risk if the scores were below 50%.

2.7 Data Analysis and Synthesis

The included material was heterogeneous for each type of built environment structure (e.g., supermarkets) in terms of consumer choice indicators, types of alternative proteins, and built environment characteristics. Additionally, a limited number of studies (between 0 and 8) were found for the respective types of built environment. Therefore, a meta-analysis was not feasible. Meta-analysis should only be considered when a group of studies has adequate homogeneity between participants, conditions, and outcomes to provide a meaningful summary. According to the Cochrane guidelines for systematic reviews (Higgins et al., 2022), in the cases of substantial diversity, a qualitative approach that combines studies is more appropriate.

We employed narrative synthesis methods, drawing from the Economic and Social Resesarch Council guidance on narrative synthesis (Campbel et al., 2019; Popay et al., 2006). First, a narrative synthesis uses a theoretical model providing the underpinnings for the analyzed patterns of associations (Campbel et al., 2019; Popay et al., 2006). In this review, the built environment typology proposed by Downs et al., (2020) served as the framework for synthesizing evidence related to associations between built environment characteristics and consumer choices indicators. Second, the preliminary synthesis should be provided, including an initial description of the results of included studies (e.g., their textual description, forming data into a common rubric characterizing the studies, tabulation) (Campbell et al., 2019; Popay et al., 2006). Specifically, we coded the studies included along the four categories (type of food product, type of environment, characteristics of the type of environment, and consumer choice indicator) and provided an initial description of the results in the form of table and textual synthesis. The third step accounts for exploring the relationships in the data by examining emerging patterns that allow to identify patterns of associations and provide explanations of differences in the direction of associations. This may be achieved by analyses of emerging cluster groups, conceptual mapping, context description, and frequency distributions (see Campbel et al., 2019; Popay et al., 2006). In this review, we grouped the studies along the types of the built environment proposed by Downs et al.'s (2020) typology. Next, within each built environment type, we clustered the findings referring to plant-based vs. insect-based vs. other types of alternative protein sources. Context factors or specific characteristics of the environment (e.g., ways of exposing food, actual availability at the setting) were used to further examine the patterns of associations. Fourth, the narrative synthesis should account for an assessment of the robustness of the obtained results, for example, using the quality assessment tools that address the respective risk of bias (see ESRC guidance; Campbel et al., 2019; Popay et al., 2006). This review addressed the heterogeneity of studies in reference to the quality of included papers.

3. Results of Study 1

3.1 Description of Included Studies

A total of $k = 36$ original studies were included. Table 1 presents the general descriptive information (number of participants, gender, age, country of data collection, the overall design) and main results of the included studies.

Across the original studies, the following APFs were addressed:

(a) $k = 17$ studies discussed the plant-based alternative protein products (Aaslyng & Højer, 2021; Bogueva et al., 2022; Borkowski et al., 2020; Brooker et al., 2022; Clark & Bogdan, 2019; Drake & Gerard, 2003; Garcia-Segovia et al., 2020; Grasso & Jaworska, 2020; Gravely & Fraser, 2018; Michel

et al., 2020; Motoki et al., 2022; Ortega et al., 2022; Palmieri & Forleo, 2021; Pérez-Lloréns, 2020; Weinrich & Elshiewy, 2023; Vandenbroele et al., 2021 [study 1 & 2]);

(b) k = 15 studies addressed insect-based alternative protein products (Ali & Ali, 2022; Baker et al., 2016 [study 1,2&3]; Bisconsin-Junior et al., 2022; Collins et al., 2019; Florenca et al., 2021; Herbert & Beacom, 2021; Hwang et al., 2020; Jones, 2020; Menozzi et al., 2017; Motoki et al., 2022 [study 1]; Pippinato et al., 2020; Porretta et al., 2019; Reverberi, 2021);

(c) k = 1 accounted for hybrid meat products (i.e., meat and plant-based meat replacement combined into one product) (Grasso & Jaworska, 2020);

(d) k = 4 analyzed foods from either plant-based proteins or insect-based sources (Cai et al., 2021; Schwark et al., 2020; Motoki et al., 2022 [study 2 & 3]);

(e) k = 3 focused on a broader category of novel food, including either plant-based or insect-based APF, or APF from various sources (Aerni et al., 2011; Cai et al., 2021; Schwark et al., 2020).

Regarding the subtypes of environmental structures, none addressed informal market food environment types (wet markets, street vendors, kiosks, mobile vendors), whereas, k = 31 (all studies) addressed formal market food environment. In particular:

(a) k = 6 addressed supermarkets (Brooker et al., 2022; Grasso & Jaworska, 2020; Gravely & Fraser, 2018; Menozzi et al., 2017; Ortega et al., 2022; Reverberi, 2021),

(b) k = 10 addressed other food retailer structures (e.g., groceries) (Aaslyng & Højer, 2021; Baker et al., 2016 [study 1&3]; Collins et al., 2019; Drake & Gerard, 2003; Herbert & Beacom, 2021; Porretta et al., 2019; Weinrich & Elshiewy, 2023; Vanderbroele et al., 2019 [study 1 & 2]),

(c) k = 2 addressed farmer markets (Aerni et al., 2011; Porretta et al., 2019),

(d) k = 17 addressed restaurants (Ali & Ali, 2022; Baker et al., 2016 [study 2&3]; Bisconsin-Junior et al., 2022; Bogueva et al., 2022; Cai et al., 2021; Florenca et al., 2021; Hwang et al., 2020; Michel et al., 2020; Motoki et al., 2022 [study 1, 2 & 3]; Ortega et al., 2022; Palmieri & Forleo, 2021; Pérez-Lloréns, 2020; Schwark et al., 2020; Weinrich & Elshiewy, 2023),

(e) k = 2 addressed institutions and public procurement (schools) (Borkowski et al., 2020 and Jones, 2020),

(f) k = 4 addressed online vendors (Herbert & Beacom, 2021; Reverberi, 2021; Pippinato et al., 2020; Porretta et al., 2019),

(g) k = 1 addressed vending machines (Garcia-Segovia et al., 2020),

(h) k =4 addressed food festivals (Motoki et al., 2022 [study 1, 2 & 3]); Palmieri & Forleo, 2018).

(i) No study addressing mobile vendors and hypermarkets was found.

The consumer choices indicators included:

(a) consumers' attitudes and beliefs about, e.g., healthiness and sustainability (k = 2 studies – Hwang et al., 2020; Weinrich & Elshiewy, 2023),

(b) consumers' trust and confidence (k =1 study, Reverberi, 2021),

(c) easiness to find APF (k = 1 study, Gravely & Fraser, 2018),

(d) self-reported indication for the preferred location where the product should be available (k = 10 studies – Bisconsin-Junior et al., 2020; Cai et al., 2021; Garcia-Segovia et al., 2020; Herbert & Beacom, 2021; Motoki et al., 2022 [study 1,2&3]; Palmieri & Forleo, 2021; Porretta et al., 2019; Schwark et al. 2020),

(e) satisfaction with plant-based proteins k =1 study (Aaslyng & Højer, 2021),

(f) consumers approval of a specific cuisine k = 1 study (Perez-Llorens, 2020).

(g) acceptance of APF k =1 study (Michel et al., 2020),

(h) preferred location for the consumption k =1 study (Ortega et al., 2022),

(i) the likelihood to visit a location where APF is sold, k =1 study (Bogueva et al., 2022),

(j) the intention to (re) visit restaurants *k* =1 study (Ali & Ali, 2022),
(k) consumers' intention to buy (*k* = 5 studies – Baker et al., 2016 [study 1, 2 & 3]; Collins et al., 2019; Porretta et al., 2019),
(l) consumers' intention to pay (*k* =2 studies - Collins et al., 2019; Ortega et al., 2022),
(m) consumers' intention to eat (*k* = 6 studies – Clark & Bogdan, 2019; Jones, 2020; Menozzi et al., 2017; Motoki et al., 2022 [study 1, 2 & 3]),
(n) actual sales of products (*k* = 4 studies – Aerni et al., 2011; Pippinato et al., 2020; Vandenbroele et al., 2021 [study 1 & 2]),
(o) self-reported purchase by the consumers (*k* = 4 studies – Drake & Gerard, 2003; Ortega et al., 2022; Palmieri & Forleo, 2021; Weinrich & Elshiewy, 2023),

Finally, studies focusing on actual availability of APF products in the specific structures of built food environment, e.g., schools, were included (k = 3 studies – Borkowski et al., 2020; Brooker et al., 2022; Grasso & Jaworska, 2020). Although these studies did not address consumer choice indicators (such as e.g., intention to buy or an actual purchase), they provided data regarding a type of built environment and barriers or facilitators operating in this structure.

The enrolled populations were heterogeneous, with a total *N* = 113,984 and sample sizes ranging between 15 and <100,000 (M = 3,453.09, SD = 17,344.40) and age ranging from 7 to 90 years old. Overall *k* = 31 (86.11%) of the studies included consumer samples from the general population (Aaslyng & Højer, 2021; Aerni et al., 2011; Ali & Ali, 2022; Baker et al., 2016 [study 1, 2 & 3]; Bisconsin-Junior et al., 2022; Brooker et al., 2022; Cai et al., 2021.; Clark & Bogdan, 2019; Florenca et al., 2021; Garcia-Segovia et al., 2020; Grasso & Jaworska, 2020; Gravely & Fraser, 2018; Herbert & Beacom, 2021; Hwang et al., 2020; Menozzi et al., 2017; Michel et al., 2020; Motoki et al., 2022 [study 1, 2 & 3]; Ortega et al., 2022; Palmieri & Forleo, 2021; Pérez-Lloréns, 2020; Pippinato et al., 2020; Porretta et al., 2019; Reverberi, 2021; Schwark et al., 2020; Weinrich & Elshiewy, 2023; Vanderbroele et al., 2019 [study 1 & 2]). Only *k* = 5 enrolled specific populations, such as students, homemakers (women), men only, etc. (Bogueva et al., 2022; Borkowski et al., 2020; Collins et al., 2019; Drake & Gerard, 2003; Jones, 2020). Original studies were conducted in 22 different countries. Most frequently, the studies were conducted in the United States of America (n = 9, 25%), UK (n = 4, 11.1%), Belgium (*n*=3, 8.3%), Canada (*n* = 3, 8.3%), Italy (*n* =3, 8.3%), Germany (*n* =3, 8.3%), Japan (*n*=3, 8.3%). Two studies (5.5%) were conducted in each Australia, France, Netherlands, Spain, and Denmark. Other studies (*n* = 14, 38.8%) were conducted in China, Ireland, Switzerland, Brazil, Portugal, South Korea, Austria, Finland, Norway, and Sweden.

Almost half of the studies applied an observational—cross-sectional design (*k* = 15, 41.6 %), (*k* = 11, 30.5%) were experimental, (*k* = 9, 25%) were qualitative, and (*k* = 2, 5.5%) were mixed methods.

Regarding the risk of bias (Table 1, see also Annex 1, Table S1), the findings indicated that 24 of the included publications presented a low risk of bias, the risk of bias was moderate for three studies, high risk of bias was identified for four studies. An inter-rater reliability analysis was performed between the independent reviewer's scores. For this purpose, the weighted Cohen's Kappa was calculated, which is a measure of the agreements between two dependent categorical ratings. Cohen's Kappa values that are larger than .60 indicate strong agreement. The analysis showed that there was a moderate agreement between the two raters with κ = .69 (95 CI: [.42, .96]). No study was excluded on the basis of the quality assessment.

Table 1. Descriptive Information about the Original Research Included in Study 1.

First author, year	Build Food Environment structure	Population	Country	Study design & quality index (JBI)	Consumer's choice indicator in studies assessing consumer choices/ Indicators of actual availability in studies addressing the actual presence of APF in the environment (no choice indicators measured in consumers)	*Type of alternative proteins*
		N; gender; age				Associations between the types of environmental structures and APF choices by consumers
	Wet markets					-
No study identified						
	Street vendors					-
No study identified						
	Kiosks					-
No study identified						
	Mobile vendors					-
No study identified						
	Supermarkets					
						Plant-based alternative proteins
Brooker et al. (2022)		Not provided	Australia	Quantitative (Analysis of data from FoodTrack database); JBI = low	Actual availability in the subtype of the environment	The total number of alternative protein products in supermarkets between 2014 and 2021: 130% increase overall. Subcategories: plant-based meats (150% increase) and legume products (129% increase) increased, but the number of tofu products decreased over time. Across alternative protein products, 58% were available in 1 year only. On average, alternative protein products were available for 2.2 years; 62% of products collected in 2021 had not been collected before (Australia)
Grasso & Jaworska (2020)		Not provided	UK	Qualitative (language analysis) JBI = high	Actual availability in the subtype of the environment	In total, 38 hybrid (meat combined with plants) products were launched in UK supermarkets in 2016–20, and 12 of these products were available in 2020. The most popular hybrid meat products launched and sold in supermarkets were sausages, with 20 products launched, followed by meatballs (7 products launched), and burgers (6 products launched)
Gravely & Fraser (2018)		*N* = 24 participants	Canada	Qualitative (interviews)	Easiness to find APF	Shelf space in meters: supermarkets allocate a significantly higher amount of shelf space for animal-based protein (*M* = 131.9 m) compared to plant-based protein (*M* = 30.8 m)

				JBI = low	Actual availability in the subtype of the environment	Significantly more sales per meter shelf space within supermarkets for animal-based protein products (M = 0.71) than plant-based protein products (M = 0.36) A significantly higher proportion of animal-based protein products had sale and/or descriptive signage displayed at their point-of-purchase display (M = 32%) compared to plant-based protein products (M = 2%) Participants agreed that the meat, seafood, and dairy sections were the most "prominent" in-store, meaning they occupy the most space and are equipped with significant promotional signage advertising sales and/ or the quality of products. For the plant-based protein, consumers noted how many of the products were "hidden" around the store. The most common area for plant-based protein was in the grocery aisles of supermarkets (34%), although this area was disproportionately represented by packaged grains, legumes, nuts, and seeds. Plant-based meat substitutes were commonly clustered in the produce (i.e., fruits and vegetables) section of the store (44%), and plant-based dairy products were most commonly found in the dairy section of the store (41%). Aside from the produce section, the organics section was another location where plant-based proteins were clustered, although this was most important for the high-end conventional retail stores that had an expansive natural values section containing a high number of organic and premium products. Only about a third of the plant-based meat substitutes were placed on the same shelving unit as other meat products. The organization of plant-based proteins on the shopping floor was related to participant perceptions about the ease of locating these products. Participants rated it easier on a Likert scale to find animal-based protein (M = 4.67, SD = 0.65) than plant-based protein (M = 3.64, SD = 1.14, p < .01). The most common factor that participants communicated in determining the ease of finding a product was "consistency" in product location. Consistency relates to whether a product can be located between stores in the same section on the shopping floor. Several consumers indicated that plant-based sources of protein, especially plant-based meat analogues, were often not in the sections that they expected them to be and had difficulty finding these products in new shopping environments. By this, retailers want to "keep ahead" of consumers in anticipation of a rising demand for plant-based protein, but are simultaneously highly attentive to the engagement level of consumers. Supermarkets want to appear progressive by catering to the diverse tastes of their customers, but they are only willing to take a certain degree of risk in "pushing" new products onto consumers (slim profit margin, low shelf life) when innovating new plant-based meat substitute products, there's a "prove it to me first" mentality on the part of the supermarket. This finding underscores supermarkets,

						as relatively risk-averse entities that require sufficient demand signals before they are willing to incorporate more plant-based protein products onto their shelves. Sensitivity towards product organization: Keeping plant-based meat substitutes away from meat to satisfy the perceived concerns of vegetarians and vegans. Reserving prime retail space for "core" items like meat and dairy (including alternative proteins there would reduce retail incomes). Organizing plant-based protein in the natural values section to profit from price premiums.
Ortega et al. (2022)		*N* = 2015 participants; 51% women; M_{age} = 35 years old	China	Quantitative (online survey) JBI = low	Preferred location for the consumption Intention to pay	Plant-based protein: rather than at home, consumers preferred to eat APF away from home locations (e.g., restaurants, bars) or in supermarkets. Consumers were willing to pay more for APF, whereas those who usually shopped in cheaper domestic discount supermarkets indicated they would pay less for APF, which may be explained by the perceived higher quality of the products available in international chains.
						Insect-based alternative proteins
Menozzi et al. (2017)		*N* = 109 participants; 61.9% women; M_{age} = 23.6 years old	Italy	Quantitative (survey, semi-structured questionnaire, tasting session, content analysis, TPB questionnaire) JBI = low	Intention to eat	Perceived lack of availability in the supermarkets was a barrier, reducing the intention to eat a product containing insect flour.
Reverberi (2021)		Not provided	Not provided	Qualitative (interviews) JBI = high	Trust and confidence	Packaged processed insect (PPI)- based products. The interviewed companies confirmed that insect-based products perform better through physical retailers than e-commerce. Between 2015 and 2018, start-ups focused on e-commerce. PPIs still need to win consumer trust. The best approach is an exposure on the shelves of supermarkets or corner shops. However, traditional food retailers expect products to sell quickly, which might be challenging. But, obtaining shelf exposure will improve consumers' emotional confidence in PPIs. Consumers tend to trust a supermarket chain more than an online shop. Until PPIs are widely distributed in normal retail points of purchase, consumers will not fully embrace them as credible and safe.
	Hypermarkets					-
No study identified						
	Other retailers (groceries)					
						Plant-based alternative proteins

Drake & Gerard (2003)		Participants recruited from university campus: *n* = 388; 45% women; Participants recruited in a grocery store: *n* = 159; 77% women Age range between 18 and 45 years old	USA (Mississippi)	Quantitative (experiment) JBI = low	Self-reported purchases by the consumers	Higher intake among students who purchase food in groceries compared to those who buy their food on university campuses
Weinrich & Elshiewy (2023)		*N* = 938 participants; 51% women; Age range between 16 and >56 years old	Germany, France, Netherlands	Quantitative (survey) JBI = low	Consumers' attitudes and beliefs (e.g., about healthiness, sustainability, etc.); Self-reported purchase by the consumers	Perceiving microalgae-based food as healthy, sustainable, and nutritious was unrelated to habits of shopping in specialty food stores among consumers from France, Germany, and the Netherlands (men and women subsamples).
Vandenbroele et al. (2021) (2 studies)		Study 1: *N*<100,000; Gender not provided Study 2: *N* = 231 participants; Study 1: Gender not provided Study 2: *n* = 111 males	Belgium	Quantitative (field experiment & experiment 2x2 mixed models design) JBI = low	Actual sales of products	Presentation of plant-based alternative foods in large groceries In the month preceding the intervention, which was used as a pre-intervention period, the meat product was offered in the butchery, and the meat substitute was available on a separate, vegetarian shelf in the vegetables and fruits department. This pre-intervention period reflects the default choice architecture. Then, during the one-month intervention period, the meat substitute remained on the vegetarian shelf but also appeared in the butchery, pairwise with the meat product and in proximity to other sandwich offerings containing meat. No intervention took place in the eight control stores; the meat and meat substitute options were offered separately. The control stores were all branches of the same retail chain, with similar layouts and assortments. The control stores' data helped rule out environmental influences (e.g., promotions of products in the same category). Meat substitute sales were higher in the experimental store during the intervention period. The sandwich department in the hypothetical retail store, established in a university lab, consisted of two refrigerators, placed back-to-back; only one was immediately visible to the participants as they entered the lab. In each condition, an equal number of products appeared in both fridges. All meat substitutes were presented next to their meat-based alternative, such that each fridge contained two pairs. In the control condition, the meat and meat substitutes were in different fridges.

						Four products were placed in the immediately visible fridge to create a high product visibility condition. The four remaining products, situated in the fridge that was not immediately visible, represented the low visibility condition. Accordingly, visibility was not a between-subjects factor because all participants were exposed to eight products, of which four were high in visibility and four others were low in visibility. Main effect of visibility: Higher visibility led to more purchases of meat substitutes. The main effect of the pairwise presentation was also significant, with more meat substitutes sold in such a presentation mode
Aaslyng & Højer (2021)		*N* = 395 participants; 78% women; Most participants were between 18 and 29 years old	Denmark	Quantitative (online survey) JBI = low	Satisfaction with plant-based proteins	Perceived availability of plant-based alternatives in groceries where food is usually purchased was related to satisfaction with plant-based proteins.
Clark & Bogdan (2019)		*N* = 410 participants; 55.1% women; Most participants were between 55 and 75 years old	Canada	Quantitative (online survey) JBI = low	Intention to eat Intention to buy	When asked about the key barriers to trying new plant-based alternative proteins, 25% of respondents indicated "not available where I buy food." Also, those who intended to buy such food claimed that the availability was low. While 42.7% of respondents likely to purchase new protein alternatives identified the lack of availability as a factor in their decision-making, this was statistically higher when compared to respondents who were undecided (19.5%) or unlikely to buy them (10.1%).
						Insect-based alternative proteins
Baker et al. (2016) (3 studies)		Study 1: *N* = 221 participants Study 2: *N* = 200 participants Study 3: *N* = 201 participants Study 1: 43% women Study 2: 38% women Study 3: 47.8% women M_{age} = 35 years old	USA	Quantitative (experiment) JBI = low	Intention to buy	No major differences in intention to purchase, expected liking/ attractiveness: Products in a grocery with visible insects on the package vs. pictures of insect-based powder + a name in Latin.
Collins et al. (2019)		*N* = 1020; 65% women in online survey; Age range between 12 and 90 years old	UK	Quantitative (survey) JBI = low	Intention to buy Intention to pay	Regular green shoppers were more likely to choose food with insects invisible. High frequency of green shopping was a predictor of willingness to pay for insect-based foods

Herbert & Beacom (2021)		*N* = 105 survey respondents; Age range between 18 and 62 years old	Ireland	Mixed methods (focus groups, survey) JBI = low	Self-reported indication for the preferred location where the product should be available	53% (the largest group) indicated that insect-based products should be sold in convenience stores/petrol stations.
Porretta et al. (2019)		*N* = 106 participants; *n* = 71 women;	USA and Canada	Quantitative (experiment) JBI = high	Self-reported indication for the preferred location where the product should be available; Intention to buy	People > 50 years old were more likely to buy insect-based food if it was available in many kinds of food stores/retail (relevant for men only)
	Farmer's markets					
						Insect-based alternative protein food
Porretta et al. (2019)		*N* = 106 participants; *n* = 71 women	USA and Canada	Quantitative (experiment) JBI = high	Self-reported indication for the preferred location where the product should be available; Intention to buy	People > 50 years old were more likely to buy insect-based food if it was available from local producers in small farmer's markets.
						Various novel alternative protein food, including insect-based and plant-based alternative proteins, or alternative proteins from any other sources (e.g., fungi, bacteria)
Aerni et al. (2011)		*N* = 3275 participants	Switzerland (Zurich and Lausanne)	Quantitative (experiment) JBI = low	Actual sales of products	Genetically modified novel food based on corn: Lower sales at a local food market/farmers market in the center of the city than at the railway stations [in Zurich and Lausanne, Switzerland].
	Restaurants					
						Plant-based alternative protein food
Bogueva et al. (2022)		*N* = 36 participants; males only (Generation Z and Millenials)	Australia	Qualitative (semi-structured in-depth interviews) JBI = low	Likelihood of visiting a location where APF is sold	Young daily meat-eating men: Vegan burgers are seen as a new trend for which people are prepared to stay in a queue to have that novel experience (social pressure – presenting oneself as being a part of this new experience) "happy to line up with other men." "restaurants serving plant-based alternatives are becoming an arena of social change and an important turning point in the transition toward making more ethical and sustainable food choices while connecting with the people you love." However, "Sharing food selfies on social media from the vegan restaurant is seen as a formula for trouble and irreversible image destruction." (it's all about masculinity)
Michel (2020)		*N* = 1039 participants; 51%	Germany	Quantitative (survey)	Acceptability	For omnivores and flexitarians, the acceptance ratings for eating plant-based meat alternatives during business lunches at restaurants were low.

		women; Age range between 20 and 69 years old		JBI = low		
Ortega et al. (2022)		*N* = 2015 participants; 51% women; M_{age} = 35 years old	China	Quantitative (online survey) JBI = low	Self-reported purchase by the consumers	This study found a similar intake of alternative protein-based food in establishments for food away from home consumption (e.g., restaurants) vs. at home vs. at supermarkets. Similar purchase and intake of alternative protein-based food in establishments for food away from home consumption (e.g., restaurants) vs. at home. Consumption that takes place in away-from-home food establishments (in China), which are often seen as an extension of at-home cuisine; and it's further fueled by the recent increase in the availability of alternative meat products in restaurant settings.
Palmieri & Forleo (2021)		*N* = 257 participants; *n* = 148 women; M_{age} = 36 years old	Italy	Quantitative (web-based survey) JBI = low	Self-reported purchase by the consumers	Those who have the opportunity to find it on a menu are more likely to purchase and consume algae-based food
Perez-Llorens (2020)		Not provided	Not provided	Qualitative (overview) JBI = moderate	Consumers approval of a specific cuisine	The world's most-celebrated chefs have 'discovered' or 'rediscovered' microalgae and their potential to be included as ingredients in their cuisine. Microalgae have been incorporated in their menus for a growing audience of consumers voracious for novelty and who identify with the chef's discourses and philosophy about sustainability, ethnicity, authenticity, or exotic nature. As has already happened with seaweeds, avant-garde restaurants can popularize the use of microalgae as an additional ingredient in casual or mid-range restaurants as well as home cuisine
Weinrich & Elshiewy (2023)		*N* = 938 participants; 51% women; Age range between 16 and >56 years old	Germany, France, Netherlands	Quantitative (survey) JBI = low	Consumers attitudes and beliefs (e.g., about healthiness, sustainability)	Perceiving microalgae-based food as healthy, sustainable, and nutritious was related to more frequent dining out/going to restaurants with friends and family among Dutch women, but it was related to less frequent dining out with family and friends among Dutch men and German men. No association were observed for French consumers, both men and women, nor for German women
						Insect-based alternative protein food
Ali & Ali (2022)		*N* = 702 participants; 37.7% women; Age range between 26 and 35 years old	USA	Quantitative (online survey) JBI = low	Intention to (re) visit restaurants	Low risk perception (e.g., getting ill) and low tension/anxiety while eating respective types of foods related to higher intention to visit restaurants
Baker et al. (2016)		Study 1: *N* = 221 participants Study 2: *N* = 200 participants	USA	Quantitative (experiment) JBI = low	Intention to buy	Restaurant customers indicated a preference for insects being invisible: lower intention to purchase, lower expected liking, and lower attractiveness were found for food with visible insects compared to food without visible insects and a vague description of insect-based ingredients.

		Study 3: N = 201 participants Study 1: 43% women Study 2: 38% women Study 3: 47.8% women M_{age} = 35 years old				A lack of visible insects in a restaurant served meal was related to low perceived risks
Bisconsin Junior et al. (2022)		N = 780 participants; 52.3% women; Age range between 18 and > 51	Brazil	Qualitative (interviews) JBI = low	Self-reported indication for the preferred location where the product should be available	Open-ended questions regarding "how would you eat food made with edible insects?". The majority states – "with an expert", followed by: "in a restaurant", and "with someone who knows how to prepare it"
Florença et al. (2021)		N = 213 participants; 79% women; Age range between 18 and > 66 years old	Portugal	Quantitative (online questionnaire) JBI = low	Actual availability in the subtype of the environment, e.g., restaurants	"Some European gourmet restaurants use edible insects in culinary preparation" – only 31% agree
Hwang et al. (2020)		N = 448 participants; 49.8% women; M_{age} = 38 years old	South Korea	Quantitative (web-based questionnaire) JBI = low	Consumers attitudes and beliefs (e.g., about healthiness, sustainability)	Being an environmental advocate (ability to convince others to act for environment conservation) was related to a better image of the insect restaurants. A positive image of edible insect restaurants was related to a higher intention to eat insects
						Various novel alternative protein food, including insect-based and plant-based alternative proteins, or alternative proteins from any other sources (e.g., fungi, bacteria)
Cai et al. (2021)		N = 20 participants; 20% women	USA	Qualitative (in-depth interviews) JBI = low	Self-reported indication for the preferred location where the product should be available	- Restaurant image building (destination for sustainable leisure and entertainment, growing media recognition) - Restaurant promotion (attractiveness of pushing boundaries with unusual ingredients, encouraging customers to try novel food (including various types of APF) in small portions; no charges if the meal is not satisfactory; online demonstrations by chefs; promotional strategies giving customers a greater sense of freedom of choice); - Name ambiguity of meals with insects (language toning down unusual origin, e.g., insects); - Deliberate beautification in presentation – garnishing to obscure ingredients and reduce neophobic tendencies
Schwark et al. (2020)		First Round: N = 60 participants	Asia, Europe, South America,	Quantitative (questionnaire)	Self-reported indication for the preferred location	Alternative proteins (insect and plant-based): Haute cuisine restaurant trends predictions by expert panels (selected based on their entry on the official Guide Michelins website).

		Second Round: *N*= 22 participants First Round: 81.7% males, 10% women; Second Round: 90.9% males, 9.1% women	North America	JBI = moderate	where the product should be available	It is predicted that vegetable and insect-based proteins will be served rather than in vitro/cultivated meat. The experts expect that the trend towards local food will continue and that ingredients from distant regions will not play a more important role
Motoki et al. (2022) (3 studies)		Study 1: *N*= 117 participants; Study 2: *N*= 108 participants; Study 3 = 120 participants Study 1: *n* = 47 women; Study 2: *n* = 46 women; Study 3: *n* = 56 women M_{age}= 41 years old	Japan	Quantitative (experiment) JBI = low	Intention to eat	Plant-based and insect-based meat replacements – higher willingness to try at a food festival, followed by a restaurant (lower at home, café, bar, pub)
Institutions and public procurement: schools						
Borkowski et al. (2020)		Not provided	USA (New York)	Quantitative JBI = low	Actual availability in the subtype of the environment, e.g., schools	Number of times plant-based meat alternatives were provided for lunch at schools (kindergarten to 8th grade): In public schools, they were not offered (hot breakfast or lunches), while meat was available every day. In private schools, they were offered an average of 0.7 days out of 5 days per week (with various types of meat offered on the remaining days)
						Insect-based alternative protein food
Jones (2020)		*N*= 187 participants; Age range between 7 and 14 years old	UK	Mixed methods (pre- and post-questionnaire, interview, observation during workshops)	Intention to eat	Workshop at schools (45 min) with an entomologist and a chef discussing reasons for insect consumption in the West, pros/cons, and featuring the tasting of two products. Pre-workshop self-reported willingness to choose insects for school lunch stood at 18-35%, while post-workshop, it increased to 45-60% (at least a 20% rise).

				JBI = moderate		
	Mobile vendors					-
No study identified						
	Online vendors					
						Insect-based alternative protein food
Reverberi (2021)		Not provided	Not provided	Qualitative (interviews) JBI = high	Trust and confidence	Packaged processed insect (PPI)- based products. The interviewed companies confirmed that insect-based products perform better through physical retailers than e-commerce. Between 2015 and 2018, start-ups focused on e-commerce. PPIs still need to win consumer trust. The best approach is an exposure on the shelves of supermarkets or corner shops. However, traditional food retailers expect products to sell quickly, which might be challenging. But, obtaining shelf exposure will improve consumers' emotional confidence in PPIs. Consumers tend to trust a supermarket chain more than an online shop. Until PPIs are widely distributed in normal retail points of purchase, consumers will not fully embrace them as credible and safe
Pippinato et al. (2020)		Not provided	Austria, Belgium, Denmark, Finland, France, Germany, Italy, The Netherlands, Norway, Spain, Sweden, UK	Quantitative (survey) JBI = high	Actual sales of products	Edible insect producers identified in 12 European countries primarily distribute their products through e-commerce (n = 48), with physical sales at farms, catering, and restaurants being less common (n =9). The total number of companies providing physical sales: n =11.
Herbert & Beacom (2021)		*N* = 15 focus groups *N* = 105 survey respondents Age range = 18-62	Ireland	Mixed methods (focus groups, survey) JBI = low	Self-reported indication for the preferred location where the product should be available	53 % (the largest group) indicated that insect-based products should be sold in convenience stores/petrol stations
Porretta et al. (2019)		*N* = 106 participants; *n* = 71 women;	USA and Canada	Quantitative (experiment) JBI = high	Self-reported indication for the preferred location where the product should be available	People > 50 years old were more likely to buy insect-based food if they were available in many kinds of food stores/retail (relevant for men only)
	Food festivals					

						Various novel alternative protein food including insect-based and plant-based alternative proteins, or alternative proteins from any other sources (e.g., fungi, bacteria)
Motoki et al. (2022)		Study 1: *N* = 117 participants, Study 2: *N* = 108 participants Study 3: *N* = 120 participants Study 1: *n* = 47 women Study 2: *n* = 46 women Study 3: *n* = 56 women M_{age} = 41 years old	Japan	Quantitative (experiment) JBI = low	Intention to eat Self-reported indication for the preferred location where the product should be available	Potential consumers asked about their preferred location to try insect-based food or novel food with plant-based alternative proteins reported that they are most willing to try it during a food festival, whereas significantly lower levels were reported for trying at home, restaurant, café, bar, or pub.
						Plant-based alternative protein food
Palmieri & Forleo (2021)		*N* = 257; *N* = 148 women; M_{age} = 36 years old	Italy	Quantitative (web-based survey) JBI = low	Self-reported indication for the preferred location where the product should be available Self-reported purchase by the consumers	Consumers who reported an opportunity to consume seaweed during a gastronomic event or a trip are more likely to buy and consume algae-based foods than those who did not participate in such events
	Vending machines					
						Plant-based alternative protein food
Garcia-Segovia et al. (2020)		*N* = 85; 27.1% women; Age range between 25 and 69 years old	Spain	Quantitative (pre-and post-questionnaire) JBI = low	Self-reported indication for the preferred location where the product should be available	Algae-based breadstick Participants indicated that it should be eaten as a vegetarian snack, sold from the vending machine (it was not perceived as a meal substitute or to be eaten with specific food only)

Note. Study design = Type of the study; JBI = Joanna Briggs Institute overall study quality index; Study quality values are reported as three levels of risk of bias: low risk, moderate risk, or high risk; APF = alternative protein food

3.2 Findings for the Formal Market Food Environment

3.2.1 Supermarkets

The characteristics of supermarkets linked with consumer choices of APF were reported in 6 studies (Brooker et al., 2022; Grasso & Jaworska, 2020; Gravely & Fraser, 2018; Menozzi et al., 2017; Ortega et al., 2022; Reverberi, 2021). Three studies discussed plant-based alternative proteins and three discussed insect-based proteins. All studies focused on the APF presentation in supermarkets, the period a specific product was available for sale, and the actual and perceived availability of the products.

The number of *plant-based alternative protein* products available in the supermarkets has been on the rise. For example, Australian data indicate a doubling of APFs (130% increase) between 2014 and 2021, with an increase of plant-based meat replacements (150% increase) and legume products (129% increase). However, the availability of tofu products decreased over time (Brooker et al., 2022). Most APF are available in supermarkets for an average of 2 years only (Brooker et al., 2022; Grasso & Jaworska, 2020). Sausages being the most popular plant-based meat replacement (Grasso & Jaworska, 2020).

Plant-based meat alternatives are exposed using lower shelf length (in meters) than other protein products. Plant-based APF products are placed in less prominent sections of supermarkets, thus they are perceived as "hidden". They are also less likely to have sales, quality, or promotion signage compared to traditional meat products (Gravely & Fraser, 2018). Plant-based meat alternatives were often placed in the produce (fruit and vegetable) sections or among high-end products (Gravely & Fraser, 2018).

Plant-based meat alternatives are perceived as difficult to locate in stores, especially compared to meat products. This difficulty in finding them is attributed to inconsistencies in their placement within and across retail chains (Gravely & Fraser, 2018). Supermarket retailers tend to await clear demand signals before introducing new APF products (Gravely & Fraser, 2018). Retailers believe that including APF in dairy and meat sections is expected to reduce supermarket profits, and placing APF-based meat substitutes away from meat sections may address the concerns of vegetarians and vegans (Gravely & Fraser, 2018).

Consumers who typically purchase protein products in upscale supermarket chains were willing to pay more for plant-based APF products (Ortega et al., 2022). In contrast, those who usually shop in discount supermarkets indicated a lower willingness to pay for APF products, possibly due to lower quality perceptions (Ortega et al., 2022). Consumers generally prefer to eat plant-based APF away from home locations (e.g., restaurants, bars) or within supermarkets (Ortega et al., 2022).

Regarding *insect-based APF products,* the focus of retail on e-commerce instead of supermarkets may constitute a barrier for consumers. To enhance consumer trust and confidence, widespread distribution of insect-based APF products in supermarkets and other groceries is recommended (Reverberi, 2021). Finally, consumers report that the lack of availability of insect-based APF is a barrier to the intention to eat (Menozzi et al., 2017).

3.2.2 Grocery Stores/Other Types of Shops Selling Food

The characteristics of grocery stores associated with consumer choices of alternative protein food were reported in 11 studies (Aaslyng & Højer, 2021; Baker et al., 2016 [study 1&3]; Clark & Bogdan, 2019; Collins et al., 2019; Drake & Gerard, 2003; Herbert & Beacom, 2021; Porretta et al., 2019; Weinrich & Elshiewy, 2023; Vandenbroele et al., 2021 [study 1&2]). Six studies discussed plant-based alternative proteins, five discussed insect-based proteins. The research focused on the APF presentation in retail points, perceived availability of the products, preference for the type of point of sale/retail, consumer shopping practices, including "green" shopping, specialty food shopping, and shopping off-campus (students).

A case-controlled experimental study provided evidence that the placement of *plant-based APF* on shelves with vegetarian food or in produce departments resulted in lower sales of APF, while higher sales occurred when placed in the meat section (Vandenbroele et al., 2021). Besides, an increase in APF sales was also obtained by

presenting sandwiches with plant-based APF in: (i) the same refrigerator, next to sandwiches with meat (compared to a separate refrigerator), or (ii) in the refrigerator visible from the shop entrance (versus with its back to the entrance) (Vandenbroele et al., 2021). Although the study by Vandenbroele et al. (2021) was conducted in grocery stores, the findings may have broader implications for various types of shops, including supermarkets.

Perceived availability of plant-based alternatives in locations where food is usually purchased was related to satisfaction with plant-based proteins (Aaslyng & Højer, 2021). Clark and Bogdan (2019) found that 25% of respondents indicated "not available where I usually buy food" as a key barrier to trying new plant-based alternative proteins. Furthermore, consumers who intended to purchase such foods claimed that the availability in their usual food shopping places was low (Clark & Bogdan, 2019). Availability was a significant factor for 43% of respondents likely to purchase new protein alternatives but less of a concern for those undecided (19.5%) or unlikely to buy such products (10.1%) (Clark & Bogdan, 2019).

The level of approval of plant-based APF was higher among customers who regularly shop in specialty food stores (Weinrich & Elshiewy, 2023). Students who shopped for food in groceries located outside of the university campuses were more likely to purchase plant-based APF than those who shopped on campus (Drake & Gerard, 2003).

Frequent "green shopping" in groceries was positively associated with a higher willingness to buy and expected liking of *insect-based APF*, as well as a greater willingness to pay for insect-based APF (Collins et al., 2019). Consumers indicated their preference for the availability of insect-based APF across different food sale points, such as groceries/convenience stores/petrol stations, and disagreed with a statement that this type of food should be available via e-commerce only or in specialty shops (Herbert & Beacom, 2021; Porretta, 2019). Research addressing how insect-based APF were presented in groceries indicated no major differences in intention to purchase, expected liking/ attractiveness among products in a grocery with visible insects on the package vs. pictures of insect-based powder and a Latin name (Baker et al., 2016). Noteworthy, the levels of intention to buy insect-based APF were relatively low (Baker et al., 2016; Collins et al., 2019; Herbert & Beacom, 2021).

3.2.3 Farmer's Markets

Only two studies have investigated the characteristics of farmer's markets linked with consumer choices of APF (Aerni et al., 2011; Porretta et al., 2019). Porretta et al. (2019) found that older consumers were willing to buy *insect-based APF* if available from local producers selling their products in small markets. In contrast, Aerni et al. (2011) reported that points of sale at railway stations in large cities (e.g., Zurich) sold more *plant-based alternative food* compared to small farmer's markets in the same cities.

3.2.4 Restaurants

Seventeen studies addressed characteristics of restaurants in relation to consumer choices of APF: Ali & Ali, 2022; Baker et al., 2016 [study 2&3]; Bisconsin-Junior et al., 2022; Bogueva et al., 2022; Cai et al., 2021; Florenca et al., 2021; Hwang et al., 2020; Michel et al., 2021; Motoki et al., 2022 [study 1&2&3]; Ortega et al., 2022; Palmieri & Forleo, 2021; Perez-Llorens, 2020; Schwark et al., 2020; Weinrich & Elshiewy, 2023. Six focused on plant-based APP, five dealt with insect-based APP, six discussed APF from various sources. The investigation dealt with a preference for restaurants as APF environments, a prognosis of availability by experts, consumer social norms conformity, creating restaurant image and restaurant promotion, and meal presentation (insect visibility).

Perceived availability of APF in the restaurant was identified as a determinant of consumers' decision to purchase *plant-based APF* in these restaurants. For example, consumers' perceptions that plant-based APF are easy to find in the restaurant menus were associated with a higher willingness to pay for this type of food (Palmieri & Forleo, 2021).

Research highlights the relevance of social norms and the social context in the consumption of plant-based APF in vegetarian/vegan restaurants (Bogueva et al., 2022). It was observed that young meat-eating men were more likely to eat plant-based APF burgers in vegetarian restaurants when encountering specific social cues, such as the

presence of other men queuing for a veggie burger or dining with a female romantic partner (Bogueva et al., 2022). Conversely, visiting such restaurants and portraying oneself as dining in a vegetarian restaurant on social media was seen as a threat to masculinity (Bogueva et al., 2022). In line with this, omnivores and flexitarians indicated low acceptance rates for eating plant-based APF while dining in a restaurant or during a business lunch with co-workers (Michel et al., 2022).

Research investigating haute cuisine restaurant trends suggested that expert panels (selected on the basis of their entry on the official Guide Michelin website) predict that alternative proteins (insect and plant-based) will become a strong trend in major European restaurants (Schwark et al., 2020). These experts anticipated that plant- and insect-based proteins would be served at a larger extent than in vitro/cultivated meat. Additionally, the trend towards using locally sourced ingredients is expected to continue, with distant region ingredients playing a less important role (Schwark et al., 2020).

Creating a positive social image for restaurants is a strategy to increase consumer interest in plant-based APF. Renowned chefs have recognized the potential of microalgae-based APF as ingredients in their cuisine (Perez-Llorens, 2020). Microalgae have been incorporated into their menus for a growing audience of consumers interested in food novelty and identifying themselves with a chef's discourses about sustainability, ethnicity, and authenticity (Perez-Llorens, 2020). Such celebrated restaurants may help popularize the use of plant based-APF in casual or mid-range restaurants as well as home-based dining (Perez-Llorens, 2020).

A higher frequency of eating in restaurants was related to a higher willingness to pay for plant-based meat alternatives (Ortega et al., 2022). A higher frequency of dining out/going to restaurants with friends and family among women was related to perceiving microalgae-based food as healthy, sustainable, and nutritious (Weinrich & Elshiewy, 2023). However, among men, a higher frequency of dining out/going to restaurants with friends and family was related to unfavorable perceptions of microalgae-based APF (e.g., perceiving limited healthiness or nutritional values of algae-based foods) (Weinrich & Elshiewy, 2023). Weinrich and Elshiewy (2023) also noted that frequency of dining out/going to restaurants with friends and family may not only differ depending on gender, but also depending on the country where study was conducted. The findings referring to the gender differences align with previous research indicating that higher masculinity is associated with lower acceptance of social eating situations (e.g., in restaurants), involving the consumption of non-meat products among men (Bogueva et al., 2022).

Consumers report that eating plant-based APF in more casual, private situations may be perceived as more appropriate than consuming this type of food during more celebratory occasions (Michel et al., 2021). These eating occasions may take place at home, or in pubs, bars, or restaurants. For omnivores and flexitarians, situations involving eating alone, with friends, or with the family on a weekday are perceived as the best (and equally appropriate) environment to eat plant-based meat alternatives (Michel et al., 2021). However, for both omnivores and flexitarians, eating plant-based meat alternatives for a family Sunday meal or going out for a barbecue party received a similar, low appropriateness rating (Michel et al., 2021). These findings, highlighting the influence of social norms and self-presentation during more celebratory occasions, are echoing similar findings obtained by Bogueva et al. (2022) who highlighted the influence of social norms on the purchase of plant-based meat alternatives in restaurants.

Restaurants were indicated as the second most preferred place where consumers reported their willingness to *try various types of novel food including insect-based, but also plant-based APF* (food festivals were the most preferred, and home, café, pubs, and bars were less preferred) (Motoki et al., 2022). The use of APF (both plant-based and insect-based) can serve as a strategic promotional tool for restaurants. This strategy may include aspects such as pushing boundaries with unusual ingredients, encouraging customers to try novel food in small portions, and offering no charges if the meal is unsatisfactory (Cai et al., 2021). Applying such strategies conveys a greater sense of freedom of choice to customers (Cai et al., 2021). A positive image of edible insect restaurants was related to a higher intention to eat insects (Hwang et al., 2020). Furthermore, being an environmental advocate (ability to convince others to act for environment conservation) was related to a better image of insect-serving restaurants (Hwang et al., 2020).

Regarding *insect-based APF*, restaurant customers generally prefer that insects were not visible in their meals. Studies have shown that the presence of visible insects led to lower intention to purchase, lower expected liking, and lower attractiveness of the food compared to food with invisible insects and a vague description of insect-

based ingredients (Baker et al., 2016). Restaurants serving insects often employ strategies such as name ambiguity for meals containing insects and a deliberate beautification in presentation (e.g., garnishing to obscure ingredients and reduce neophobic tendencies) (Cai et al., 2021). The absence of visible insects in restaurant-served meals was related to low perceived risks (Baker et al., 2016). In turn, low risk perception (e.g., getting ill) and low tension or anxiety while eating respective types of foods resulted in higher intention to (re)visit restaurants serving insect-based APF (Ali & Ali, 2022).

Restaurants are perceived as the preferred places to eat *insect-based* APF products. When asked about how they would eat food made with edible insects, majority of consumers stated: "with an expert", followed by "in a restaurant," and "with someone who knows how to prepare it" (Bisconsin-Junior et al., 2022). However, insect-serving restaurants were perceived as relatively rare with only 31% of consumers agreeing that some European gourmet restaurants incorporate edible insects into their food preparation (Florenca et al., 2021).

3.2.5 Schools

Research in school settings has been limited, with only two studies (Borkowski et al., 2020 and Jones, 2020) focusing on the availability of plant-based APF and the impact of school workshops among children aged 7-14 years old. Other institutions or public procurement environments were not investigated. These studies found that public schools did not offer *plant-based APF* for lunch, whereas private schools offered them less than once per week (Borkowski et al., 2020). Approximately a 20% increase in readiness to choose *insect-based APF* for lunch by children was observed after brief (45 min) workshops delivered at schools (Jones, 2020). Such workshops addressed the reasons for and context of eating insects, followed by insect-based APF tasting (Jones, 2020).

3.2.6 Online Vendors

Regarding online vendors, four studies discussed aspects associated with consumer choices of APF (Herbert & Beacom, 2021; Pippinato et al., 2020; Poretta, 2019; Reverberi, 2021), with all of them reporting on *insect-based APF* products. These studies explored the proportions of e-commerce usage (compared to physical points of sale) by retailers and consumer preferences for the different sale points.

Sales of insect-based APF predominantly occur through online retail channels, with European producers using e-commerce as a distribution channel five times more frequently than physical sale points (Pippinato et al., 2020). However, this strategy may have limitations in terms of consumer trust and credibility. To enhance consumer trust and credibility these products may need to be sold in supermarkets and local groceries, instead of focusing on e-commerce (Reverberi, 2021). When consumers were asked about their preference for the availability of insect-based APF across different food sale points, they generally disagreed with the idea that this type of food should be exclusively available through e-commerce (Herbert & Beacom, 2021; Poretta, 2019).

3.2.7 Food Festivals

Two studies (Motoki et al., 2022; Palmieri & Forleo, 2021) highlighted the significance of food events and food festivals as highly approved environments to try *plant- and -insect-based APF*. Regarding the willingness to try plant-based meat alternatives, consumers indicated the highest willingness to try at a food festival, followed by a restaurant (lower at home, café, bar, pub) (Motoki et al., 2022). Consumers who reported an opportunity to consume seaweed or algae-based food during a gastronomic event or a trip are more likely to consume *plant (algae)-based APF* than those who did not participate in such events (Palmieri & Forleo, 2021). Potential consumers asked about their preferred location to try *insect-based APF* reported that they are most willing to try it during a food festival, whereas significantly lower levels were reported for trying at home, restaurant, café, bar, or pub (Motoki et al., 2022).

3.2.8 Food Vending Machines

Research focusing on a specific type of food (algae-based breadsticks) suggests that customers consider this type of food a snack rather than a meal substitute, which should be sold from vending machines (Garcia-Segovia et al., 2020).

3.3 Informal Market Environment: Wet Markets, Mobile Vendors, Street Vendors, Kiosks, Vending machines, and Farmer's Markets

There is no evidence directly linking wet markets, street vendors, kiosks, mobile vendors, and European consumers' behaviors and intentions to buy/pay for *plant-based or insect-based APF*. It seems plausible that the European food market is mostly formalized due to national and European Union-level regulations referring to food safety, labeling, and quality, particularly those referring to novel foods (cf. European Commission Implementing Regulation, 2018/456 of 19 March 2018).

3.4 Summary of Findings: Structures in Built Food Environment and Barriers/Facilitators of APF Choices Operating in These Structures

The reviewed empirical evidence indicates an number of characteristics that are specific for the built food environment structures, such as supermarkets, groceries/other retail locations, farmers' markets, restaurants, schools, online vendors. Besides food environment structures proposed by Downs et al. (2020), we found that food environment structures such as food festivals or vending machines are also considered in research on APF choices of consumers. Thus, we suggest to extend the typology proposed by Downs et al. (2020), by adding these two types of structures which may be relevant for plant-based or insect-based APF choices. Due to very limited evidence for the associations between the built environment structures, barriers and facilitators that are associated with consumer choices of other types of alternative proteins (e.g., krill-based, bacteria-based, etc.), the proposed typology does not address APF other than plant-based or insect-based. This approach was chosen because across the original studies included in this review, 33 out of 36 referred to solely to plant-based APF or insect based APF.

Table 2 present our evidence-based proposal for build food environment typology, focusing on (i) the structures of the build food environment where consumers make APF choices, and (ii) barriers and facilitators for plant-based and insect-based APF choices, operating in the respective structures. A typology of food environment may merely list the potentially relevant environmental structures, but it may also include their characteristics that are associated with consumer choices of APF. Going beyond Downs et al. (2020), we propose that a build food environment typology should indicate evidence-based factors that hinder or facilitate consumer choices of plant-based APF (Figure 2) and insect-based APF (Figure 3), specifically.

Table 2 presents our evidence-based proposal for food environment typology, focusing on (i) the structures of the build food environment where consumers make APF choices, and (ii) barriers and facilitators for plant-based and insect-based APF choices, operating in the respective structures.

Table 2. Typology of Structures in the Built Food Environment and Barriers/Facilitators That May be Associated with Consumer Choices of Alternative Protein Food (APF).

Type of built food environment	Type of alternative protein	The barriers and facilitators operating in the built food environment associated with consumer choices of respective APF
Supermarkets	**Plant-based APF**	**Barriers:** 1. APF perceived by consumers as difficult to find (presented in less prominent sections, inconsistencies in exposition between different supermarkets shorter shelf length) 2. Barriers to availability may include retailers' beliefs (a) better to wait for high demand signals before increasing availability (b) including APF into meat or dairy sections will reduce supermarket profits (c) presenting APF far away from meat sections will satisfy vegetarians 3. Consumers willing to pay more for APF in international chains than in domestic discounts (perceived lower quality in discounts as a barrier)
	Insect-based APF	**Barriers:** 1. Retailers using e-commerce (instead increasing availability in supermarkets) may be a barrier to increase intake 2. Perceived lack of availability in supermarkets as a barrier to consumers' intention to eat **Facilitators:** 1. Consumers' trust/confidence in APF may be higher if APF widely available in supermarkets (instead of sales mostly via e-commerce)
Groceries/ other food retailers	**Plant- based APF**	**Barriers** 1. Selling APF from vegetarian or produce shelves/sections associated with lower actual sales; selling from meat sections – higher sales 2. Key barrier indicated by the consumers who intended to try/eat APF: "APF not available where I usually shop for food" (Note: consumers who are undecided to eat APF rarely indicate this barrier) 3. Availability of APF limited to specialty shops and e-commerce **Facilitators** 1. Selling APF sandwiches presented side by side with meat sandwiches (from the same refrigerators) results in higher sales of APF; the refrigerators visible from the shop entrance: higher sales of APF 2. Frequent 'green shopping' related to higher willingness to pay 3. Frequent specialty food stores shopping related to higher approval 4. Availability of APF across different food retail outlets (not only in specialty shops or via e-commerce) in line with consumers' preference 5. Purchase of APF more likely among students shopping for food outside of campus compared to those shopping for food mostly on campus
	Insect-based APF	**Neutral characteristic** 1. Similar (low) intention to buy perceived attractiveness regardless the types of packaging (with insect visible vs. insect powder+ a Latin name)
Farmers' markets	**Plant-based APF**	**Barrier** 1. Adult consumers are less likely to buy at small farmers' markets than at popular larger groceries (e.g., on their way home from work, at/near the public transportation stop)
	Insect-based APF	**Facilitator** 1. Older consumers willing to buy APF if they are available from local producers at local famers' market
Restaurants	**Plant-based APF**	**Barriers** 1. Young omnivorous men: being seen as APF consumer in a vegetarian restaurant as a threat for masculinity; lining up with other men or visiting with a female romantic partner may reduce this barrier 2. Beliefs about low social approval for eating APF a barrier for acceptance of eating APF in restaurants or eating at business lunches 3. Among men, high frequency of dining out at restaurants with friends (findings for Dutch and German men, but not French) may be a barrier **Facilitators** 1. Predictions of experts in haute cuisine: APF will be a strong trend in EU restaurants (together with local food)

Type of built food environment	Type of alternative protein	The barriers and facilitators operating in the built food environment associated with consumer choices of respective APF
		2. Creating a social image of a restaurant as promoting novel food; chef's discourse on sustainability and authenticity 3. Eating APF considered more appropriate in casual situations, (compared to more formal, celebratory occasions) 4. Consumers' ability to easily find the APF in menus related to higher willingness to pay 5. Restaurants are the most preferred or 2nd most preferred location where consumers are willing to try (versus cafés, pubs, bars, homes) 6. Higher frequency of eating out in restaurants related to higher willingness to pay
	Insect-based APF	**Barriers** 1. The majority (68%) of consumers believed insects are not served in gourmet restaurants **Facilitators** 1. Restaurants indicated as the most preferred environment to try insect-based APF. Preferably, "with an expert" and "someone who knows how to prepare it" 2. The image of a restaurant: being an environmental advocate 3. Insects invisible in the meal (in contrast to visible insects), name ambiguity, deliberate beautification and garnishing related to lower anxiety when trying new APF, higher attractiveness, and higher likelihood of buy and to eat APF
Schools	**Plant based APF**	**Barriers** Public schools not offering any APF for lunches
Online vendors	**Insect based APF**	**Barriers** 1. E-commerce 5 times more likely to be used as a distribution channel by the producers (versus physical locations for sales, e.g. groceries) 2. Consumers preferences for APF to be distributed in places where they usually buy their food (supermarkets, etc.) not mostly via e-commerce
Food festivals	**Plant-based APF**	**Facilitators** 1. Food events or food festivals perceived as the most adequate environment to try new APF (homes, cafés, pubs: less preferred) 2. Taking part in a gastronomic event or a trip
	Insect based APF	**Facilitators** 1. Food event or food festival perceived as the most adequate environment to try insect-based APF
Vending machines	**Plant-based APF**	**Facilitators** 1. APF sold as a snack from a vending machine

Figure 2. The Built Environment Barriers/Facilitators of Plant-Based Alternative Protein Food (APF) Choices by Consumers.

Figure 3. The Built Environment Structures and Their Characteristics Facilitating or Hindering Insect-Based Alternative Protein Food (APF)Choices by Consumers

4. Discussion of Study 1

Complementing the proposal of Downs et al. (2020) which lists environmental structures, the findings of this review provide a typology of the structures in the build food environment and their characteristics that can either promote, or hinder consumers' choices of APF products (see Table 2). The existing typologies of food environments (e.g., Downs et al., 2020; Lytle & Sokol, 2017; McKinnon et al., 2009) have suggested characteristics, such as food availability, affordability, convenience, promotion and quality (e.g., labeling, menu composition). These approaches account for *potentially* relevant characteristics and address the overall food composition in the respective structures of the built environment. In contrast, our approach proposes a typology of structures in the built environment that are matched with evidence-based characteristics associated with consumers' choices of specific types of food, namely alternative proteins.

Consistent with existing typologies (Downs et al., 2020; Lytle & Sokol, 2017; McKinnon et al., 2009) and systematic reviews (Bianchi al., 2018; Stiles et al., 2022) our study highlights that *availability* is the core characteristic of the built environment that facilitates consumers' choices of APF. Our review provides insights into the complex ways in which availability is shaped and how it influences the choices of different types of APF across different settings within the built food environment. Limited availability appears to constitute a common barrier observed across supermarkets, groceries, restaurants, and schools. Additionally, the availability of APF is a key aspect addressed in research related to the e-commerce food environment.

The *actual availability of APF* has received relatively limited research attention, and in some cases, there appears to be no or very limited actual availability of APF e.g., in public schools (Borkowski et al., 2020). However, research has shown that brief psychosocial interventions may substantially increase children's readiness to choose APF for lunch (Jones, 2020). Importantly, schools are built environment structures where dietary interventions have the potential to reach diverse populations with varying economic and social status or ethnic backgrounds, making them a promising avenue for reducing social inequalities (Swinburn et al., 2013). In contrast, the actual availability of APF is higher via e-commerce, which is five times more likely to be used as a distribution channel compared to other built environment structures (Pippinato et al., 2020). Barriers to wider actual availability in traditional retail settings include retailers' beliefs that increasing APF in supermarkets and selling them from the meat and produce sections will harm retail profits, and a perception that higher demand from consumers should occur before expanding the availability of APF (e.g., Gravely & Fraser, 2018). Contrary to these beliefs, research suggests that presenting APF in meat sections increases APF sales, whereas exposing them in sections for vegetarians/vegans reduces actual sales in grocery stores (Gravely & Fraser, 2018).

Limited a*vailability can* be *operationalized as consumers' perceptions of APF being difficult to find* in supermarkets (e.g., perceived as hidden; positioned in less prominent sections, inconsistencies between shops in sections where APF is sold, e.g., Gravely & Fraser, 2018), in restaurants' menus (Palmieri & Forleo, 2021), across the types of groceries where consumers declare they usually shop for food (Clark & Bogdan, 2019). Wider actual availability of APF through online vendors (e.g., Herbert & Beacom, 2021; Pippinato et al., 2020) is unlikely to compensate for a limited perceived availability in supermarkets or groceries, as consumers declare a preference for the availability of APF in places where they usually buy their food. It is possible that broader availability of APF in supermarkets and other grocery stores may increase the trust of consumers (Reverberi, 2021). In contrast, consumers tend to have less trust in food that is primarily available through e-commerce (Yang, 2023). Unlike well-established food products, consumer trust is one of the key determinants of decisions to buy and eat novel foods (Meijer et al., 2021). The lack of actual availability of plant-based APF at schools (e.g., Borkowski et al., 2020) may also result from low trust of consumers in novel foods, such as APF.

Concluding, a *vicious cycle of APF actual and perceived availability* includes retailers' beliefs (e.g., waiting for higher demand signals), retailers' actions (selling APF via e-commerce), and consumer's preferences for wider perceived availability in the built food environment where they usually shop for food (easy to find in restaurant menus, widely available in supermarkets, groceries).

Furthermore, the current systematic review highlights that *barriers and facilitators are specific for both the type of built environment and the type of APF (plant-based vs insect-based).* Regarding the type of the structures in built environment, our review indicates a number of specific social barriers and facilitators that operate in *restaurants*. First, restaurants are preferred locations to try novel foods for the first time (e.g., Bisconsin-Junior et al., 2022), possibly because consumers may perceive restaurants as places where experts prepare and serve food they can trust to consume (see Meijer et al., 2021). Second, the narrative created by chefs and the social image of restaurants promoting novel and sustainable foods (Perez-Llorens, 2020) may be a facilitator for trying APF in restaurants. Consumers' beliefs about the importance of the sustainability of APF are among the key individual-level predictors of consumer choices of APF (cf. e.g., Onwezen 2022). Third, social norms of masculine behavior among young meat-eating men may act as barriers, particularly in official or business settings or when dining with meat-eating male friends (Bogueva et al., 2022).

Food festivals or gastronomic events emerge as *specific types of food environment structures that may be relevant for trying APF* by consumers. Our review indicates that consumers perceive these types of environments as most preferred for trying new plant-based or insect-based APF (cf. Motoki et al., 2022; Palmieri & Forleo, 2021). Visiting food events or festivals may satisfy consumer needs of being adventurous, their curiosity or sensation seeking, which, in turn, are related to higher intention to try, higher attractiveness, and trying APF (Onwezen et al., 2022; Wendin & Nyberg, 2021). While food restaurants and food festivals, or gastronomic events may be the locations where consumers may *try APF, the adoption of regular intake of APF may depend on* structures, such as supermarkets and groceries, where consumers typically buy their food, and the associated barriers and facilitators within these structures (Clark & Bogdan, 2019).

The findings highlight that certain barriers and facilitators may be relevant in specific types of built food environments where consumers try new foods, but may not apply in environments where daily food shopping takes place. For instance, the lack of visible insects and the use of ambiguous names of insect-based APF in restaurants were found to facilitate consumer choice, likely by reducing anxiety and increasing the likelihood of trying this type of APF in restaurants (e.g., Cai et al., 2021). In contrast, the perceived attractiveness of insect-based APF remained consistently low regardless of insect visibility and package labelling of food sold in retail stores.

Our review also provides evidence for *differences in barriers and facilitators for consumers' choices of plant-based APF, compared to insect-based APF*. These differences are particularly evident when considering restaurants as built food environments. Social norms related to masculinity were identified as barriers to young men visiting vegetarian restaurants or buying and eating a plant-based APF in restaurants, or eating plant-based APF at business lunch (Bogueva et al., 2022; Michel et al., 2021). Previous systematic reviews on individual determinants of insect-based APF indicated that being a young male and having high sensation seeking were factors that facilitated a higher likelihood of trying insects (Kauppi, 2019). Therefore, it is possible that social norms referring to masculinity could actually form a facilitator of trying insect-based APF in restaurants among young men.

The food environment typology proposed by Downs et al. (2020) lists sustainability-related determinants of food choices that may be specific for the built food environment. The respective barriers or facilitators may include the amount of packaging, food waste, carbon footprint, local production, transparency of production practices. This systematic review did not identify empirical research that indicates links between the sustainability-related determinants and the consumers' choices of APF *in the context of the types of the built food environment*. Therefore, the sustainability-related determinants are not directly indicated in the proposed extension of the typology of the built environment and barriers/facilitators for APF choices. However, we found evidence for direct associations between sustainability-related factors and consumers' choices, presented in research which did not account for the built food environment context. For example, locality of the production of APF was related to a higher likelihood of consumers' APF choices; a review of original research addressing this association is reported in Study 2 of D.1.2. Furthermore, consumers' sustainability beliefs (e.g., beliefs that preventing climate change is important) were related to APF choices; a review of respective evidence is presented in D1.1.

This study has potential *implications for the practice of promotion of APF* choices. Our typology of the built food environment and its characteristics may be used in interventions targeting an initiation and adoption of intake

of APF, by indicating that some food environments may have a role in an increase of initial trying of APF (restaurants), while others are potentially relevant for regular maintenance (supermarkets). The results have implications for the APF promotion strategies, which may be adjusted to specific types of barriers/facilitators operating in specific structures of the built environment. Furthermore, the results referring to availability of APF may suggest changes in strategic considerations at the retailers' level (for example, a shift from sales via e-commerce to supermarkets). The results may also inform public health policies and interventions addressing the 'micro-environmental' food environment, helping to prioritize specific changes in the respective food setting (e.g., positioning APF in meat and produce sections in the supermarkets).

This study has multiple limitations related to the number, quality, and heterogeneity of the included studies. First, the number of studies we were able to identify was limited and replications across contexts (e.g., in different countries) are missing. Furthermore, most of the empirical evidence is based on correlation studies, while a limited number of studies used experimental design (n = 6); therefore, causal conclusions cannot be drawn. The included research used a broad range of indicators of consumer choices, ranging from intention (to buy or to try/eat) to actual intake. Factors that affect barriers and facilitators that affect intention may have limited effect on the adoption of a new consumer behavior and its maintenance over time, (Hagger & Luszczynska, 2014) because intention is only moderately associated with respective food intake (Mullan et al., 2014). The quality of 22.3% of the included studies was moderate or low, which is a further limitation for any conclusions. Furthermore, the applied methods of the systematic review had their limitations as well. The use of narrative synthesis and a lack of possibility to conduct a meta-analysis hindered the evaluation of the actual significance and strength of the relations between the characteristics operating in the respective types of the built food environment and the indicators of consumer choices. Due to very limited empirical evidence for other types of APF than plant-based and insect-based, the proposed extension of the typology for built environment does not provide insights into the characteristics of food environment that may promote or hinder mainstreaming krill-based, fungi-based, bacteria-based alternative proteins, or proteins from other sources.

5. Study 1: Conclusions

Concluding, despite the limitations, this study provides a novel insight into the types of built physical environments and their characteristics, including barriers and facilitators that may affect the uptake of novel foods developed with APF. We expand the food environment typology proposed by Downs et al. (2020), by providing an evidence-based list of barriers and facilitators of plant-based and insect-based APF choices by the consumers. In particular, our results indicate that perceived and actual availability is a common determinant, operating across the types of built environment. The results also indicated several determinants that are associated with consumer choices in specific types of built food environment: the ways food is presented in produce sections (supermarkets), consumer habits of green and specialty shopping (groceries), a mismatch between retailers' actions of making APF available in one type of environment (e-commerce) and consumers' preference for in another type of APF food environment (supermarkets, groceries). We also indicate that one type of a barrier/ facilitator, operating within one type of the built food environment, may form different associations with consumers' choices, depending on the type of APF (e.g., social norms referring to masculinity as a barrier for plant-based, but not insect-based APF in restaurants).

6. Study 2: Geographical Context of Consumer's Choices of Alternative Food Proteins: European Countries, Regions, Rural-Urban Differences and Locality of the Products

6.1 Introduction

Food systems, food environments, food production, and intake are usually discussed in the context of political and administrative units that are geographically defined, such as countries, states, regions, and cities (Arcaya et al., 2015; Boto, 2013; Vandecandelaere et al., 2009). These units represent populations residing in the same geographic areas exposed to similar risk and protective factors, including food policies, and distances to various built food environment structures (Arcaya et al., 2015). The geographically defined European units (countries, regions, cities, etc.) exhibit diverse cultural, political, and economic characteristics, which in turn shape consumer health behaviors, including nutrition, and overall health (Bambra et al., 2019). These differences contribute to health inequalities between countries, regions, cities, and urban and rural environments (Arcaya et al., 2015). In light of these variations, understanding differences in food environments and food systems across Europe's countries, regions, cities/rural areas represents the initial step toward reducing disparities and, in turn, promoting better health for all (Monfort, 2008).

The importance of geographical factors is highlighted in frameworks discussing key contextual factors that may determine the effectiveness of health promotion policies or interventions, including those addressing healthy and sustainable nutrition choices (Pfadenhauer et al., 2017). Moreover, geographical factors determine if the food system actors evaluate a policy or intervention as feasible and acceptable (see Pfadenhauer et al., 2017). Existing evidence suggests that considering the country, regions or cities (or a lower administrative unit) as meaningful categories is crucial in both health promotion research (Bambra et al., 2019) and research focusing on development of sustainable food systems (Pucci et al., 2021).

Numerous original research studies examining *consumers' choice indicators* of APF have investigated differences across geographical or political/administrative units in Europe (e.g., Banovic et al., 2022; Banovic & Sveinsdóttir, 2021; Barska, 2014; Grasso & Jaworska, 2020; Gomez-Luciano et al., 2019; Henn et al., 2022; Naranjo-Guevara et al., 2021; Piha et al., 2018; Ribeiro et al., 2022; Tzompa-Sosa et al., 2023; Weinrich & Elshiewy, 2023; Zabrocki, 2017). The consumer choice indicators in the context of APF fall into, namely: (1) Attitudes towards and perceptions of the physical and social environment, which either facilitate or hinder APF consumption or the APF product itself (i.e., its attractiveness, approval, acceptance, appropriateness); (2) intentions to act (e.g., intention to buy, intention to eat APF); (3) actual behavioral performance (e.g., buying APF, intake of APF). These categories align with theories of behavior change (e.g., Ajzen & Schmidt, 2020; Luszczynska & Schwarzer, 2020).

Although research on this topic is mounting, an overarching synthesis of the geographical differences in consumers' choice indicators is missing. Existing systematic reviews that have examined cross-European differences in consumers' choices of APF products have largely overlooked differences between administrative units (e.g., countries, regions, rural vs. urban environments). For example, Mancini et al. (2019) summarized methods and analyzed the determinants of consumers' choices within Europe as a single administrative unit. Siddiqui et al. (2022) reviewed consumers' acceptability of APF products related to individual countries, presenting between-country specificity based on data from one country without empirically evaluating differences between countries. Another review of consumers' choices of APF products and their determinants provided between-country comparisons using original studies with data collected in at least two countries, but provided limited comparisons between European countries, relying on only two original studies (Kröger et al., 2022). In conclusion, there is a pressing need for a synthesis of research testing the differences across European countries in terms of the indicators of consumers' choices of APF products.

Beyond cross-country differences in health determinants and health outcomes, there are well-documented regional differences within certain European countries (e.g., Germany and the United Kingdom), as well as rural-urban differences. These disparities may relate to economic development in the region, socio-economic position, and age of consumers (Bambra et al., 2019; Giannakis & Bruggeman, 2020). Moreover, the food environment may differ greatly across these geographical units. For example, research conducted in the Netherlands indicated that between 2004 and 2018, there was an increase in the number of supermarkets and food convenience stores in urbanized neighborhoods, while a decrease was observed in less urbanized areas (Pinho et al., 2020). While some original studies addressing consumers' choices of APF have taken into account regional and urbanization-related differences (Brandner et al., 2022; Bryant & Sanctorum, 2021; Florença et al., 2021; Henn et al. 2022; Szendrő et al., 2020), a synthesis of such evidence has not been presented thus far.

The geographical context factors also play a crucial role in the frameworks of local food systems (Deller et al., 2017). Local food systems are often presented as networks involving producers, intermediate food system actors, and consumers who, by prioritizing "local products," collectively contribute to the economic development of "local" communities, and promote a better environment by shorter producer-to-consumer supply chains (Deller et al.). However, the definition of "local food" is relative and may encompass a range of geographic definitions from a neighborhood to an entire country (Deller et al., 2017; Giovannucci et al., 2010). This broad concept can be translated into a country or a region within a country, or a geographical area spanning several countries. Conversely, other approaches propose more restrictive definitions of local food systems, defining them as systems in which foods are produced, processed, and retailed within approximately a 20 to 100 km radius (Kneafsey et al., 2013). Reviews on various types of local food products indicate that consumers are willing to pay more for local foods than non-local ones. Additionally, producers benefit from greater recognition, which, in turn, has positive economic implications for the local community (Enthoven & van den Broeck, 2021). Several studies investigating consumers' choice indicators have also taken into account the "local production" of APF products (Aaslyng & Højer, 2021; Brayden et al., 2018; Henn et al., 2022; Hoerterer et al., 2022; Porretta et al., 2019). However, there is currently no comprehensive synthesis of these findings.

6.2 Aims of Study 2

Using the methods of the systematic review, this study aims to synthesize empirical evidence for the geographical context factors as the source of differences in consumers' dietary choices of APF products. In particular, we explore: (i) differences and similarities across European countries; (ii) differences and similarities within regions of European countries; (iii) differences between rural and urban areas in developed countries, (iv) the associations between the "local" positioning of APF products in developed countries and consumers' choice indicators.

7. Methods of Study 2

7.1 Materials and General Procedures

This study was conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Page et al., 2021). The present study reports findings obtained in a search conducted in a larger systematic review (registered with the PROSPERO database; no. CRD42023388700) aimed at eliciting physical environment characteristics that are related to consumer's choices of APF.

7.2 Search Strategy

A systematic search encompassing 11 databases of peer-reviewed journals (Academic Search Ultimate, PsycInfo, PsycArticles Business Source Ultimate, Agricola, GreenFILE, Health Source: Nursing Academic Edition,

SocINDEX, MEDLINE, MasterFILE Premier, Academic Research Source eJournals) was performed using the EBSCO platform. The selected databases either have a multidisciplinary focus or cover fields related toeconomics and business, agriculture, medical sciences, and social sciences. The primary search was followed by separate searches in Web of Science and SCOPUS. Documents and articles published between the inception of the databases and March 2023 were included.

The search was conducted using a combination of three groups of keywords referring to: (1) APF (e.g., "seaweed*" OR "alga*" OR "insect*" OR "lupin*" OR "dry pea*" OR "chickpea*" OR "cow pea*" OR "pigeon pea*" OR lentil* OR "meat alternative*" OR "meat substitute*" OR "plant-based meat*" OR "meat analogue*"OR "rapeseed kernel protein" OR "mealworm protein" OR "krill protein" OR "microbial protein" OR "cultivated mushroom protein" OR "fermented fungal protein" OR "pea protein" OR "meat analogue*"); (2) physical environment, including geographical context variables allowing for conducting cross-country or cross-cultural comparisons, urban, rural environment, and investigation of locality, as well as physical environment variables (e.g., “cross-cultur*” OR “cross-countr*” OR “between-countr*” OR “between-cultur*” OR “across-countr*” OR "urban" OR "local sale" OR "food outlet*" OR "food store*" OR "workplace" OR "rural" OR "suburban" OR "transport" OR "geograph*" OR "neighborhood*" OR "neighbourhood*"); and (3) consumer or behavior-related (e.g., "intake" OR "food" OR "consume*" OR "eat" OR "sale" OR "purchase" OR "buy*" OR "sell*"). The keywords were selected based on existing reviews on APF (Biasini et al., 2021; Mancini et al., 2019; Nguyen et al., 2022), the food environment typology by Downs et al. (2020) (terms included to investigate the built environment in a local community, See Study 1 in D1.2), geographical context variables investigated in geography of health inequalities such as country, region, urban vs rural area (cf. Arcaya et al., 2015) and frameworks for research on changing consumer behaviors (Pfadenhauer et al., 2017). Additionally, the keyword selection process involved consultation with researchers from the fields of consumer sciences, food sciences, and nutrition within the LIKE-A-PRO consortium. For this review, we employed a broad and inclusive search string (e.g., applying multiple terms that could represent the investigated factors, using only basic operators [AND, OR], and applying no specific limits) that could be used across the databases. The feasibility of this search strategy was pretested across the selected databases before initiating the search. The decision to use this broad search string aimed to maximize the number of identified articles and increase the likelihood of including relevant documents during the initial stages of the screening process.

To secure the robustness of the search, the systematic search was complemented by: (1) Manual reference searches: We conducted manual searches of the references of retrieved full-text original studies that were assessed for inclusion. (2) Complementary searches in Google Scholar: We conducted a search in Google Scholar using the same keywords as those used in the databases were conducted. (3) CORDIS and Open Research Europe (ORE) Databases: We searched these two databases which host open peer-reviewed documents reporting results from the European Union’s Horizon2020 and Horizon Europe research projects. The search was performed using ‘alternative protein’ keywords (the keywords used were modified as CORDIS and Open Research Europe impose limits for the length of search strings, allowing for up to 50 characters).

7.3 Inclusion and Exclusion Criteria

The following inclusion criteria were applied: (1) peer-reviewed English-language original quantitative or qualitative studies, (2) studies addressing alternative protein-based food, including land or sea plant-based protein, including microalgae-based proteins, insect-based protein (any type of insects used in the production of food), APF based on any other alternative protein sources, such as krill, bacteria, or fungi, etc.; and (3) studies investigating differences in consumers’ choices of alternative protein in at least two European countries, or (4) studies investigating differences in/effects of urban, suburban, rural areas, or studies investigating the effects of the locality of production of an alternative protein product on a consumer choice indicator, (5) studies that assess a consumer choice indicator in the original research, such as perceptions of availability, intention to buy, intention to eat, actual intake, or actual sales.

The exclusion criteria were: (1) documents that do not report any original data, including reviews or position papers, (2) dissertations, protocols, conference materials, and book chapters, (3) studies focusing solely on a reduction of meat intake without investigating how proteins could be supplemented in diet by APF products, (4) studies focusing on increasing fruit and/or vegetable intake without specific data on plant-based protein sources, (5) studies accounting for countries located in Asia, Africa, or South America, entailing locally collected wild-living insects and their local consumption or local retail, (6) studies comparing consumer choices in only one European country with a consumer choice indicators in a country in Asia or Africa, or South America (no within-European countries comparisons), (7) studies involving "novel food" without an indication that the food is made from/with alternative protein sources, e.g., novel drinks based on sea buckthorn, collection/sales of wild forest mushrooms, (8) studies addressing consumers' choices on alternatively grown beef, poultry or pork meat (e.g., laboratory based, in-vitro grown), without any added any alternative (other than laboratory grown meat) proteins added, (9) studies investigating APF products as supplements or as animal feed.

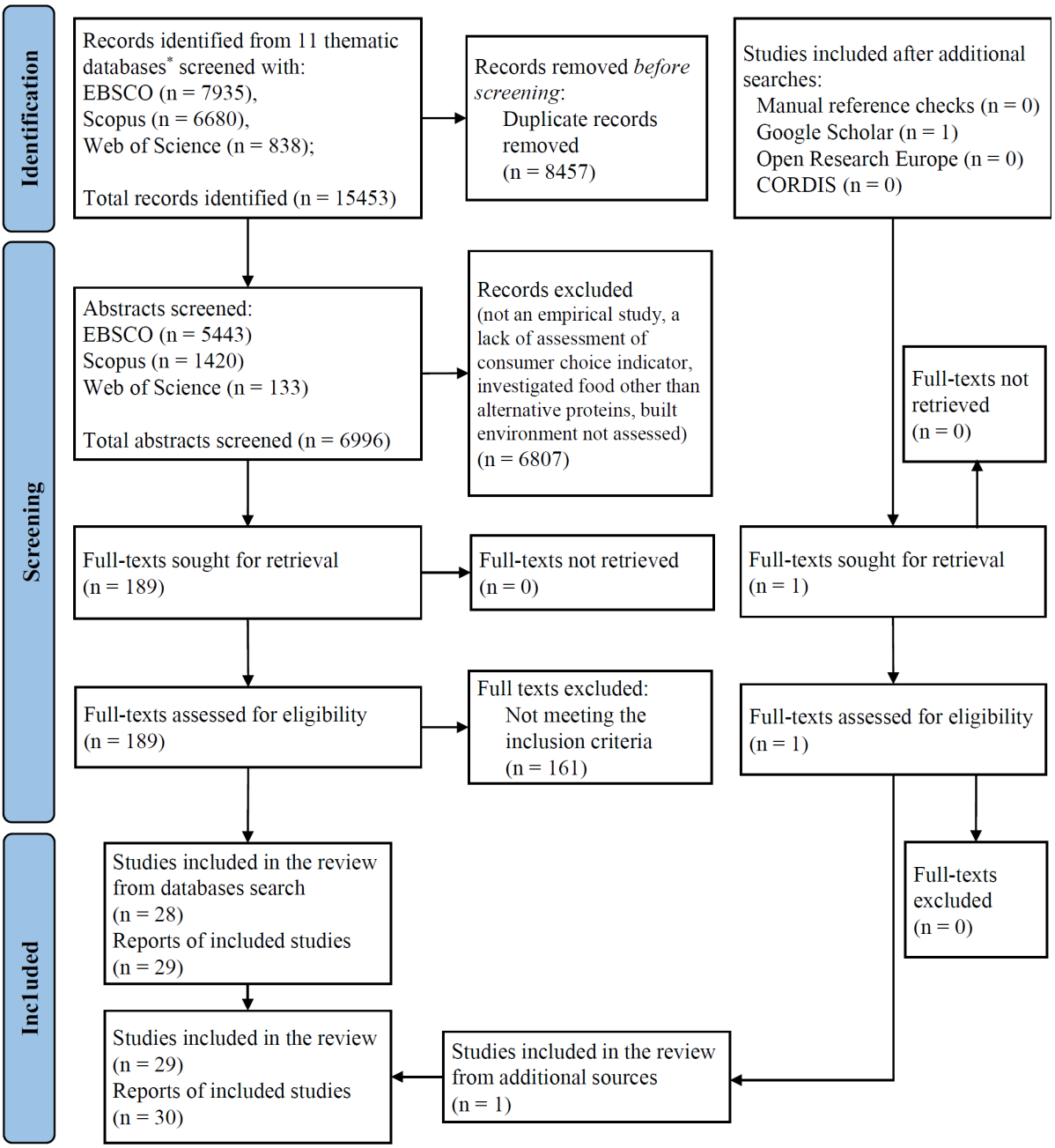
7.4 Data Collection and Extraction

Figure 4 presents the details of the data selection process. The initial search yielded k = 7,935 records obtained in searches of 11 databases using EBSCO search engine, k = 838 in Web of Science, and k = 6,680 in Scopus. All identified abstracts were screened by two researchers (randomly assigned from a group of five researchers, HZ, EK, ZS, MS, and AB) to elicit potentially relevant studies. Any conflicts related to the potential inclusion of a document were resolved through discussions with a fourth researcher (AL). Next, three researchers (AL and two researchers randomly assigned from a group of five, HZ, EK, ZS, MS, AB) independently read the full-text versions of the articles and determined their alignment with the inclusion criteria.

Additional searches for any other papers reporting original peer-reviewed studies, beyond those identified in the database search, involved the following strategies: screening references of the articles evaluated for inclusion (conducted by two reviewers independently (PC and TP), searches in Google Scholar (conducted independently by HZ and AL) and searches in CORDIS database and Open Research Europe database (conducted by AL). Overall, the search process and evaluation of all studies resulted in the inclusion of 30 articles reporting 29 independent studies (two articles were reporting the same study) (see Figure 4).

To address the study objectives, the following data were extracted (see Table 3): characteristics of the studied population; the country where data was collected; the location within the country (rural vs. suburban vs. rural; an indicator of locality); the design of the original study and the methods used to collect data; the type of APF investigated; the indicators of consumer choice; the key results.

Data extraction and coding were conducted by two researchers (HZ and AL). Any disagreements during these stages were resolved through a consensus method, which involved searching for possible rating errors, followed by discussion and arbitration by a third researcher, AB (Higgins et al., 2022).



*Academic Search Ultimate, PsycInfo, PsycArticles Business Source Ultimate, Agricola, GreenFILE, Health Source: Nursing Academic Edition, SocINDEX, MEDLINE, MasterFILE Premier, Academic Research Source eJournals

Figure 4. The manuscript flow in Study 2.

7.5 Data Coding

Data retrieved from each original study were coded into three categories: (1) type of APF products, (2) geographical context variables (countries, regions within countries, living in urban vs. rural environment, locality), (3) type of consumer choice indicator.

The APF *products* were coded into the following categories, based on protein sources (Grossman & Weiss, 2021): (1) food developed with land or sea plant-based protein (including microalgae-based proteins); (2) food including or made of insect-based protein (encompassing any type of insects used in the food production). Within plant-based alternative proteins, we distinguish a sub-category of food developed with a combination of plant-based proteins and meat. These products were categorized as plant-meat hybrid foods, including food developed by

combining meat products (pork, beef, poultry) with plant protein sources, with a proportion of 50-50% or 25-75% of respective types of sources; (3) food including or made of other types of alternative protein sources, such as krill, bacteria, or fungi.

The *geographical context variables* referred to macro-level factors representing a broader physical, social, and political environment, as well as access to services (e.g., as proposed by the CICI framework, Pfadenhauer et al., 2017) and included country, regions within countries, urban vs. suburban vs. rural environment, locality of the production/sale of the alternative protein products.

The *consumer choice indicators* included three broad types of variables used in research on behavior determinants, as seen in theories such as the theory of planned behavior (Ajzen & Schmidt, 2020) or social cognitive theory (Luszczynska & Schwarzer, 2020). These include (1) attitudes towards/perceptions of the physical and social environment or the food product itself (i.e., its attractiveness, approval, acceptance, appropriateness), (2) intentions to act, and (3) the actual performance of a behavior. The indicators of relevant perceptions or attitudes included: acceptability of foods, perceived availability of foods, consumers' approval or liking of food, and preference for the point of sale (or the type of environment where the food is sold). According to behavior change theories, attitudes, beliefs, and perceptions may refer to the consumers themselves (e.g., perceived capabilities, skills, or emotions). These types of perceptions, not referring to the physical environment directly, were not considered as consumer choice indicators but rather as individual characteristics of a consumer that determine other consumer choice indicators and, therefore, were excluded. The separation of perceptions of /beliefs about the environment from beliefs/perceptions of oneself is used in theoretical approaches focusing on environmental versus individual determinants of other human behaviors (c.f., the model of four domains of active living, Sallis et al., 2006).

The intentions to act encompassed variables such as intention to eat (e.g., the behavior change models such as the theory of planned behavior, Ajzen & Schmidt, 2020), intention/willingness to pay, and intention/willingness to buy (e.g., Lu & Hsee, 2019).

The actual behaviors included variables related to the actual consumption of the food in the study location, the actual purchase by a consumer, sales of a product in the study location/food environment type, and visiting the location selling alternative protein food products.

7.6 Risk of Bias and Quality Assessment

Pairs of two researchers (PC and TP or AB and MS) independently rated the potential risk of bias related to the quality of each included study using the Joanna Briggs Institute Critical Appraisal Tool (Moola et al., 2020) for cross-sectional studies. This tool was selected because it is suitable for evaluating both qualitative studies and quantitative cross-sectional research (there were no longitudinal studies included, whereas only $k = 3$ experimental studies were included). Each study was evaluated along eight criteria, followed by an overall quality evaluation (good, fair, or poor). The obtained scores are reported in Table 3 (see also Annex 1, Table S1). Studies were scored based on the responses to the critical appraisal questions (Yes = 2 –the criterion met completely, No = 0 – the criterion was not met, Unclear = 1 – some information on the criterion was provided but there was no complete clarity or information was inadequate in order to make a judgement). Any discrepancies in ratings were resolved through discussion or by involving the third researcher (AL). The overall risk of bias for individual studies was determined using the following cutoffs: low risk of bias – at least 70% of answers were 'yes', moderate – 50 to 69% of answers were 'yes', and high risk if the scores were below 50%.

7.7 Data Analysis

The included material in this review exhibited heterogeneity in terms of the countries compared, consumer choice indicators, and types of APF (see Table 3). Additionally, there was a limited number of comparative studies between any pair of countries (e.g., Spain vs. Germany). Given this, a meta-analysis was not deemed appropriate. Meta-analysis is typically considered when a group of studies demonstrates adequate homogeneity between

participants, conditions, and outcomes to provide a meaningful summary. According to the Cochrane guidelines for systematic reviews (Higgins et al., 2022), if there is substantial diversity, a qualitative approach combining studies is appropriate.

We employed a narrative synthesis method based on the Economic and Social Research Council guidance on narrative synthesis (Campbel et al., 2019; Popay et al., 2006). The narrative synthesis process consists of several key steps. First, it uses a theoretical model to provide the underpinnings for the analyzed patterns of associations (Campbel et al., 2019; Popay et al., 2006). In this review, we drew from health determinants and inequality frameworks, indicating that macro-level geographical factors explain differences in various health indicators in European populations (Arcaya et al., 2015) including indicators of dietary changes. This study also uses the CICI framework (Pfadenhauer et al., 2017), suggesting that the geographical context categories should be taken into account in any research that discover ways to promote better health outcomes, including an uptake of a healthier diet. Second, the preliminary synthesis should be provided, including an initial description of the results of included studies (e.g., their textual description, forming data into a common rubric characterizing the studies, tabulation) (Campbel et al., 2019; Popay et al., 2006)). In the present review, we grouped studies along the three categories (type of food product, the geographical context variable, and the consumer choice indicator) and provided an initial description of the results in the form of a table and textual synthesis. The third step of the narrative synthesis accounts for exploring the relationships in the data by examining emerging patterns that allow the identification of patterns of associations and provide explanations of differences in the direction of associations. This may be achieved through the analysis of emerging cluster groups, conceptual mapping, context description, and frequency distributions (Campbel et al., 2019; Popay et al., 2006). In this review, we grouped the studies based on geographical context variables and investigated the evidence for: (1) cross-country differences/similarities in consumer choices of alternative protein foods, (2) the evidence for rural vs. urban environment differences/similarities in consumer choices of alternative protein foods, (3) any country cases, with at least two studies showing that a country differs from other countries in terms of the levels of consumers' choices of alternative proteins, (4) the links between locality of production/sales and consumer choices of alternative protein foods. Fourth, the narrative synthesis should account for an assessment of the robustness of the obtained results, for example, using the quality assessment tools that address the respective risk of bias (Campbel et al., 2019; Popay et al., 2006). This review addressed the heterogeneity of studies in reference to the quality of included papers.

8. Results of Study 2

8.1 Description of Included Studies

A total of $k = 29$ original studies were included (Aaslyng & Højer, 2021; Andreani et al., 2023; Banovic et al., 2022; Banovic & Sveinsdóttir, 2021; Barska, 2014; Brandner et al., 2022; Brayden et al., 2018; Bryant & Sanctorum, 2021; Florença et al., 2021; Gomez-Luciano et al., 2019; Grasso & Jaworska, 2020; Henn et al., 2022; Hoek et al., 2013; Hoerterer et al., 2022; Lucas et al., 2019; Menozzi et al., 2017; Naranjo-Guevara et al., 2021; Nevalainen et al., 2023; Piha et al., 2018; Pippinato et al., 2020; Porretta et al., 2019; Ribeiro et al., 2022; Szendrő et al., 2020; Tzompa-Sosa et al., 2023; Vartiainen et al., 2020; Verneau et al., 2020; Verneau et al., 2016; Weinrich & Elshiewy, 2019, 2023 [the same study reported in two articles], Zabrocki, 2017). Table 3 presents the details of the populations analyzed (number of participants, gender, age), the country of data collection, the overall design, the type of alternative protein food (APF) products, and a brief summary of the main results.

Across the original studies, $k = 15$ focused on the plant-based alternative protein products (Aaslyng & Højer, 2021; Andreani et al., 2023; Banovic et al., 2022; Banovic & Sveinsdóttir, 2021; Brandner et al., 2022; Brayden et al., 2018; Bryant & Sanctorum, 2021; Gomez-Luciano et al., 2019; Grasso & Jaworska, 2020; Henn et al., 2022; Hoek et al., 2013; Hoerterer et al., 2022; Lucas et al., 2019; Nevalainen et al., 2023; Weinrich & Elshiewy, 2019, 2023), $k = 2$ addressed hybrid APF combining meat and plant-based meat alternatives (Banovic et al., 2022; Grasso & Jaworska, 2020), $k = 13$

addressed insect-based alternative protein products (Brandner et al., 2022; Florença et al., 2021; Menozzi et al., 2017; Naranjo-Guevara et al., 2021; Piha et al., 2018; Pippinato et al., 2020; Porretta et al., 2019; Ribeiro et al., 2022; Szendrő et al., 2020; Tzompa-Sosa et al., 2023; Vartiainen et al., 2020; Verneau et al., 2020; Verneau et al., 2016;), *k* = 3 addressed both proteins form plant and insect-based sources (Barska, 2014, Brandner et al., 2022; Zabrocki, 2017), *k* = 2 focused on a broader category of novel food, including, among others, either plant-based or insect-based products (Barska, 2014; Zabrocki, 2017).

The consumers' choice indicators included:

(a) consumers' willingness/intention to buy (*k* = 10 studies - Banovic et al., 2022; Banovic & Sveinsdóttir, 2021; Brayden et al., 2018; Gomez-Luciano et al., 2019; Grasso & Jaworska, 2020; Hoerterer et al., 2022; Piha et al., 2018; Porretta et al., 2019; Weinrich & Elshiewy, 2019; Zabrocki, 2017);

(b) consumers' willingness/intention to eat (*k* = 7 studies - Grasso & Jaworska, 2020; Henn et al., 2022; Menozzi et al., 2017; Vartiainen et al., 2020; Verneau et al., 2020; Verneau et al., 2016; Tzompa-Sosa et al., 2023);

(c) actual sales of products (*k* = 4 studies - Andreani et al., 2023; Barska, 2014; Brandner et al., 2022; Pippinato et al., 2020);

(d) self-reported purchase by the consumers (*k*=4 studies - Aaslyng & Højer, 2021; Hoek et al., 2013; Lucas et al., 2019; Nevalainen et al., 2023);

(e) consumers' attitudes and beliefs (e.g., about healthiness, sustainability, etc.) (*k* = 7 studies - Bryant & Sanctorum, 2021; Florença et al., 2021; Naranjo-Guevara et al., 2021; Ribeiro et al., 2022; Szendrő et al., 2020; Weinrich & Elshiewy, 2023; Zabrocki, 2017).

Original studies were conducted in 19 European countries. The studies involved data collected in Germany (*n* = 10, 34.48%) (Andreani et al., 2023; Banovic & Sveinsdóttir, 2021; Barska, 2014; Henn et al., 2022; Hoerterer et al., 2022; Naranjo-Guevara et al., 2021; Piha et al., 2018; Pippinato et al., 2020; Weinrich & Elshiewy, 2019, 2023; Zabrocki, 2017), Denmark (*n* = 9, 31.03%) (Aaslyng & Højer, 2021; Andreani et al., 2023; Banovic et al., 2022; Banovic & Sveinsdóttir, 2021; Grasso & Jaworska, 2020; Henn et al., 2022; Pippinato et al., 2020; Verneau et al., 2020; Verneau et al., 2016), UK (*n* = 7, 21.8%) (Andreani et al., 2023; Banovic et al., 2022; Brandner et al., 2022; Gomez-Luciano et al., 2019; Grasso & Jaworska, 2020; Henn et al., 2022; Pippinato et al., 2020), Italy (*n* = 6, 20.6%) (Andreani et al., 2023; Menozzi et al., 2017; Pippinato et al., 2020; Verneau et al., 2020; Verneau et al., 2016; Tzompa-Sosa et al., 2023), Spain (*n* = 6, 20.6%) (Andreani et al., 2023; Banovic et al., 2022; Gomez-Luciano et al., 2019; Grasso & Jaworska, 2020; Henn et al., 2022; Pippinato et al., 2020), the Netherlands (*n* = 6, 20.6%) (Andreani et al., 2023; Hoek et al., 2013; Naranjo-Guevara et al., 2021; Pippinato et al., 2020; Vartiainen et al., 2020; Weinrich & Elshiewy, 2019, 2023), Finland (*n* = 4, 13.79%) (Banovic & Sveinsdóttir, 2021; Nevalainen et al., 2023; Piha et al., 2018; Pippinato et al., 2020), France (*n* = 4, 13.79%) (Andreani et al., 2023; Lucas et al. 2019; Pippinato et al., 2020; Weinrich, 2019&2023), Poland (*n* = 4, 13.79%) (Andreani et al., 2023; Barska, 2014; Henn et al., 2022; Zabrocki, 2017), Belgium (*n* = 3, 10.34%) (Bryant & Sanctorum, 2021; Pippinato et al., 2020; Tzompa-Sosa et al., 2023), Sweden (*n* = 2, 6.89%) (Piha et al., 2018; Pippinato et al., 2020), Czech Republic (*n* = 2, 6.89%) (Barska, 2014; Piha et al., 2018), Norway (*n* = 2, 6.89%) (Pippinato et al., 2020; Ribeiro et al., 2022), Portugal (*n* = 2, 6.89%) (Florença et al., 2021; Ribeiro et al., 2022), One study each (3.44%) were conducted in: Romania (Banovic & Sveinsdóttir, 2021), Iceland (Banovic & Sveinsdóttir, 2021), Austria (Pippinato et al., 2020),, Slovakia (Barska, 2014), Hungary (Szendrő et al., 2020).

Besides European countries, several studies included also data from 7 countries in other continents: USA (*n* = 4, 13.79%) (Andreani et al., 2023; Brayden et al., 2018; Porretta et al., 2019; Tzompa-Sosa et al., 2023), Brazil (*n* = 2, 6.89%) (Andreani et al., 2023; Gomez-Luciano et al., 2019), Canada (*n* = 2, 6.89%) (Andreani et al., 2023; Porretta et al., 2019), Dominican Republic (1 study, 3.44%; Gomez-Luciano et al., 2019), China (1 study, 3.44%; Tzompa-Sosa et al., 2023), Mexico (1 study, 3.44%; Tzompa-Sosa et al., 2023), Australia (1 study, 3.44%; Andreani et al., 2023).

One study (Pippinato et al., 2020) included comparisons of 12 European countries, *k* = 1 compared 8 European countries (Andreani et al., 2023), *k* = 3 (Banovic & Sveinsdóttir, 2021; Henn et al., 2022; Tzompa-Sosa et al.,

2023) compared 5 countries, *k* = 3 included samples from 4 countries (Barska, 2014; Gomez-Luciano et al., 2019; Piha et al., 2018), *k* =3 accounted for 3 countries (Banovic et al., 2022; Grasso & Jaworska, 2020; Weinrich & Elshiewy, 2019, 2023), *k* =6 compared 2 countries (Naranjo-Guevara et al., 2021; Porretta et al., 2019; Ribeiro et al., 2022; Verneau et al., 2020; Verneau et al., 2016; Zabrocki, 2017) and *k* =12 (Aaslyng & Højer, 2021; Brandner et al., 2022; Brayden et al., 2018; Bryant & Sanctorum, 2021; Florença et al., 2021; Hoek et al., 2013; Hoerterer et al., 2022; Lucas et al., 2019; Menozzi et al., 2017; Nevalainen et al., 2023; Szendrő et al., 2020; Vertiainen et al., 2020) addressed one country only (research rural-urban differences and locality of the product).

The enrolled populations were heterogeneous, with the total *N* = 31,977 and sample sizes ranging between 106 and 4,322 (*M* = 1173.88, *SD* = 1128.03) and age ranging from 15 to 89 years old. Among the studies, *k* = 26 (89.6%) included consumer samples from the general population, whereas *k* = 3 (10.3%) (Naranjo-Guevara et al., 2021; Verneau et al., 2016; Zabrocki, 2017) enrolled specific populations, such as students, homemakers (women), and participants only above 55 years old (Zabrocki, 2017).

Majority of studies applied an observational—cross-sectional design (*k* = 26, 89.65 %), 2 (6.89%) were experimental, and 1 (3.22%) was qualitative.

No study was excluded on the basis of the quality assessment. Overall, 26 of the studies presented a low risk of bias, 1 was evaluated as representing moderate risk of bias, and 2 presented a high risk of bias (see Table 3). An inter-rater reliability analysis was performed between the independent reviewers scores. For this purpose, the weighted Cohen's Kappa was calculated, which is a measure of the agreements between two dependent categorical ratings. Cohen's Kappa values above .80 indicate a very high level of agreement. The analysis showed that there was a high agreement between the two raters with $\kappa = 0.91$ (95 CI: [0.74, 1.00]).

Table 3. Descriptive Information About the Original Research Included in Study 2.

Author, year	Population *(N,* age, gender	Type of the study (design), the JBI quality evaluation score	Type of consumer choice indicators/	The type of alternative proteins	Country/region/ urbanization /locality	Main findings of the original studies
Comparisons Across European Countries						
Andreani et al. (2023)	Not provided	Quantitative (market trend analysis) JBI = low	The number of actual products launched	Plant-based	France, UK, Germany, Netherlands, Poland, Spain, Denmark, Italy (also: Canada, the USA, Brazil, Australia) (*k* = 12 countries)	New products launched between 2019 and 2021: between 250 and 500 products: France, UK, Germany, Netherlands; 150-250: Poland, Spain, Denmark; 100-150: Italy.
Banovic & Sveinsdóttir (2021)	*N* = 1,397; women only; M_{age} = 43 years old	Quantitative (questionnaire) JBI = low	Intention to buy, attractiveness of APF	Plant-based	Denmark, Romania, Germany, Finland, Iceland (*k* = 5 countries)	Positive attitude, attractiveness of meat analogues: similar level across 5 countries. Intention to buy was the lowest in Denmark (higher meat intake) compared to Romania, Germany, Finland, and Iceland.
Banovic et al. (2022)	*N* = 2,766; 51% women; M_{age}= 42 years old	Quantitative (online questionnaire) JBI = low	Intention to buy	Plant-based	Denmark, Spain, the UK (*k* = 3 countries)	Hybrid products (50% meat + 50% plant combination): UK, Denmark, Spain. Intention to buy hybrid products was low-to-moderatre across countries (around 3.5-4.5 on a 7-point scale). Intention to buy was the lowest when hybrid products contained rapeseed (*M* = 3.68) and soy (*M* = 3.95) protein. This was particularly true for Spanish participants who showed lowest levels of appropriateness for rapeseed protein (*M* = 3.17), mainly due to their lower levels of familiarity with this plant-based ingredient; Danish participants had lower preference for soy protein (*M* = 3.60). Intention to buy hybrid products was highest when containing pea (*M* = 4.20), followed by bean (*M* = 4.15), and oat (*M* = 4.09) protein. Pea protein was preferred by Spanish participants (*M* = 4.33), while bean protein was preferred among the UK participants (*M* = 4.45) as an appropriate ingredient for APF. For Danish participants pea and bean

						proteins were found as appropriate parts of APF (pea: *MP* = 4.04; bean: *M* = 4.07).
Barska (2014)	*N* = 791; 60% women; consumers aged 18-29 years old	Quantitative (survey) JBI = high	Self-reported buying, intention to buy	Various innovative food (plant- and insect-based)	Poland, Czech Republic, Slovakia, Germany (*k* = 4 countries)	Innovators and early followers (buying soon after various innovative foods are out vs after some consideration): A difference between Germany (73%), compared to Poland, Czech Republic and Slovakia (24-36%); reluctance to buy new product: 0% in Germany, 13-17% Poland, Czech, Slovakia.
Gómez-Luciano et al. (2019)	*N* = 983; UK sample =48.3% men, 51.7%women; Spain sample = 50.5% men, 47% women; Age range between 25 and 54 years old	Quantitative (digital and paper questionnaire) JBI = low	Intention to buy	Plant-based	UK, Spain, (also included: Brazil, Dominican Republic) (*k* = 4 countries)	Percentage of willingness to buy plant-based alternative proteins high among countries (50-60% in UK and Spain), much lower willingness to buy insect-based alternative proteins 18-22% in UK and Spain, respectively.
Grasso & Jaworska (2020)	*N* = 2,405; 25.63% were 18–32 years old, 24.74% were 33–46 years old, 31.68% were 47–61 years old and 17.95% were 62–75 years old.; UK - 51.0% women; Spain - 49.8% women; Denmark - 50% women	Quantitative (online survey) JBI = low	Intention to eat; Intention to buy	Plant-based	UK, Spain, Denmark (*k* = 3 countries)	Hybrid meat: In the UK and Denmark there was no significant difference between the meat-to-plant ratios, 75:25 and 50:50, indicating that both ratios were deemed equally preferable. Spanish consumers ranked the 50:50 ratio as the most preferable, followed by 75:25. Across 3 countries, at least 50% of consumers were willing to try hybrid meats, but they were less willing to buy them. Spanish consumers seemed to be the most favorable, with 71% willing to try and 63% willing to buy. In the UK willingness to buy was 53%, in Denmark- 46% were willing to buy hybrid meat
Henn et al. (2022)	*N* = 4,322 participants	Quantitative (web-based survey) JBI = low	Intention to eat	Plant-based	Denmark, Germany, Spain, UK, Poland (*k* = 5 countries)	Poland had higher intention to replace animal products (meat, cheese and eggs) with Pulses-based (pulses) products. Compared to Denmark, Germany, Spain and UK. Poland had higher intention to replace animal products (meat, cheese and eggs) with pulses-based (pulses) products. Compared to Denmark, Germany, Spain and UK. Respondents from Poland did not only show higher odds of being part of the “replacer” segment, but significantly more

						respondents indicated replacing pork and poultry, fish, cheese, and eggs with pulses. Polish consumers did not replace beef to an extent comparably to pork and poultry. In contrast, many Danish consumers used pulses to first and foremost replace beef. Danish consumers may be in advanced stages of meat reduction i.e. consume less beef than poultry. The Danish consumers may be more informed about the environmental impact of beef production, leading to more conscious choices on reducing beef compared to other meat types
Naranjo – Guevara et al. (2021)	N = 222 participants; 30% women; university students; M_{age} = 21 years old	Quantitative (survey) JBI = low	Consumers attitudes and beliefs (acceptance)	Insect-based	Netherlands, Germany (k = 2 countries)	No differences between Dutch and German students in acceptance of insects as food.
Piha et al. (2018)	N = 887 participants; Northern Europe - 60% women; M_{age} = 37 years old; Central Europe – 61% women; M_{age} = 39 years old	Quantitative (questionnaire) JBI = low	Intention to buy	Insect-based	Sweden, Finland, Germany, Czech Republic (k = 4 countries)	Consumers in Sweden and Finland (data from 2 countries combined) had more positive beliefs about insect-based food and higher willingness to buy them than consumers in Germany and Czech Republic (data combined). Objective knowledge about insect-based products did not differ across the clusters whereas product related experiences were higher in Sweden-Finland cluster than in Germany-Czech Republic cluster
Pippinato et al. (2020)	Not provided	Quantitative (survey) JBI = high	he number of APF producers across Europe	Insect-based	Austria, Belgium, Denmark, Finland, France, Germany, Italy, the Netherlands, Norway, Spain, Sweden, the UK (k = 12 countries)	Edible insect producers identified in 12 European countries: core is concentrated in northern European countries, with the United Kingdom (n = 14), Germany (n = 7) and Belgium (n = 7) showing the highest number of activities, followed by the Netherlands, France, Finland and Denmark (n = 5 or 6).
Ribeiro et al. (2022)	N = 666; Norway = 67% women, Portugal = 59% women; M_{age} Norway = 41 years	Quantitative (online-based questionnaire) JBI = low	Consumers attitudes and beliefs (acceptance)	Insect-based	Norway, Portugal (k = 2 countries)	Acceptance of insects as food was low-to -medium but higher in Norway than in Portugal. The predictors of acceptance vs rejection of insects as food is determined by lower disgust, higher education, higher familiarity among Norwegians and by lower disgust, younger age, male gender among

	old; M_{age} Portugal = 40 years old; Age range between 18 and >55 years old					Portuguese. Norway had higher and earlier promotion of insect-based food than southern European countries.
Tzompa-Sosa et al. (2023)	N = 1046 Belgium – 271 women and 247 men; Italy – 278 women and 250 men; Age range: 18 to >65 years old	Quantitative (online survey) JBI = low	Intention to eat	Insect-based	Belgium, Italy, (also included: the USA, China, Mexico) (k = 5 countries)	Italy (compared to Belgium) had the highest number of people who indicate they are not willing to include whole insects into their food (80% vs 72% and &4% respectively).. The lowest approval to include whole insects in Italy may be-based on the shortest time this type of food is present in the market (compared to Belgium). For powdered insect-based food the refusal of including was respectively 61% (Italy), 48% (Belgium). Europeans are more likely to refuse inclusion of whole insects than non-Europeans.
Weinrich & Elshiewy (2019)	N = 938 participants; 51% women; M_{age} between 31 and 34 years old	Quantitative (questionnaire) JBI = low	Intention to pay	Plant-based	Germany, the Netherlands, France (k = 3 countries)	There was no significant difference in the average willingness to pay for more micro-algae-based proteins in meat substitutes across Germany, the Netherlands, and France. Some determinants of willingness to pay may differ across the countries, e.g., the most positive attitude toward a meat-free diet was found in the Netherlands, while the opposite was true for France.
Weinrich & Elshiewy (2023)	N = 938 participants; 51% women; M_{age} between 31 and 34 years old	Quantitative (questionnaire) JBI = low	Consumers attitudes and beliefs (perceived healthiness)	Plant-based	Germany, the Netherlands, France (k = 3 countries)	Perceiving microalgae-based food as healthy, sustainable, and nutritious was unrelated to habits of shopping in specialty food stores among consumers from France, Germany, and the Netherlands (men and women subsamples).
Verneau et al. (2016)	N = 282 participants; university students; Denmark – 65 women, M_{age} = 23 years old; Italy – 74 women, M_{age} = 23 years old	Quantitative (experiment) JBI = low	Intention to eat	Insect-based	Denmark, Italy (k = 2 countries)	The main effect of nation on intention was significant, p < .001, the mean score of intention was higher for the Danish (M = 4.37) compared to the Italians (M = 3.55). The effect of nation on intention was also significant p < 0.01, the mean score was higher for the Danish participants (M = 4.43) compared to the Italian participants (M = 3.84)
Verneau et al. (2020)	N = 280 participants; 138 women; M_{age} = 23 years old	Quantitative (computer-based questionnaire)	Intention to eat	Insect-based	Denmark, Italy (k = 2 countries)	Intentions to eat insects stronger in Denmark than in Italy.

		JBI = low				
Zabrocki (2017)	*N* = 428 participants; population aged 55+ years old	Quantitative (survey questionnaire) JBI = moderate	Intention to buy; consumers attitudes and beliefs (knowledge about APP)	Various innovative food (plant- and insect-based)	Germany, Poland (*k* = 2 countries)	Among individuals aged over 55 years old, German respondents declared greater knowledge of innovative products and were more inclined to make faster purchasing decisions for such products compared to respondents from Poland.
Regional Differences						
Brandner et al. (2022)	*N* = 1,177; 65% women; the majority were Millenials	Quantitative (cross-sectional survey) JBI = low	Actual sales of products	Insect-based	England versus Scotland	Higher purchase in England than in Scotland (differences may be driven by ethnicity, e.g, Asian & Black people more likely to purchase than White)
Bryant & Sanctorum (2021)	*N* = 1,001 in 2019 & *N* = 1,000 in 2020; 50% women; *M*age = 48 years old	Quantitative (cross-sectional survey) JBI = low	Consumers attitudes and beliefs (acceptability)	Plant-based	Flanders versus Walloon, versus Brussels (Belgium)	Significant but small differences plant-based meat acceptance (higher in Flanders [49.1%] compared to Walloon [45.6] or Brussels [44.3])
Lucas et al. (2019)	*N* = 495; Sample 1: 53% women; Sample 2: 54% women; Sample 3: 51% women; Age: > 15 years old	Qualitative (in-person interviews) JBI = low	Self-reported intake	Plant-based	France (different regions)	Paris and western France had higher intake (Western France is where more seaweed-based food is produced hence likely to be more available).
Menozzi et al. (2017)	*N* = 109; 61% women; *M*age = 23 years old	Quantitative (questionnaire, tasting session) JBI = low	Intention to eat	Insect-based	Italy (different regions)	Intention to eat insect-based foods was weakest in Southern Italy and strongest in the Central and Northern region. No associations between intention and actual behavior were found.
Rural Versus Urban Environment						

Brandner et al. (2022)	*N* = 1,177; 65% women; Most of the participants were Millenials	Quantitative (cross-sectional survey) JBI = low	Actual sales of products	Plant-based	The UK (areas of low and high socioeconomic position index)	No overall differences in areas of high vs low deprivation index (although there are differences in eating legumes , e.g. frozen or dried beans, with low deprivation buying more/indicating a good source of protein).
Bryant & Sanctorum (2021)	*N* = 1,001 in year 2019 & *N* = 1,000 in year 2020; 50% women; *M*age = 48 years old	Quantitative (cross-sectional survey) JBI = low	Consumers attitudes, beliefs (satisfaction)	Various innovative food (plant- and insect-based)	Flanders versus Walloon versus Brussels (Belgium)	Urban vs rural areas did not differentiate satisfaction with products.
Florença et al. (2021)	*N* = 213; 79% women; Age range between 18 and > 66 years old	Quantitative (online questionnaire) JBI = low	Consumers attitudes and beliefs (acceptability)	Insect-based	Portugal (different regions, rural and urban)	Living in urban, rural or suburban environment has no effect on beliefs about edible insects or acceptability of insect-based food products.
Henn et al. (2022)	*N* = 4,322	Quantitative (web-based survey) JBI = low	Intention to eat	Plant-based	Denmark, Germany, Spain, the UK, Poland (rural and urban)	Plant-based (pulses) replacements of animal products (meat, cheese and eggs): no differences between urban and rural residence for an analyses conducted from data of consumers from Denmark, Germany, Poland, Spain and the U.
Hoek et al. (2013)	*N* = 3,613; Vegetarians: n=32 (73% women); consumers of meat substitutes: n=17 (59% women); meat consumers: n=3,564 (54% women); age range: 18-75 years old	Quantitative (survey) JBI = low	Self-reported intake by the consumers	Various innovative food (plant- and insect-based)	The Netherlands (different regions, rural and urban)	Being a meat substitute consumer was related to higher level of urbanization
Nevalainen et al. (2023)	*N* = 1,000; 50.5% women; age range: 18 – 79 years old	Quantitative (online questionnaire)	Self-reported intake by the consumers	Various innovative food (plant-	Finland (different regions, rural and urban)	The respondents in the 'Less red meat, more plant proteins' were more likely to live in a larger city compared to the whole sample. Respondents of the 'Less red meat, more poultry' cluster: living in middle-sized or small cities or

		JBI = low		and insect-based)		municipalities. 'No/very little meat, more plant proteins' cluster: lived mostly in the capital area of Helsinki
Szendrő et al. (2020)	*N* = 414; 65.5% women	Quantitative (questionnaire) JBI = low	Consumers attitudes and beliefs (acceptability)	Insect-based	Hungary (different regions, rural and urban)	No associations between the type of residence (urban vs rural) and acceptance or rejection of insect-based foods
Vartiainen et al. (2020)	*N* = 564; 66.8% women; age range: 16- 89 years old	Quantitative (questionnaire) JBI = low	Intention to eat	Insect based	The Netherlands (different regions, urban and rural)	The strength of intention to consume insect-based foods in the future: people living in rural areas had less intention than people living in city areas. Nevertheless, most of those living in rural areas were among either potential or likely (76%) consumers of insect-based food. In urban areas either potential or likely consumers constituted 85% of the population.
Locality of Products						
Aaslyng & Højer (2021)	*N* = 395; 78% women; age range: 18 - 29 years old	Quantitative (online survey) JBI = low	Self-reported intake by the consumers	Plant-based	Denmark	Higher intake of plant-based proteins if they were 'locally' produced.
Brayden et al. (2018)	*N* = 2,155; 52% women	Quantitative (survey and choice experiment) JBI = low	Intention to pay	Plant-based	The USA (different states)	Higher willingness to pay in case of food with a certificate that it has been produced 'locally' (in the state).
Henn et al. (2022)	*N* = 4,322	Quantitative (web-based survey) JBI = low	Intention to eat Intention to eat, self-reported intake	Various innovative food (plant- and insect-based)	Denmark, Germany, Spain, the UK, Poland	Plant-based (pulses) replacements of animal products (meat, cheese and eggs): no effect of locality (related to consumer's residence) for the analyses conducted from data of consumers from Denmark, Germany, Poland, Spain and the UK.
Hoerterer et al. (2022)	*N* = 362; 53% women; mostly ≤25 years old	Quantitative (questionnaire) JBI = low	Intention to pay	Plant-based	Germany	Local seaweed-based food production is a significant correlate of intention to buy and willingness to pay
Lucas et al. (2019)	*N* = 495; Sample 1: 53% women; Sample 2: 54%	Qualitative (in-person interviews)	Self-reported intake by the consumers	Plant-based	France	Seaweed-based food: production in France (versus imported) did not have effect on self-reported intake

	women; Sample 3: 51% women; age > 15 years old	JBI = low				
Porretta et al. (2019)	*N* = 106 participants; *n* = 71 women;	Quantitative (experiment) JBI = high	Intention to buy	Insect-based	The USA and Canada	People > 50 years old: Higher willingness to buy insect-based food if it produced locally, or produced in the country where it is sold.

Note. Study design = Type of the study; JBI = Joanna Briggs Institute overall study quality index; Study quality values are reported as three levels of risk of bias: low risk, moderate risk, or high risk; APF = alternative protein food

8.2 Cross-Country Similarities and Differences

8.2.1 Cross Countries Differences in Production of APF

Two studies (Andreani et al., 2023; Pippinato et al., 2020) covered differences in APF production in European countries. Edible insect producers in Europe were identified in 12 countries. The majority of the producers were located in northern European countries, with the United Kingdom (n = 14), Germany (n = 7), and Belgium (n = 7) showing the highest number of activities, followed by the Netherlands, France, Finland, and Denmark (Pippinato et al., 2020). Additionally, in the period 2019-2021 between 250 and 500 products were launched in France, the UK, Germany, and the Netherlands, whereas between 150 and 250 APF products were launched inPoland, Spain, and Denmark, while between 100-150 APF products were launched in Italy (Andreani et al., 2023).

8.2.2 Cross-Country Similarities and Differences in European Consumers' Choices

Sixteen studies (Andreani, et al., 2023; Banovic et al., 2022; Banovic & Sveinsdóttir, 2021; Barska, 2014; Gomez-Luciano et al., 2019; Grasso & Jaworska, 2020; Henn et al., 2022; Naranjo-Guevara et al., 2021; Piha et al., 2018; Pippinato et al., 2020; Ribeiro et al., 2022; Verneau et al., 2020; Verneau et al., 2016; Tzompa-Sosa et al., 2023; Weinrich & Elshiewy, 2019, 2023 [two papers presenting findings from one study]; Zabrocki, 2017) compared indicators of consumers' choices of APF in at least 2 European countries.

The findings suggest that across countries included in respective studies there are *similar levels of knowledge, willingness to pay, willingness to try, willingness to pay, or acceptance of APF*. Second, the results of included studies *suggest low to moderate levels of the indicators of consumers' choices* (e.g., moderate intention or a moderate percentages of consumer declaring willingness to buy a APF product) across countries. For example, objective knowledge about insect-based products did not differ across Sweden, Finland, Germany, and the Czech Republic (Piha et al., 2018). Moreover, no significant difference in the average willingness to pay for more micro-algae-based meat substitutes was found across Germany, the Netherlands, and France (Weinrich & Elshiewy, 2019). Across the UK, Denmark, and Spain, at least 50% of consumers were willing to try hybrid meats (Grasso & Jaworska, 2020). Additionally, consumers across these three countries were less willing to buy hybrid meats than to try these products (e.g., 71% of Spanish consumers were willing to try, and 63% were willing to buy; Grasso & Jaworska, 2020). Willingness to buy hybrid products (50% meat + 50% plant combination) was low to moderate across the UK, Denmark, and Spain (between 3.5 and 4.0 on a 7-point response scale; Banovic & Sveinsdóttir, 2021). Specifically, intention to buy was the lowest when hybrid products contained rapeseed protein (M= 3.68) and soy protein (M= 3.95) (Banovic & Sveinsdóttir, 2021). The percentage of willingness to buy plant-based alternative proteins was moderate to high in UK and Spain (50-60%), and both countries were characterized by a much lower willingness to buy insect-based alternative proteins reported by 18-22% in UK and Spain consumers, respectively (Gomez-Luciano et al., 2019). No differences between Dutch and German students in acceptance insects as human food were observed; in general, the acceptance was low-to-moderate, and 51% of participating young people did not agree to include insects into their diet or had no opinion about it (Naranjo-Guevara et al., 2021).

Besides similarities across countries, 4 in the above-mentioned 16 studies additionally suggested *differences between countries* (Banovic et al., 2022; Piha et al., 2018; Ribeiro et al., 2022; Weinrich & Elshiewy, 2019, 2023 [two papers reporting the same study]).

First, the studies indicate *cross-country differences referring to insect-based APF*. For example, consumers in Sweden and Finland (data combined) seem to be generally more positive attitude towards insect-based food and have a higher willingness to buy compared to consumers in Germany and the Czech Republic (data combined) (Piha et al., 2018). Insect-based APF product-related experiences and attitudes were more positive in the Sweden-Finland cluster than in the Germany-Czech Republic cluster (Piha et al., 2018). Another

study also yielded higher acceptance of insect-based food in Scandinavia: Rebeiro et al. (2022) showed higher acceptance of including insect-based APF into the daily diet in Norway compared to Portugal.

Second, *cross-country differences were also observed in the strength and direction of associations between determinants and consumers' choice indicators, depending on 'the third variables', e.g., gender.* This has been observed when associations between beliefs about algae-based APF and the frequency of eating out with friends was investigated (Weinrich & Elshiewy, 2023). Among Dutch women, a higher frequency of dining out/going to restaurants with friends and family was related to positive beliefs that microalgae-based APFs are healthy, sustainable, and nutritious (Weinrich & Elshiewy, 2023). However, among Dutch and German men, a higher frequency of dining out/going to restaurants with friends and family was related to unfavorable beliefs of microalgae-based APF (e.g., perceiving limited healthiness or nutritional values of algae-based foods; Weinrich & Elshiewy, 2023). No associations between the frequency of going out to restaurants with beliefs about microalgae-based APF were observed for French consumers (Weinrich & Elshiewy, 2023).

Furthermore, *preferences for specific types of plant-based proteins may differ across European countries*. Spanish participants indicated the strongest intention to buy hybrid products (combining 50% meat with 50% plant ingredients) with pea protein (mean scores of 4.33), while UK participants reported the strongest intention to buy hybrid products with bean protein (M = 4.45; Banovic et al., 2022). The differences may be explained by familiarity with the respective types of pulses in the analyzed countries (Banovic et al., 2022).

8.3 Differences Between Macro-Regions: Northern vs Eastern vs Southern Europe

8.3.1 Denmark as an Example of Northern Europe

Seven studies address consumer choice of APF in Denmark when compared to other European countries (Banovic et al., 2022; Banovic & Sveinsdóttir, 2021; Grasso & Jaworska, 2020; Henn et al., 2022; Pippinato et al., 2020; Verneau et al., 2020; Verneau et al., 2016). Research comparing Denmark to other European countries shows that Danish consumers are in a *transition stage*: they already hold positive attitudes towards plant-based APF, and although the intentions to adopt ATP are still moderate and intake of plant-based APF is relatively low, Danish consumers are on their way to increase intake of plant-based APF. For summary of findings see Figure 5.

For example, regarding the intention to buy plant-based APF and the intention to replace meat with plant-based APF in Denmark, one study showed that these were the lowest compared to Romania, Germany, Finland, and Iceland (Banovic & Sveinsdóttir, 2021). Across the countries, respective intentions were moderate-to-high (Banovic & Sveinsdóttir, 2021). All these countries have a low actual intake of pulses per capita (from 0.7 to 1.8 kg per annum, except for Finland, with 3.7kg per annum in 2020; FAO, 2023).

Although intention to buy plant-based APF is relatively low in Denmark, levels of knowledge and attitudes of Danish consumers indicate that they favor plant-based APF. For example, for Danish consumers, hybrid and plant-based meat-free alternatives were rated higher than meat products for the attributes healthy, ethical, environmentally friendly, and nutritious (Grasso & Jaworska, 2020). Furthermore, compared to German, Polish, Spanish, and UK-based consumers, Danish consumers declared more frequent use of pulse-based APF to replace beef (Henn et al., 2022). Danish consumers may be in the 'advanced stages' of meat reduction and focusing on a reduction of beef rather than poultry or fish (Henn et al., 2022). Danish consumers may be more informed about the environmental impact of beef production, which could lead to more conscious choices in reducing beef consumption compared to other types of meat (Henn et al., 2022). Danish consumers find both pea and bean proteins equally appropriate parts of the hybrid products composed of plants and meat (Banovic et al., 2022). Danish consumers have equal awareness of the healthiness of pulses-based protein products as Spanish consumers, but they consume fewer pulses (Banovic et al., 2022). However, the trends in pulses consumption show an increase in the intake of pulses per capita in Denmark (from 0.8 in 2018 to 1.5kg in 2020), whereas pulses intake is stable and relatively high in Spain (from 6.3 to 5.9kg respectively) (FAO, 2023). This increase in pulse consumption in Denmark may result from positive attitudes towards pulses in the Danish population.

Research addressing the intention to buy plant-and-meat hybrid products also indicated differences between Denmark and some other European countries. For example, the respective intention was higher in the UK or Spain and lowerin Denmark (Banovic et al., 2022). In Denmark, only 46% of consumers were willing to buy hybrid meat (a product combining plants and meat), compared to 63% of consumers in Spain and 53% in the UK (Grasso & Jaworska, 2020). Although previous research explained low intention to buy plant-and-meat hybrid products in Denmark by higher intake of meat, compared to other countries (Banovic & Sveinsdóttir, 2021), this may not be the case any longer. The country-level data collected in years 2018-2020 indicated a substantial reduction of meat intake in Denmark (from 79kg to 64kg), whereas the changes in the comparison countries were smaller, and levels of intake were higher in Spain (108kg in 2018 to 102kg in 2020), Iceland (92kg to 90kg), Finland (78kg to 71kg), Germany and UK (81kg to 79kg), to stable intakes (66kg) in Romania (FAO, 2023). Thus, the low intention to buy hybrid meat among Danish citizens (Banovic et al., 2022), may reflect lower purchase per capita of any meat-based products (including hybrid meat) in Denmark (FAO, 2023).

Besides specific patterns for plant-based APF, *Danish consumers differ from southern European countries, such as Italy, in terms of intention to eat insect-based APF*. Specifically, in comparison to Italy, the intention to eat insect-based APF was stronger in Denmark (Verneau et al., 2020). However, a study comparing the effects of communication on individual vs. societal benefits of eating insects in Italy and Denmark did not show a country effect (Verneau et al., 2016).

8.3.2 Poland as an Example of Eastern Europe

Three studies highlight a specificity of central-eastern European countries, particularly Poland, when compared to Northern European countries (Barska, 2014; Henn et al., 2022; Zabrocki, 2017). Research comparing Poland to other European countries indicate that Polish consumers are in a stage characterized by limited knowledge regarding innovative food products, relative reluctance to adopt novel foods. They may report strong intention to use plant-based products to replace animal-based proteins, but these intentions are reflecting limited sustainability awareness (e.g., preference to replace poultry rather than beef with plant-based APF). For summary of findings see Figure 5.

For example, research indicated that Polish consumers report higher intentions to use pulses to replace animal-based protein products (pork, poultry, fish, cheese, and eggs), but also higher intentions to replace nuts and tofu with pulse-based APF, compared to Denmark, Germany, Spain, and the UK, all of which had relatively similar, lower levels of intention to replace respective products with pulse-based APF (Henn et al., 2022). The findings presented by Henn et al. (2022) should be discussed in the context of the preference to replace poultry, pork, and eggs with pulses-based APF, but not beef. In contrast to consumers in Poland (but also Germany, Spain, UK), the preferences of Danish consumers were first and foremost to replace beef (Henn et al., 2022). The difference in replacing poultry/pork/eggs vs. beef may result from relatively low sustainability awareness among Polish consumers, compared to Danish consumers (Henn et al., 2022). Additionally, meat consumption in Poland is high, with 90 kg per capita in 2018-2020, but consumption of pulses is very low, with 1.3-1.0 kg per capita in 2018-2020; in contrast to Denmark, where the consumption of meat is declining (79 to 64kg) and pulses were increasing (0.8 to 1.5) between 2018 and 2020 (FAO, 2023). Thus, there is a substantial possibility to increase the intake of pulses in countries like Poland (FAO, 2023). Another factor explaining the differences between Poland and other countries may be that family income per capita is lower in Poland than in Germany, Denmark, the UK, or Spain (European Union, 2023 - Eurostat), which may result in perceiving pulses as an affordable source of protein and increase a selection of cheaper foods in countries with low income.

A study comparing Polish and German consumers aged over 55 years found that German consumers had higher levels of knowledge with regard to innovative food products, less hesitant in their decisions, and they more frequently decided to purchase such products (Zabrocki, 2017). Among young people in Germany, ‘food innovators’ (i.e., buying soon after various innovative foods are out) and ‘early followers’ (those who buy after some consideration) constitute 73% of the population (Barska, 2014). This is in contrast to young people in

Poland, the Czech Republic, and Slovakia, where “food innovators” and “early followers” constitute only 24-36% of consumers (Barska, 2014). Furthermore, a reluctance to buy innovative APF was found among 0% of young consumers in Germany, while it was present among 13%-17% consumers in Poland, the Czech Republic, and Slovakia (Barska, 2014).

8.3.3 Italy as an Example of Southern Europe

Three studies indicate differences between Italy’s and other European countries' intentions to eat insect-based APF (Verneau et al., 2020; Verneau et al., 2016; Tzompa-Sosa et al., 2023). Overall, these studies suggest a difference in attitudes, intentions, or acceptance of insect-based APF among Italian consumers, compared to consumers in Northern European countries. For summary of findings see Figure 5.

In Italy, intentions to eat insects were weaker than in Denmark (Verneau et al., 2020). Findings from another study conducted in Denmark and Italy also indicated significant differences in intention to eat insects, which was stronger among Danish consumers than among Italian consumers (Verneau et al., 2016). The effects indicating between-countries differences were of medium size (Verneau et al., 2016). Compared to Belgium or the US, Italy had the highest number of consumers who indicated they would not eat whole insects (72% and 74%, respectively, versus 80% in Italy; Tzompa-Sosa et al., 2023). The refusal to include powdered insect-based food into the meal was also highest in Italy (61%), and lower in other countries included in the study (USA - 54%; Belgium - 48%; China -16%; Mexico - 18%; Tzompa-Sosa et al., 2023).

Similarly to research conducted in Italy, a study conducted in Portugal yielded a similar pattern of consumer choices for insect-based APF. Acceptance of insects as food was low to medium in both Portugal and Norway, but significantly lower in Portugal than in Norway (Ribeiro et al., 2022). The predictors of acceptance vs. rejection of insects as food were also partly different across countries with lower disgust, higher education, and higher familiarity among Norwegians and by lower disgust, younger age, and male gender (Ribeiro et al., 2022).

One study (Pippinato et al., 2020) which addressed the production of insect-based APF across 12 European countries, showed that Italy is among the countries with the lowest number of insect-based APF producers.

Findings for Denmark as an example of Scandinavian country:

- lower willingness to buy hybrid meat (meat + plant-based product) than in several European countries
- Positive attitudes towards meat replacements, high awareness
- In years 2018-2020: the largest decline in studied European Countries in meat intake (from 79 to 64kg)
- low intake (and low approval) of pulses
- **A country "in transformation" in terms of increasing sustainability awareness, trends for meat intake reduction, and improving (yet still low) intake of protein-rich plants**

Findings for Poland as an example of Eastern European country:

- higher intentions to replace poultry, pork (but not beef) with pulses, compared to several western European countries
- lower knowledge about 'novel food', higher reluctance, lower intention to buy 'novel food'
- high meat intake
- no major changes (years 2018-2020: approx 90 kg)
- low intake of pulses
- **A country "in stagnation", with low levels of knowledge and low readiness to shift dietary patterns towards higher alternative protein food intake**

Findings for Italy as an example of Mediterranean country with strong cuisine traditions:

- low intention/approval to eat insects, compared to several central and northern European countries
- lower approval may be based on a relatively short time this type of food is present in the Italian market
- moderate to high intake of meat (approx. 70 kg/per year, relatively high intake of pulses)
- **A "strong traditional cuisine" country: Higher acceptability of insect-based APF in Scandinavian countries, compared to Italy, where strong cuisine traditions of local food and meat intake may counteract the adoption of insect-based alternative protein food***

Figure 5. Specificity of Consumer Preferences for Alternative Protein Foods across Europe: Denmark, Poland and Italy as Examples of Northern, Eastern and Southern European Macro-Regions.

8.4 Differences Across Regions Within European Countries

Four studies indicated regional differences (within a European country) (Brandner et al., 2022; Bryant & Sanctorum, 2021; Lucas et al., 2019; Menozzi et al., 2017). The differences may be mostly explained by factors such as availability, familiarity, ethnicity, or influences by differences in neighboring countries.

Paris and western France had higher self-reported intake of more plant (seaweed)-based APF compared to the rest of France (Lucas et al., 2019). Western France is where more seaweed-based food is produced, hence likely to be more available, and Paris is considered fast in incorporating a variety of food trends (Lucas et al., 2019). Intention to eat insect-based APF was weakest in southern Italy and strongest in the central region of Italy, however, no differences between the Italian regions and actual levels of insect-based food intake were found (Menozzi et al., 2017). It may be the case that, as in France (Lucas et al., 2019), the exposure of consumers to insect-based food is more frequent in cosmopolitan Italian cities (e.g., Rome and Milan) in central and northern regions, than in southern Italy.

Higher levels of self-reported buying of plant-based meat alternatives were found in England, compared to Scotland (Brandner et al., 2022). Differences may be driven by ethnicity, e.g., people of Asian and African origin (who more frequently reside in England than in Scotland) may be more likely to report purchase of plant-based meat alternatives than people of European origin (Brandner et al., 2022).

Significant but small differences in acceptance of plant-based APF were found across regions of Belgium (higher in Flanders [49%] compared to Walloon [46%] or Brussels [44%; Bryant & Sanctorum, 2021). These differences may be explained by the higher acceptance of a meat-free diet, which is found in the Netherlands, while a less positive attitude toward a meat-free diet is found in consumers from France (Weinrich & Elshiewy, 2019). Flanders is a Dutch-speaking region of Belgium, whereas Walloon is a French-speaking region, with cultural influences of respective countries presisting in these regions of Belgium.

8.5 Rural Versus Urban Environment

Regarding comparisons in APF choices in rural vs urban environment, five studies indicated a lack of differences in consumer's choices of plant-based and insect-based APF (Brandner et al., 2022; Bryant & Sanctorum, 2021; Florença et al., 2021; Henn et al., 2022; Szendrő et al., 2020). Urban/rural/small-town locations did not differentiate satisfaction with plant-based meat alternatives in Belgium (Bryant & Sanctorum, 2021). The willingness to replace animal products (meat, cheese, and eggs) with plant-based (pulses) products was similar among consumers from urban and rural residences across 5 EU countries: Denmark, Germany, Poland, Spain, and the UK (Henn et al., 2022). In Portugal, living in urban, rural, or suburban environment had no effect on attitudes towards edible insects or acceptability of edible insects (Florença et al., 2021). Similarly, there were no associations between the type of residence (urban vs. rural) and acceptance or rejection of insect-based foods in Hungary (Szendrő et al., 2020). The lack of differences in urban and rural environments is in line with a lack of evidence for differences between areas of high and low economic deprivation. Regarding the self-reported purchase of plant-based meat alternatives, no differences in areas of high vs. low deprivation index were found in a UK-based study (Brandner et al., 2022).

On the other hand, two studies (Hoek et al., 2013; Nevalainen et al., 2023) indicated the effect of living in an urban area on (more favorable) consumer behavior and preferences for APF. Being a (self-reported) meat substitute consumer was related to a higher level of urbanization in the Netherlands (Hoek et al., 2013). This study, however, is one of the earliest studies on plant-based meat substitutes and effects could have changed int he period of more than 15 years that passed between the Hoek et al. (2013) study and more contemporary research on urban vs. rural environment (Brandner et al., 2022; Bryant & Sanctorum, 2021; Florença et al., 2021; Henn et al., 2022; Szendrő et al., 2020). Moreover, a study conducted in Finland showed that consumers who tend to agree with the statement 'less red meat, more plant proteins' were more likely to live in a larger city compared

to the whole sample (Nevalainen et al., 2023). Respondents of the 'Less red meat, more poultry' cluster were living in middle-sized or small cities or municipalities. 'No/very little meat, more plant proteins' cluster – lived mostly in the capital area (Helsinki) (Nevalainen et al., 2023). These findings show that the differences may be driven by the differences in overall dietary patterns and regional differences between cosmopolitan cities and other locations in the country, as found in France (Lucas et al., 2019).

8.6 Local Alternative Protein Food Products

Seven studies that addressed the "locality" of the production or the origin of APF and their relationships with consumer choices (Aaslyng & Højer, 2021; Brayden et al., 2018; Henn et al., 2022; Hoerterer et al., 2022; Lucas et al., 2019; Porretta et al., 2019; Weinrich & Elshiewy, 2023). The majority of the studies (6 out of 7) suggest that locality may be a relevant predictor of consumers' choices of APF.

Consumers in Denmark were more likely to indicate higher intake of APF products based on pea, beans-based protein products if they were "locally" produced (Aaslyng & Højer, 2021). Local seaweed-based food production was a significant correlate of intention to buy and willingness to pay among German consumers (Hoerterer et al., 2022). In the case of seaweed-based products, "local" was defined as a national or a European product (Hoerterer et al., 2022). Another study indicated that in the case of seaweed-based APF production in France (vs. imported foods) did not have an effect on self-reported intake (Lucas et al., 2019). However, this study did not specify if the seaweed-based product was imported from another EU country or from elsewhere. Consumers in France, Germany and the Netherlands indicated a high preference for purchasing food from local plant-based meat substitutes (79% of consumers reported such preference; Weinrich & Elshiewy, 2019). This may be compared to a preference for buying 'organic' meat (found among 64% of consumers; Weinrich & Elshiewy, 2019). Among consumers older than 50 years, willingness to buy insect-based food was higher if the food was produced in the same country where it was sold (Porretta et al., 2019). Similarly to the majority of the European studies, a study conducted in the USA indicated that a higher willingness to pay for APF was reported if a food item had a certificate that it had been produced locally (in a state) (Brayden et al., 2018).

Only one study showed no effect of the local origin of the APF. Among consumers from Denmark, Germany, Poland, Spain, and UK (Henn et al., 2022), there was no effect of locality of the product on consumer's willingness to purchase plant-based (pulses) replacements of animal products (meat, cheese, and eggs). The study specified only that the locality referred to the consumer's place of residence; the actual breadth of the 'local' origin was not specified (e.g., a region in the country, the whole country, the European Union market).

9. Discussion of Study 2

This review provides a synthesis of evidence for the effects of geographical context on the intentions, purchase, and intake of APF. Specifically, we elucidate evidence-based differences and similarities across European countries, regions within European countries, and urban and rural environments. Additionally, w synthesized studies addressing the effect of locality of APF.

The findings of this systematic review suggest that existing studies show some similarities between European countries. Notably, there is *a recurring pattern of relatively low levels of intention to eat, acceptance, intention to buy, try or adopt insect-based APF products. Additionally, there is a moderate intention to buy hybrid products (plant-based proteins combined with meat-based proteins), and plant-based APF*. Importantly, all existing studies testing for cross-country differences accounted for a minority of EU countries (e.g., 3-5 countries only). Thus, the conclusions of this review referring to differences across European countries may be only seen as indicative. Before any solid conclusions regarding potential cross-country differences can be drawn, research should test consumers' preference indicators across all European (or all 27 European Union) countries.

Given the low or moderate level of intentions to buy or eat APF, it becomes imperative to develop and implement targeted intervention and promotion campaigns that aim at bolstering consumer motivation. In line

with theories of behavior change, such as the theory of planned behavior (Ajzen & Schmidt, 2020), social cognitive theory (Luszczynska & Schwarzer, 2020), or the COM-B model (Michie et al., 2011), in case of weak or moderate intention to adopt a new behavior, such as buying and/or eating APF, interventions should initially focus on increasing individual motivational factors, such as perceived benefits for health and environment (Graca et al., 2019; Onwezen et al., 2021), beliefs about one's own capabilities to take action (e.g., prepare meals with APF; Graca et al., 2019), focus on enhancing positive emotions (e.g., curiosity; Onwezen et al., 2021; Wendin & Nyberg 2021), or propose changes in the physical and social environment that may nudge consumers towards strengthening opportunities to initiate a behavior change.

Furthermore, findings point out that some similarities or differences between countries may be attributed to the influence of "third" variables, such as individual-level characteristics (e.g., gender or/and preference for APF intake in a specific setting). These differences may be explained partially by the desire to conform to social norms of masculinity and the related reluctance of men (in particular, meat-eaters) to be perceived by other men as "going vegetarian" (Bogueva et al., 2022). Gender thus is a variable that plays a role in as far as acceptance of APF in specific social settings is concerned (for review, see e.g., Nguyen et al., 2022)

The results of this study indicate that there may be macro-regional differences within Europe. The first difference refers to acceptance of insect-based APF, which may be lower in Southern European countries (e.g. Italy, Portugal) than in Northern (Scandinavian) countries. the relatively low willingness of Italians to include whole insects into a meal may be attributed to the relatively short presence of this type of food is present in the Italian market compared to markets like Belgium or Norway (Ribeiro et al., 2022; Tzompa-Sosa et al., 2023). Food culture and eating patterns in Scandinavia might have changed in recent decades, embracing a number of innovative approaches, whereas Italian culture may be considered one of the strongest in Europe (Verneau et al., 2016), with over 200 food products awarded Protected Designation of Origin or Protected Geographic Indication certificates, and meat playing an important role in this local cuisine (Mancini & Antonioli, 2022). Our findings align with a previous review on the Italian market of alternative proteins conducted by Mancini & Antonioli (2022), which suggests limited readiness among Italian customers to embrace insect-based APF. Similar reluctance to mainstreaming insect-based APF may hold for other Southern European countries, with comparably strong culinary cultures

The second type of differences between European macro-regions refers to attitudes and intentions towards plant-based APF, intake of plant-based APF and meat, that may be observed in Scandinavian or Northern European countries, (e.g., Denmark, Norway). These countries may be characterized by positive attitudes towards APF, such as viewing plant-based APF as healthier and more sustainable than meat. On the other hand, the intention to adopt plant-based APF may be relatively low (compared to countries in other EU macro-regions). This should be considered in the context of a decrease in meat intake (albeit the intake is still) and an increase in pulse intake in recent years (albeit the intake is still low, compared to other EU countries; FAO, 2023). The results may suggest that Scandinavian countries, such as Denmark, may be undergoing a transformation in its consumption habits of plant-based APF and meat. Using the terminology applied in the transtheoretical model of behavior change (DiClemente & Prochaska, 1998), Danish consumers' attitudes toward plant-based APF align with the stages of contemplation (considering behavioral changes) and initiation (moving towards an initiation of behavioral change).

The third type of differences between the macro-regions refers to Eastern European consumers' choices of APF. The findings may suggest lower knowledge regarding innovative food products of consumers in Eastern Europe (e.g., Poland compared to Denmark) and higher reluctance to adopt novel foods (e.g., Poland compared to Germany). These patterns should be considered in the context of high and stable intake of meat per capita and low and stable intake of pulses in the years between 2018 and 2020 in countries such as Poland (FAO, 2023). Referring to the terminology applied in the transtheoretical model (DiClemente & Prochaska, 1998), Eastern European consumers may be in the stage of precontemplation (or "in stagnation"). This suggests that they are not yet considering the pros and cons of moving towards more sustainable food choices and embracing APF,

indicating a potential need for targeted interventions and awareness campaigns to promote such dietary changes.

Our findings indicate that, with the exception of the oldest study, recent research indicates limited rural-urban differences in consumer preference for APF within Europe. When differences are observed, they may be explained not solely by the size of the city, but rather by its multicultural and cosmopolitan character in comparison to other locations within the country. For example, cities like Paris (France), Helsinki (Finland), and Milan (Italy), which are more cosmopolitan and ethnically diverse, tend to exhibit higher levels of consumer acceptance of APF or intentions to consume APF compared to less diverse regions within respective countries. (cf. Lucas et al., 2019). Such cosmopolitan cities are also more likely to have restaurants offering alternative cuisine or embracing novel food trends, including alternative proteins (Pérez-Lloréns, 2020; Schwark et al., 2020). Importantly, restaurants and food festivals/events are among the most preferred locations where consumers are willing to try novel APF (Bisconsin-Júnior et al., 2022; Motoki et al., 2022).

Moreover, our review aligns with previous reviews addressing any type of local foods (Enthoven & van den Broeck, 2021). Our findings indicate that consumers are more likely to choose APF products when they are perceived as “local.” It is important to note that most of the studies in our review did not specify how "local" was defined and whether it accounted for sustainable and short food chains or simply meant a product originating in the same country. Nevertheless, labeling APF products as local and promoting locally produced APF could facilitate dietary shifts among European consumers.

The findings have some potential implications for polices and strategies aiming to increase APF choices by consumers. Our review provides insights into the geographical differences that may point towards considering the use of different strategies to promote APF intake across macro-regions of Europe. For example, building awareness of APF-related benefits may be more needed in Eastern Europe than in Scandinavia. Across Europe, the levels of intention to eat, try, and buy APF may be moderate or low-to-moderate, which points towards the importance of further interventions prompting consumers’ motivational factors and environmental opportunities (such as higher availability, cf. Bianchi et al., 2018; Stiles et al., 2022).

The present study has several limitations that need to be considered. First, the number of studies available for inclusion was limited and those reporting cross-country comparisons were restricted to 12 countries in total. Across the studies, the heterogeneity of APF types was high. Therefore, some of the observed differences between countries may, to some degree, be explained by the sensory characteristics of the APF tested in each study. The conclusions referring to differences between European macro-regions should be treated with caution, as the systematic cross-regional comparisons are lacking and the conclusions are based on a relatively small number of studies. Another limitation is the absence of longitudinal studies, which could provide more robust insights into the process of change over time. The included research used a wide range of indicators for consumer choices, ranging from intentions (to buy or to try/eat) to actual intake. Actual intake was investigated rarely. It has to be noted that intention is only moderately associated with respective food intake (Mullan et al., 2014). The quality of the included studies was, with $k = 3$ studies of moderate or high risk of bias. This poses a limitation to drawing firm conclusions. As discussed, the between-country differences may, at least partially, be explained by “third variables”, including sociodemographic characteristics of the consumers enrolled in respective studies, their motivations and capabilities, policies operating in the respective country. Future research should consistently control for key sociodemographic variables and motivational variables that have an empirically established association with consumers’ choices of APF. Furthermore, the applied methods of the systematic review had their limitations as well. The narrative synthesis and a lack of possibility to conduct a meta-analysis to evaluate the actual effect sizes limit any conclusions.

10. Study 2: Conclusions

Concluding, regardless the limitations, this review offers new insights into the patterns of consumers' choices of APF across European countries. In general, the levels of intention to eat, try, and buy APF may be moderate or low-to-moderate. Key differences are observed in the acceptability of insect-based APF, with Scandinavian countries showing more acceptance compared to Italy (where strong cuisine traditions of local food and meat intake may counteract the adoption of insect-based APF). Second, we present Denmark as an example of a country "in transformation" in terms of sustainability awareness, trends for meat intake reduction, and improving yet still low intake of protein-rich plants. Third, we present Poland as an example of a country "in stagnation", with low readiness to shift dietary patterns towards higher APF intake. Our findings suggest that the environments in Europe, which are more "cosmopolitan," may be characterized as those where the likelihood of APF choices is higher. Finally, positioning APF products as local may be a possible strategy to increase the likelihood of APF choices by European consumers.

11. Study 1: References

References marked with an asterisk indicate studies included in the systematic review.

*Aaslyng, M. D., & Højer, R. (2021). Introducing Tempeh as a New Plant-Based Protein Food Item on the Danish Market. *Foods (Basel, Switzerland)*, *10*(11), 2865. https://doi.org/10.3390/foods10112865

*Aerni, P., Scholderer, J., & Ermen, D. (2011). How would Swiss consumers decide if they had freedom of choice? Evidence from a field study with organic, conventional and GM corn bread. *Food Policy*, *36*(6), 830–838. https://doi.org/10.1016/j.foodpol.2011.08.002

Ajzen, I., & Schmidt, P. (2020). Changing Behavior Using the Theory of Planned Behavior. In. M. Hagger, L. D. Cameron, K. Hamilton, N. Hankonen & T. Lintunen (Eds.), *The Handbook of Behavior Change* (pp. 17-31). Cambridge University Press. doi:10.1017/9781108677318.002

*Ali, L., & Ali, F. (2022). Perceived risks related to unconventional restaurants: A perspective from edible insects and live seafood restaurants. *Food Control*, *131*, 108471. https://doi.org/10.1016/j.foodcont.2021.108471

*Baker, M. A., Shin, J. T., & Kim, Y. W. (2016). An Exploration and Investigation of Edible Insect Consumption: The Impacts of Image and Description on Risk Perceptions and Purchase Intent. *Psychology & Marketing*, *33*(2), 94–112. https://doi.org/10.1002/mar.20847

Bianchi, F., Garnett, E., Dorsel, C., Aveyard, P., & Jebb, S. A. (2018). Restructuring physical micro-environments to reduce the demand for meat: A systematic review and qualitative comparative analysis. *The Lancet Planetary Health*, *2*(9), e384–e397. https://doi.org/10.1016/S2542-5196(18)30188-8

Biasini, B., Rosi, A., Giopp, F., Turgut, R., Scazzina, F., & Menozzi, D. (2021). Understanding, promoting and predicting sustainable diets: A systematic review. *Trends in Food Science & Technology*, *111*, 191–207. https://doi.org/10.1016/j.tifs.2021.02.062

*Bisconsin-Júnior, A., Rodrigues, H., Behrens, J. H., da Silva, M. A. A. P., & Mariutti, L. R. B. (2022). "Food made with edible insects": Exploring the social representation of entomophagy where it is unfamiliar. *Appetite*, *173*, 106001. https://doi.org/10.1016/j.appet.2022.106001

*Bogueva, D., Marinova, D., & Bryant, C. (2022). Meat Me Halfway: Sydney Meat-Loving Men's Restaurant Experience with Alternative Plant-Based Proteins. *Sustainability*, *14*(3). https://doi.org/10.3390/su14031290

*Borkowski, S., Rubenstein, W., Galvez, M., & Deierlein, A. L. (2020). Prevalence of meats offered during meals at New York city schools. *Health Behavior and Policy Review*, *7*(2), 146–153. https://doi.org/10.14485/HBPR.7.2.7

Bronfenbrenner, U. (1981). *The Ecology of Human Development: Experiments by Nature and Design*. Harvard University Press.

*Brooker, P. G., Hendrie, G. A., Anastasiou, K., & Colgrave, M. L. (2022). The range and nutrient profile of alternative protein products sold in Australian supermarkets between 2014 and 2021. *International Journal of Food Sciences and Nutrition*, *73*(8), 1067–1079. https://doi.org/10.1080/09637486.2022.2137786

*Cai, C.H., Ding, A., & Legendre, T.S. (2021). Exploring persuasive sales techniques to improve customer acceptance of sustainable but unfamiliar menu in restaurants. *International Journal of Contemporary Hospitality Management*, *33*(10), 3093-3114. https://doi.org/10.1108/IJCHM-08-2020-0924

Campbell, M., Katikireddi, S. V., Sowden, A., & Thomson, H. (2019). Lack of transparency in reporting narrative synthesis of quantitative data: A methodological assessment of systematic reviews. *Journal of Clinical Epidemiology*, *105*, 1–9. https://doi.org/10.1016/j.jclinepi.2018.08.019

*Clark, L. F., & Bogdan, A.-M. (2019). The Role of Plant-Based Foods in Canadian Diets: A Survey Examining Food Choices, Motivations and Dietary Identity. *Journal of Food Products Marketing*, *25*(4), 355–377. https://doi.org/10.1080/10454446.2019.1566806

*Collins, C. M., Vaskou, P., & Kountouris, Y. (2019). Insect Food Products in the Western World: Assessing the Potential of a New "Green" Market. *Annals of the Entomological Society of America*, *112*(6), 518–528. https://doi.org/10.1093/aesa/saz015

Delgado, L., Garino, C., Moreno, F. J., Zagon, J., & Broll, H. (2022). Sustainable Food Systems: EU Regulatory Framework and Contribution of Insects to the Farm-To-Fork Strategy. *Food Reviews International*, *0*(0), 1–22. https://doi.org/10.1080/87559129.2022.2130354

Downs, S.M., Ahmed, S., Fanzo, J., & Herforth, A. (2020). Food Environment Typology: Advancing an Expanded Definition, Framework, and Methodological Approach for Improved Characterization of Wild, Cultivated, and Built Food Environments toward Sustainable Diets. Foods , 9, 532. https://doi.org/10.3390/foods9040532

*Drake, M. A., & Gerard, P. D. (2003). Consumer Attitudes and Acceptability of Soy-fortified Yogurts. *Journal of Food Science*, *68*(3), 1118–1122. https://doi.org/10.1111/j.1365-2621.2003.tb08297.x

EAT (2019). *EAT-Lancet Commission Summary Report*. https://eatforum.org/eat-lancet-commission/eat-lancet-commission-summary-report/

The European Commission. (2018, March). *Commission Implementing Regulation (EU) 2018/456 of 19 March 2018 on the procedural steps of the consultation process for determination of novel food status in accordance with Regulation (EU) 2015/2283 of the European Parliament and of the Council on novel foods*. http://data.europa.eu/eli/reg_impl/2018/456/oj/eng

*Florença, S. G., Correia, P. M. R., Costa, C. A., & Guiné, R. P. F. (2021). Edible Insects: Preliminary Study about Perceptions, Attitudes, and Knowledge on a Sample of Portuguese Citizens. *Foods*, *10*(4), 709. https://doi.org/10.3390/foods10040709

*García-Segovia, P., García Alcaraz, V., Tárrega, A., & Martínez-Monzó, J. (2020). Consumer perception and acceptability of microalgae based breadstick. *Food Science and Technology International*, *26*(6), 493–502. https://doi.org/10.1177/1082013220906235

Glanz, K., Sallis, J. F., Saelens, B. E., & Frank, L. D. (2005). Healthy nutrition environments: Concepts and measures. *American Journal of Health Promotion: AJHP*, *19*(5), 330–333, ii. https://doi.org/10.4278/0890-1171-19.5.330

*Grasso, S., & Jaworska, S. (2020). Part Meat and Part Plant: Are Hybrid Meat Products Fad or Future? *Foods*, *9*(12), 1888. https://doi.org/10.3390/foods9121888

*Gravely, E., & Fraser, E. (2018). Transitions on the shopping floor: Investigating the role of Canadian supermarkets in alternative protein consumption. *Appetite*, *130*, 146–156. https://doi.org/10.1016/j.appet.2018.08.018

Grossmann, L., & Weiss, J. (2021). Alternative Protein Sources as Technofunctional Food Ingredients. *Annual Review of Food Science and Technology*, *12*, 93–117. https://doi.org/10.1146/annurev-food-062520-093642

Hagger, M. S., & Luszczynska, A. (2014). Implementation intention and action planning interventions in health contexts: State of the research and proposals for the way forward. *Applied Psychology. Health and Well-Being*, *6*(1), 1–47. https://doi.org/10.1111/aphw.12017

*Herbert, M., & Beacom, E. (2021). Exploring Consumer Acceptance of Insect-based Snack Products in Ireland. *Journal of Food Products Marketing*, *27*(6), 267–290. https://doi.org/10.1080/10454446.2021.1994080

Higgins, J.P.T., Thomas, J., Chandler, J., Cumpston, M., Li, T., Page, M.J., & Welch V.A. (Ed.). (2022) Cochrane Handbook for Systematic Reviews of Interventions (version 6.3). Cochrane. www.training.cochrane.org/handbook

Hinkle, L. E., Jr., & Loring, W. C. (1977) Effect of the Man-Made Environment on Health and Behavior: A Report of the Inter-University Board of Collaborators. CDC, Atlanta.

*Hwang, J., Choe, J. Y. (Jacey), & Kim, J. J. (2020). Strategy for enhancing the image of edible insect restaurants: Focus on internal environmental locus of control. *Journal of Hospitality and Tourism Management*, *45*, 48–57. https://doi.org/10.1016/j.jhtm.2020.07.015

Joanna Briggs Institutes (2023) Critical Apprisal Tools. Retreived from: https://jbi.global/critical-appraisal-tools

*Jones, V. (2020). 'Just don't tell them what's in it': Ethics, edible insects and sustainable food choice in schools. *British Educational Research Journal*, *46*(4), 894–908. https://doi.org/10.1002/berj.3655

Kauppi, S.-M., Pettersen, I. N., & Boks, C. (2019). Consumer acceptance of edible insects and design interventions as adoption strategy. *International Journal of Food Design*, *4*(1), 39–62. doi:10.1386/ijfd.4.1.39_1

Kim, T.-K., Yong, H. I., Kim, Y.-B., Kim, H.-W., & Choi, Y.-S. (2019). Edible Insects as a Protein Source: A Review of Public Perception, Processing Technology, and Research Trends. *Food Science of Animal Resources*, *39*(4), 521–540. https://doi.org/10.5851/kosfa.2019.e53

LIKE-A-PRO: From niche to mainstream - alternative proteins for everybody and everywhere_(2022). https://cordis.europa.eu/project/id/101083961

Lu, Z. Y., & Hsee, C. K. (2019). Less willing to pay but more willing to buy: How the elicitation method impacts the valuation of a promotion. *Journal of Behavioral Decision Making*, *32*(3), 334–345. https://doi.org/10.1002/bdm.2115

Luszczynska, A., & Schwarzer, R. (2020). Changing Behavior Using Social Cognitive Theory. In M. Hagger, L. Cameron, K. Hamilton, N. Hankonen, & T. Lintunen (Eds.), *The Handbook of Behavior Change* (pp. 32-45). Cambridge University Press. doi:10.1017/9781108677318.003

Lytle, L. A., & Sokol, R. L. (2017). Measures of the food environment: A systematic review of the field, 2007-2015. *Health & Place*, *44*, 18–34. https://doi.org/10.1016/j.healthplace.2016.12.007

Mancini, S., Moruzzo, R., Riccioli, F., & Paci, G. (2019). European consumers' readiness to adopt insects as food. A review. *Food Research International*, *122*, 661–678. https://doi.org/10.1016/j.foodres.2019.01.041

McKinnon, R. A., Reedy, J., Morrissette, M. A., Lytle, L. A., & Yaroch, A. L. (2009). Measures of the food environment: A compilation of the literature, 1990-2007. *American Journal of Preventive Medicine*, *36*(4 Suppl), S124-133. https://doi.org/10.1016/j.amepre.2009.01.012

Meijer, G. W., Lähteenmäki, L., Stadler, R. H., & Weiss, J. (2021). Issues surrounding consumer trust and acceptance of existing and emerging food processing technologies. *Critical Reviews in Food Science and Nutrition*, *61*(1), 97–115. https://doi.org/10.1080/10408398.2020.1718597

*Menozzi, D., Sogari, G., Veneziani, M., Simoni, E., & Mora, C. (2017). Eating novel foods: An application of the theory of planned behaviour to predict the consumption of an insect-based product. *Food Quality and Preference*, *59*, 27–34. https://doi.org/10.1016/j.foodqual.2017.02.001

*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

Moola, S., Munn, Z., Tufanaru, C., Aromataris, E., Sears, K., Sfetcu, R., Currie, M., Lisy, K., Qureshi, R., Mattis, P., & Mu P. (2020). Systematic reviews of etiology and risk. In E. Aromataris, & Z. Munn (Eds.), JBI Manual for Evidence Synthesis. JBI. https://doi.org/10.46658/JBIMES-20-08

*Motoki, K., Park, J., Spence, C., & Velasco, C. (2022). Contextual acceptance of novel and unfamiliar foods: Insects, cultured meat, plant-based meat alternatives, and 3D printed foods. *Food Quality and Preference*, *96*, 104368. https://doi.org/10.1016/j.foodqual.2021.104368

Mullan, B., Allom, V., Brogan, A., Kothe, E., & Todd, J. (2014). Self-regulation and the intention behaviour gap. Exploring dietary behaviours in university students. *Appetite*, *73*, 7–14. https://doi.org/10.1016/j.appet.2013.10.010

Nguyen, J., Ferraro, C., Sands, S., & Luxton, S. (2022). Alternative protein consumption: A systematic review and future research directions. *International Journal of Consumer Studies*, *46*(5), 1691–1717. https://doi.org/10.1111/ijcs.12797

*Ortega, D. L., Sun, J., & Lin, W. (2022). Identity labels as an instrument to reduce meat demand and encourage consumption of plant based and cultured meat alternatives in China. *Food Policy*, *111*, 102307. https://doi.org/10.1016/j.foodpol.2022.102307

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., … Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *The British Medical Journal*, *372*, 71. https://doi.org/10.1136/bmj.n71

*Palmieri, N., & Forleo, M. B. (2021). An Explorative Study of Key Factors Driving Italian Consumers' Willingness to Eat Edible Seaweed. *Journal of International Food & Agribusiness Marketing*, *34*(4), 433–455. https://doi.org/10.1080/08974438.2021.1904082

*Pérez-Lloréns, J. L. (2020). Microalgae: From staple foodstuff to avant-garde cuisine. *International Journal of Gastronomy and Food Science*, *21*, 100221. https://doi.org/10.1016/j.ijgfs.2020.100221

Pineda, E., Poelman, M. P., Aaspõllu, A., Bica, M., Bouzas, C., Carrano, E., Miguel-Etayo, P. D., Djojosoeparto, S., Blenkuš, M. G., Graca, P., Geffert, K., Hebestreit, A., Helldan, A., Henjum, S., Huseby, C. S., Gregório, M. J., Kamphuis, C., Laatikainen, T., Løvhaug, A. L., … Vandevijvere, S. (2022). Policy implementation and priorities to create healthy food environments using the Healthy Food Environment Policy Index (Food-EPI): A pooled level analysis across eleven European countries. *The Lancet Regional Health – Europe*, *23*. https://doi.org/10.1016/j.lanepe.2022.100522

*Pippinato, L., Gasco, L., Di Vita, G., & Mancuso, T. (2020). Current scenario in the European edible-insect industry: A preliminary study. *Journal of Insects as Food and Feed*, *6*(4), 371–381. https://doi.org/10.3920/JIFF2020.0008

Popay, J., Roberts, H., Sowden, A., Petticrew, M., Arai, L., Rodgers, M., Britten, N., Roen, K., & Duffy, S. (2006). *Guidance on the conduct of narrative synthesis in systematic reviews: A product from the ESRC Methods Programme*. https://doi.org/10.13140/2.1.1018.4643

*Porretta, S., Gere, A., Radványi, D., & Moskowitz, H. (2019). Mind Genomics (Conjoint Analysis): The new concept research in the analysis of consumer behaviour and choice. *Trends in Food Science & Technology*, *84*, 29–33. https://doi.org/10.1016/j.tifs.2018.01.004

*Reverberi, M. (2021). The new packaged food products containing insects as an ingredient. *Journal of Insects as Food and Feed*, *7*(5), 901–908. https://doi.org/10.3920/JIFF2020.0111

Sallis, J. F., Cervero, R. B., Ascher, W., Henderson, K. A., Kraft, M. K., & Kerr, J. (2006). An ecological approach to creating active living communities. *Annual Review of Public Health*, *27*, 297–322. https://doi.org/10.1146/annurev.publhealth.27.021405.102100

Salter, A. M., & Lopez-Viso, C. (2021). Role of novel protein sources in sustainably meeting future global requirements. *The Proceedings of the Nutrition Society*, *80*(2), 186–194. https://doi.org/10.1017/S0029665121000513

*Schwark, N., Tiberius, V., & Fabro, M. (2020). How Will We Dine? Prospective Shifts in International Haute Cuisine and Innovation beyond Kitchen and Plate. *Foods*, *9*(10), 1369. https://doi.org/10.3390/foods9101369

Stiles, G., Collins, J., & Beck, K. L. (2022). Effectiveness of Strategies to Decrease Animal-Sourced Protein and/or Increase Plant-Sourced Protein in Foodservice Settings: A Systematic Literature Review. *Journal of the Academy of Nutrition and Dietetics*, *122*(5), 1013–1048. https://doi.org/10.1016/j.jand.2021.12.010

Swinburn, B., Vandevijvere, S., Kraak, V., Sacks, G., Snowdon, W., Hawkes, C., Barquera, S., Friel, S., Kelly, B., Kumanyika, S., L'Abbé, M., Lee, A., Lobstein, T., Ma, J., Macmullan, J., Mohan, S., Monteiro, C., Neal, B., Rayner, M., … INFORMAS. (2013). Monitoring and benchmarking government policies and actions to improve the healthiness of food environments: A proposed Government Healthy Food Environment Policy Index. *Obesity Reviews*, *14 Suppl 1*, 24–37. https://doi.org/10.1111/obr.12073

*Vandenbroele, J., Slabbinck, H., Van Kerckhove, A., & Vermeir, I. (2021). Mock meat in the butchery: Nudging consumers toward meat substitutes. *Organizational Behavior and Human Decision Processes*, *163*, 105–116. https://doi.org/10.1016/j.obhdp.2019.09.004

Vandevijvere, S., Dominick, C., Devi, A., & Swinburn, B. (2015). The healthy food environment policy index: Findings of an expert panel in New Zealand. *Bulletin of the World Health Organization*, *93*(5), 294–302. https://doi.org/10.2471/BLT.14.145540

Weinrich, R., & Elshiewy, O. (2019). Preference and willingness to pay for meat substitutes based on micro-algae. *Appetite, 142*, 104353. https://doi.org10.1016/j.appet.2019.104353

*Weinrich, R., & Elshiewy, O. (2023). A cross-country analysis of how food-related lifestyles impact consumers' attitudes towards microalgae consumption. *Algal Research*, *70*, 102999. https://doi.org/10.1016/j.algal.2023.102999

Wendin, K. M., & Nyberg, M. E. (2021). Factors influencing consumer perception and acceptability of insect-based foods. *Current Opinion in Food Science*, *40*, 67–71. doi:10.1016/j.cofs.2021.01.007

Yang, Y. (2023). Reframing the Dilemma of Consumer Trust in Food E-commerce Live Streaming: Problems, Reasons and Strategies. *Advances in Economics and Management Research*, *6*(1), 1. https://doi.org/10.56028/aemr.6.1.669.2023

12. Study 2: References

References marked with an asterisk indicate studies included in the systematic review.

*Aaslyng, M. D., & Højer, R. (2021). Introducing Tempeh as a New Plant-Based Protein Food Item on the Danish Market. *Foods*, *10*(11), 2865. https://doi.org/10.3390/foods10112865

Ajzen, I., & Schmidt, P. (2020). Changing Behavior Using the Theory of Planned Behavior. In. M. Hagger, L. D. Cameron, K. Hamilton, N. Hankonen & T. Lintunen (Eds.), *The Handbook of Behavior Change* (pp. 17-31). Cambridge University Press. https://doi.org/10.1017/9781108677318

*Andreani, G., Sogari, G., Marti, A., Froldi, F., Dagevos, H., & Martini, D. (2023). Plant-Based Meat Alternatives: Technological, Nutritional, Environmental, Market, and Social Challenges and Opportunities. *Nutrients*, *15*(2), 2. https://doi.org/10.3390/nu15020452

Arcaya, M. C., Arcaya, A. L., & Subramanian, S. V. (2015). Inequalities in health: Definitions, concepts, and theories. *Global Health Action*, *8*, 10.3402/gha.v8.27106. https://doi.org/10.3402/gha.v8.27106

Bambra, C., Smith, K. E., & Pearce, J. (2019). Scaling up: The politics of health and place. *Social Science & Medicine*, *232*, 36–42. https://doi.org/10.1016/j.socscimed.2019.04.036

*Banovic, M., Barone, A. M., Asioli, D., & Grasso, S. (2022). Enabling sustainable plant-forward transition: European consumer attitudes and intention to buy hybrid products. *Food Quality and Preference*, *96*, 104440. https://doi.org/10.1016/j.foodqual.2021.104440

*Banovic, M., & Sveinsdóttir, K. (2021). Importance of being analogue: Female attitudes towards meat analogue containing rapeseed protein. *Food Control*, *123*, 107833. https://doi.org/10.1016/j.foodcont.2020.107833

*Barska, A. (2014). Attitudes of young consumers towards innovations on the food market. *Management*, *18*(1), 419–431. https://doi.org/10.2478/manment-2014-0031

Bianchi, F., Garnett, E., Dorsel, C., Aveyard, P., & Jebb, S. A. (2018). Restructuring physical micro-environments to reduce the demand for meat: A systematic review and qualitative comparative analysis. *The Lancet Planetary Health*, *2*(9), e384–e397. https://doi.org/10.1016/S2542-5196(18)30188-8

Biasini, B., Rosi, A., Giopp, F., Turgut, R., Scazzina, F., & Menozzi, D. (2021). Understanding, promoting and predicting sustainable diets: A systematic review. *Trends in Food Science & Technology*, *111*, 191–207. https://doi.org/10.1016/j.tifs.2021.02.062

Bisconsin-Júnior, A., Rodrigues, H., Behrens, J. H., da Silva, M. A. A. P., & Mariutti, L. R. B. (2022). "Food made with edible insects": Exploring the social representation of entomophagy where it is unfamiliar. *Appetite*, *173*, 106001. https://doi.org/10.1016/j.appet.2022.106001

Bogueva, D., Marinova, D., & Bryant, C. (2022). Meat Me Halfway: Sydney Meat-Loving Men's Restaurant Experience with Alternative Plant-Based Proteins. *Sustainability*, *14*(3). https://doi.org/10.3390/su14031290

Boto, I. (2013). *The geography of food: Reconnecting with origin in the food system*. The Technical Centre for Agricultural and Rural Cooperation (CTA). https://cgspace.cgiar.org/handle/10568/76751

*Brandner, M. M. E., Fyfe, C. L., Horgan, G. W., & Johnstone, A. M. (2022). Self-Reported Purchasing Behaviour, Sociodemographic Predictors of Plant-Based Protein Purchasing and Knowledge about Protein in Scotland and England. *Nutrients*, *14*(21), 4706. https://doi.org/10.3390/nu14214706

*Brayden, W. C., Noblet, C. L., Evans, K. S., & Rickard, L. (2018). Consumer preferences for seafood attributes of wild-harvested and farm-raised products. *Aquaculture Economics & Management*, *22*(3), 362–382. https://doi.org/10.1080/13657305.2018.1449270

*Bryant, C., & Sanctorum, H. (2021). Alternative proteins, evolving attitudes: Comparing consumer attitudes to plant-based and cultured meat in Belgium in two consecutive years. *Appetite*, *161*, 105161. https://doi.org/10.1016/j.appet.2021.105161

Deller, S. C., Lamie, D., & Stickel, M. (2017). Local foods systems and community economic development. *Community Development*, *48*(5), 612–638. https://doi.org/10.1080/15575330.2017.1373136

DiClemente, C. C., & Prochaska, J. O. (1998). Toward a comprehensive, transtheoretical model of change: Stages of change and addictive behaviors. In W. R. Miller & N. Heather (Eds.), Treating addictive behaviors (pp. 3–24). Plenum Press. https://doi.org/10.1007/978-1-4899-1934-2_1

Downs, S. M., Ahmed, S., Fanzo, J., & Herforth, A. (2020). Food Environment Typology: Advancing an Expanded Definition, Framework, and Methodological Approach for Improved Characterization of Wild, Cultivated, and Built Food Environments toward Sustainable Diets. Foods , 9, 532. https://doi.org/10.3390/foods9040532

Enthoven, L., & Van den Broeck, G. (2021). Local food systems: Reviewing two decades of research. *Agricultural Systems*, *193*, 103226. https://doi.org/10.1016/j.agsy.2021.103226

European Commission, Directorate-General for Research and Innovation, Chandler, C., Figueiredo, D., & Francisco, I. (2022). *Food systems: research and innovation investment gap study research: policy paper*. Publications Office of the European Union. https://data.europa.eu/doi/10.2777/09391

European Union (2023). *Eurostat*. Retrieved August 27, 2023, from https://ec.europa.eu/eurostat/databrowser/view/ILC_DI04/default/table?lang=en

FAO (2023). *FAOSTAT*. Retrieved August 27, 2023, from https://www.fao.org/faostat/en/#data

*Florença, S. G., Correia, P. M. R., Costa, C. A., & Guiné, R. P. F. (2021). Edible Insects: Preliminary Study about Perceptions, Attitudes, and Knowledge on a Sample of Portuguese Citizens. *Foods*, *10*(4), 709. https://doi.org/10.3390/foods10040709

Giannakis, E., & Bruggeman, A. (2020). Regional disparities in economic resilience in the European Union across the urban–rural divide. *Regional Studies*, *54*(9), 1200–1213. https://doi.org/10.1080/00343404.2019.1698720

Giovannucci, D., Barham, E., & Pirog, R. (2010). Defining and Marketing "Local" Foods: Geographical Indications for US Products. *The Journal of World Intellectual Property*, *13*(2), 94–120. https://doi.org/10.1111/j.1747-1796.2009.00370.x

*Gómez-Luciano, C. A., de Aguiar, L. K., Vriesekoop, F., & Urbano, B. (2019). Consumers' willingness to purchase three alternatives to meat proteins in the United Kingdom, Spain, Brazil and the Dominican Republic. *Food Quality and Preference*, *78*, 103732. https://doi.org/10.1016/j.foodqual.2019.103732

Graça, J., Godinho, C. A., & Truninger, M. (2019). Reducing meat consumption and following plant-based diets: Current evidence and future directions to inform integrated transitions. *Trends in Food Science & Technology*, *91*, 380-390. https://doi.org/10.1016/j.tifs.2019.07.046

*Grasso, S., & Jaworska, S. (2020). Part Meat and Part Plant: Are Hybrid Meat Products Fad or Future? *Foods*, *9*(12), 1888. https://doi.org/10.3390/foods9121888

Grossmann, L., & Weiss, J. (2021). Alternative Protein Sources as Technofunctional Food Ingredients. *Annual Review of Food Science and Technology*, *12*, 93–117. https://doi.org/10.1146/annurev-food-062520-093642

*Henn, K., Bøye Olsen, S., Goddyn, H., & Bredie, W. L. P. (2022). Willingness to replace animal-based products with pulses among consumers in different European countries. *Food Research International*, *157*, 111403. https://doi.org/10.1016/j.foodres.2022.111403

Higgins, J.P.T., Thomas, J., Chandler, J., Cumpston, M., Li, T., Page, M.J., & Welch V.A. (Ed.). (2022) Cochrane Handbook for Systematic Reviews of Interventions (version 6.3). Cochrane. www.training.cochrane.org/handbook

*Hoek, A. C., Elzerman, J. E., Hageman, R., Kok, F. J., Luning, P. A., & Graaf, C. de. (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

*Hoerterer, C., Petereit, J., & Krause, G. (2022). Informed choice: The role of knowledge in the willingness to consume aquaculture products of different groups in Germany. *Aquaculture*, *556*, 738319. https://doi.org/10.1016/j.aquaculture.2022.738319

Kneafsey, M., Venn, L., Schmutz, U., Balasz, B., Trenchard, L., Eyden-Wood, T., Bos, E., Sutton, G., & Blackett, M. (2013). *Short Food Supply Chains and Local Food Systems in the EU. A State of Play of their Socio-Economic Characteristics* (F. Santini, Y. Gomez, & S. Paloma, Eds.). Publications Office of the European Union. https://data.europa.eu/doi/10.2791/88784

Kröger, T., Dupont, J., Büsing, L., & Fiebelkorn, F. (2022). Acceptance of Insect-Based Food Products in Western Societies: A Systematic Review. *Frontiers in Nutrition*, *8*. https://www.frontiersin.org/articles/10.3389/fnut.2021.759885

LIKE-A-PRO (2022). *Building A Better World Through Alternative Protein Sources.* https://www.like-a-pro.eu/

Lu, Z. Y., & Hsee, C. K. (2019). Less willing to pay but more willing to buy: How the elicitation method impacts the valuation of a promotion. *Journal of Behavioral Decision Making*, *32*(3), 334–345. https://doi.org/10.1002/bdm.2115

*Lucas, S., Gouin, S., & Lesueur, M. (2019). Seaweed Consumption and Label Preferences in France. *Marine Resource Economics*, *34*(2), 143–162. https://doi.org/10.1086/704078

Luszczynska, A., & Schwarzer, R. (2020). Changing Behavior Using Social Cognitive Theory. In M. Hagger, L. Cameron, K. Hamilton, N. Hankonen, & T. Lintunen (Eds.), *The Handbook of Behavior Change* (pp. 32-45). Cambridge University Press. https://doi.org/10.1017/9781108677318

Mancini, M. C., & Antonioli, F. (2022). Italian consumers standing at the crossroads of alternative protein sources: Cultivated meat, insect-based and novel plant-based foods. *Meat Science*, *193*, 108942. https://doi.org/10.1016/j.meatsci.2022.108942

Mancini, S., Moruzzo, R., Riccioli, F., & Paci, G. (2019). European consumers' readiness to adopt insects as food. A review. *Food Research International*, *122*, 661–678. https://doi.org/10.1016/j.foodres.2019.01.041

*Menozzi, D., Sogari, G., Veneziani, M., Simoni, E., & Mora, C. (2017). Eating novel foods: An application of the Theory of Planned Behaviour to predict the consumption of an insect-based product. *Food Quality and Preference*, *59*, 27–34. https://doi.org/10.1016/j.foodqual.2017.02.001

Michie, S., van Stralen, M. M., & West, R. (2011). The behaviour change wheel: a new method for characterising and designing behaviour change interventions. *Implementation Scienc*e, *6*, 42. https://doi.org/10.1186/1748-5908-6-42..

Monfort, P. (2008). *Convergence of EU regions Measures and evolution.* European Commission. https://ec.europa.eu/regional_policy/sources/work/200801_convergence.pdf

Moola, S., Munn, Z., Tufanaru, C., Aromataris, E., Sears, K., Sfetcu, R., Currie, M., Lisy, K., Qureshi, R., Mattis, P., & Mu P. (2020). Systematic reviews of etiology and risk. In E. Aromataris, & Z. Munn (Eds.), JBI Manual for Evidence Synthesis. JBI. https://doi.org/10.46658/JBIMES-20-08

Motoki, K., Park, J., Spence, C., & Velasco, C. (2022). Contextual acceptance of novel and unfamiliar foods: Insects, cultured meat, plant-based meat alternatives, and 3D printed foods. *Food Quality and Preference*, *96*, 104368. https://doi.org/10.1016/j.foodqual.2021.104368

Mullan, B., Allom, V., Brogan, A., Kothe, E., & Todd, J. (2014). Self-regulation and the intention behaviour gap. Exploring dietary behaviours in university students. *Appetite*, *73*, 7–14. https://doi.org/10.1016/j.appet.2013.10.010

*Naranjo-Guevara, N., Fanter, M., Conconi, A. M., & Floto-Stammen, S. (2021). Consumer acceptance among Dutch and German students of insects in feed and food. *Food Science & Nutrition*, *9*(1), 414–428. https://doi.org/10.1002/fsn3.2006

*Nevalainen, E., Niva, M., & Vainio, A. (2023). A transition towards plant-based diets on its way? Consumers' substitutions of meat in their diets in Finland. *Food Quality and Preference*, *104*, 104754. https://doi.org/10.1016/j.foodqual.2022.104754

Nguyen, J., Ferraro, C., Sands, S., & Luxton, S. (2022). Alternative protein consumption: A systematic review and future research directions. *International Journal of Consumer Studies*, *46*(5), 1691–1717. https://doi.org/10.1111/ijcs.12797

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.

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., … Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *The British Medical Journal*, *372*, n71. https://doi.org/10.1136/bmj.n71

Pérez-Lloréns, J. L. (2020). Microalgae: From staple foodstuff to avant-garde cuisine. *International Journal of Gastronomy and Food Science*, *21*, 100221. https://doi.org/10.1016/j.ijgfs.2020.100221

Pfadenhauer, L. M., Gerhardus, A., Mozygemba, K., Lysdahl, K. B., Booth, A., Hofmann, B., Wahlster, P., Polus, S., Burns, J., Brereton, L., & Rehfuess, E. (2017). Making sense of complexity in context and implementation: the Context and Implementation of Complex Interventions (CICI) framework. *Implementation Science, 12*(1), 21. https://doi.org/10.1186/s13012-017-0552-5

*Piha, S., Pohjanheimo, T., Lähteenmäki-Uutela, A., Křečková, Z., & Otterbring, T. (2018). The effects of consumer knowledge on the willingness to buy insect food: An exploratory cross-regional study in Northern and Central Europe. *Food Quality and Preference*, *70*, 1–10. https://doi.org/10.1016/j.foodqual.2016.12.006

Pinho, M. G. M., Mackenbach, J. D., den Braver, N. R., Beulens, J. J. W., Brug, J., & Lakerveld, J. (2020). Recent changes in the Dutch foodscape: Socio-economic and urban-rural differences. *International Journal of Behavioral Nutrition and Physical Activity*, *17*(1), 43. https://doi.org/10.1186/s12966-020-00944-5

*Pippinato, L., Gasco, L., Di Vita, G., & Mancuso, T. (2020). Current scenario in the European edible-insect industry: A preliminary study. *Journal of Insects as Food and Feed*, *6*(4), 371–381. https://doi.org/10.3920/JIFF2020.0008

Popay, J., Roberts, H., Sowden, A., Petticrew, M., Arai, L., Rodgers, M., Britten, N., Roen, K., & Duffy, S. (2006). *Guidance on the conduct of narrative synthesis in systematic reviews: A product from the ESRC Methods Programme*. https://doi.org/10.13140/2.1.1018.4643

*Porretta, S., Gere, A., Radványi, D., & Moskowitz, H. (2019). Mind Genomics (Conjoint Analysis): The new concept research in the analysis of consumer behaviour and choice. *Trends in Food Science & Technology*, *84*, 29–33. https://doi.org/10.1016/j.tifs.2018.01.004

Pucci, T., Casprini, E., Sogari, G., & Zanni, L. (2021). Exploring the attitude towards the adoption of a sustainable diet: A cross-country comparison. *British Food Journal*, *124*(13), 290–304. https://doi.org/10.1108/BFJ-04-2021-0426

*Ribeiro, J. C., Gonçalves, A. T. S., Moura, A. P., Varela, P., & Cunha, L. M. (2022). Insects as food and feed in Portugal and Norway – Cross-cultural comparison of determinants of acceptance. *Food Quality and Preference*, *102*, 104650. https://doi.org/10.1016/j.foodqual.2022.104650

Sallis, J. F., Cervero, R. B., Ascher, W., Henderson, K. A., Kraft, M. K., & Kerr, J. (2006). An ecological approach to creating active living communities. *Annual Review of Public Health*, *27*, 297–322. https://doi.org/10.1146/annurev.publhealth.27.021405.102100

Schwark, N., Tiberius, V., & Fabro, M. (2020). How Will We Dine? Prospective Shifts in International Haute Cuisine and Innovation beyond Kitchen and Plate. *Foods*, *9*(10), 1369. https://doi.org/10.3390/foods9101369

Siddiqui, S. A., Bahmid, N. A., Mahmud, C. M. M., Boukid, F., Lamri, M., & Gagaoua, M. (2022). Consumer acceptability of plant-, seaweed-, and insect-based foods as alternatives to meat: A critical compilation of a decade of research. *Critical Reviews in Food Science and Nutrition*, 1–22. https://doi.org/10.1080/10408398.2022.2036096

Stiles, G., Collins, J., & Beck, K. L. (2022). Effectiveness of Strategies to Decrease Animal-Sourced Protein and/or Increase Plant-Sourced Protein in Foodservice Settings: A Systematic Literature Review. *Journal of the Academy of Nutrition and Dietetics*, *122*(5), 1013–1048. https://doi.org/10.1016/j.jand.2021.12.010

*Szendrő, K., Tóth, K., & Nagy, M. Z. (2020). Opinions on Insect Consumption in Hungary. *Foods*, *9*(12), 1829. https://doi.org/10.3390/foods9121829

*Tzompa-Sosa, D. A., Sogari, G., Copelotti, E., Andreani, G., Schouteten, J. J., Moruzzo, R., Liu, A., Li, J., & Mancini, S. (2023). What motivates consumers to accept whole and processed mealworms in their diets? A five-country study. *Future Foods*, *7*, 100225. https://doi.org/10.1016/j.fufo.2023.100225

Vandecandelaere, É., Arfini, F., Belletti, G., Marescotti, A., Allaire, G., Cadilhon, J.J., Casabianca, F., Damary, P., Estève, M., Hilmi, M., Jull, C., Coent, A.L., Lecourtois, E., Mounsey, J.P., Perret, A.O., Sautier, D., Tartanac, F., Thévenod-Mottet, E., & Wallet, F. (2009). *Linking people, places and products.* Food and Agriculture Organization of the United Nations (FAO) and SINER-GI. https://www.fao.org/3/i1760e/i1760e.pdf

*Vartiainen, O., Elorinne, A.-L., Niva, M., & Väisänen, P. (2020). Finnish consumers' intentions to consume insect-based foods. *Journal of Insects as Food and Feed*, *6*(3), 261–272. https://doi.org/10.3920/JIFF2019.0042

*Verneau, F., La Barbera, F., Amato, M., Riverso, R., & Grunert, K. G. (2020). Assessing the Role of Food Related Lifestyle in Predicting Intention towards Edible Insects. *Insects*, *11*(10), 660. https://doi.org/10.3390/insects11100660

*Verneau, F., La Barbera, F., Kolle, S., Amato, M., Del Giudice, T., & Grunert, K. (2016). The effect of communication and implicit associations on consuming insects: An experiment in Denmark and Italy. *Appetite*, *106*, 30–36. https://doi.org/10.1016/j.appet.2016.02.006

*Weinrich, R., & Elshiewy, O. (2019). Preference and willingness to pay for meat substitutes based on micro-algae. *Appetite*, *142*, 104353. https://doi.org/10.1016/j.appet.2019.104353

*Weinrich, R., & Elshiewy, O. (2023). A cross-country analysis of how food-related lifestyles impact consumers' attitudes towards microalgae consumption. *Algal Research*, *70*, 102999. https://doi.org/10.1016/j.algal.2023.102999

Wendin, K. M., & Nyberg, M. E. (2021). Factors influencing consumer perception and acceptability of insect-based foods. *Current Opinion in Food Science*, *40*, 67–71. https://doi.org/10.1016/j.cofs.2021.01.007

*Zabrocki, R. (2017). A comparative analysis of the determinants of behaviours of polish and german consumers aged 55+ in the innovative food market. *Handel Wewnętrzny*, *1 (366)*, 413–423.

Zaleskiewicz, H., Kulis, E., Siwa, M., Szczuka, Z., Banik, A., Chrysochou, P., Nystrand, B. T., Perrea, T., Samoggia, A., Xhelili, A., Krystallis, A., Luszczynska, A. (2023). *Types of Built Food Environment and Their Characteristics Associated with Alternative Protein Choices by Consumers: Systematic Review and Evidence-Based Typology*. Manuscript in preparation.

13. Annexes

13.1 Annex I: Risk of Bias in Study 1 and Study 2: Evaluation of Quality of Included Original Research, Coded Using Joanna Briggs Institute Quality Evaluation Tool (Table S1)

Table S1 : Quality Evaluation of Original Resaerch Included in Studies 1 and 2

No.	Publication	1. Were the criteria for inclusion in the sample clearly	2. Were the study participants and the setting	3. Was the predictor measured in a valid and reliable way	4. Were objective, standard criteria used for	5. Were confounding factors identified?	6. Were strategies to deal with confounding factors	7. Were the outcomes measured in a valid and reliable way?	8. Was appropriate statistical analysis used?	No. of 'YES'	No. of 'YES'*2 + No. of 'UN'*1	Overall quality score	Overall risk of bias
		Final Score	Final Score	Final Score	Final Score	Final Score	Final Score	Final Score	Final Score			% of maximum score (in case of 'NA' the maximum score was adjusted)	LOW ≥ 70%; MODERATE = 50-69%; HIGH ≤ 49%
1	Aaslyng [2021]	Yes	Yes	Yes	Yes	No	No	Yes	Yes	6	12	75	LOW
2	Aerni [2011]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8	16	100	LOW
3	Ali [2022]	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	7	14	88	LOW
4	Baker [2016]	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7	14	88	LOW
5	Borkowski [2020]	Yes	Yes	NA	NA	Yes	No	Yes	Yes	5	10	83	LOW
6	Brooker [2022]	Yes	Yes	NA	NA	Yes	Yes	Yes	Yes	6	12	100	LOW
7	Clark [2019]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8	16	100	LOW
8	Collins [2019]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8	16	100	LOW
9	Drake [2003]	Yes	Yes	Yes	Yes	No	No	Yes	Yes	6	12	75	LOW
10	Florença [2021]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8	16	100	LOW
11	García-Segovia [2020]	No	No	Yes	Yes	Yes	Yes	Yes	Yes	6	12	75	LOW
12	Herbert [2021]	No	Yes	Yes	Yes	Yes	No	Yes	Yes	6	12	75	LOW
13	Hwang [2020]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8	16	100	LOW
14	Jones [2020]	Yes	Yes	NA	NA	NA	NA	UN	No	2	5	63	MODERATE
15	Menozzi [2017]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8	16	100	LOW
16	Michel [2021]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8	16	100	LOW
17	Motoki [2022]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8	16	100	LOW
18	Ortega [2022]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8	16	100	LOW
19	Palmieri [2021]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8	16	100	LOW
20	Pippinato [2020]	Yes	No	NA	NA	No	No	Yes	NA	2	4	40	HIGH
21	Porretta [2018]	No	No	Yes	Yes	No	No	Yes	No	3	6	38	HIGH
22	Schwark [2020]	Yes	Yes	Yes	Yes	No	No	Yes	No	5	10	63	MODERATE
23	Vandenbroele [2021]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8	16	100	LOW
24	Weinrich [2023]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8	16	100	LOW

No.	Publication	1. Is there congruity between the stated philosophical	2. Is there congruity between the research methodology	3. Is there congruity between the research methodology	4. Is there congruity between the research methodology	5. Is there congruity between the research methodology	6. Is there a statement locating the researcher culturally or	7. Is the influence of the researcher on the research,	8. Are participants, and their voices, adequately	9. Is the research ethical according to current criteria or, for recent	10.Do the conclusions drawn in the research report flow	No. of 'YES'	No. of 'YES'*2 + No. of 'UN'*1	Overall quality score	Overall risk of bias
		Final Score	Final Score	Final Score	Final Score	Final Score	Final Score	Final Score	Final Score	Final Score	Final Score			% of maximum score (in case of 'NA' the maximum score was adjusted)	LOW ≥ 70%; MODERATE = 50-69%; HIGH ≤ 49%
1	Bisconsin-Júnior [2022]	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	7	14	70	LOW
2	Bogueva [2022]	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	7	14	70	LOW
3	Cai [2021]	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	7	14	70	LOW
4	Grasso [2020]	Yes	Yes	Yes	Yes	Yes	No	No	NA	NA	Yes	5	10	38	HIGH
5	Gravely [2018]	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes	7	14	70	LOW
6	Pérez-Lloréns [2020]	NA	NA	NA	NA	NA	NA	NA	NA	No	Yes	1	2	50	MODERATE
7	Reverberi [2021]	No	No	Yes	UN	UN	No	No	Yes	No	UN	2	7	35	HIGH

Note:
UN - unclear
NA - not applicable

Yes - 2 points
Unclear - 1 point
No - 0 points
In case of NA - the maximum score was adjusted respectively
Maximum score (when all criteria were rated 'Yes') = 20 points
Final score - a score agreed between the two reviewers

No.	Publication	1. Were the criteria for inclusion in the sample clearly defined?	2. Were the study participants and the setting described in	3. Was the predictor measured in a valid and reliable way	4. Were objective, standard criteria used for measurement	5. Were confounding factors identified?	6. Were strategies to deal with confounding factors stated?	7. Were the outcomes measured in a valid and reliable way?	8. Was appropriate statistical analysis used?	No. of 'YES'	No. of 'YES'*2 + No. of 'UN'*1	Overall quality score	Overall risk of bias
		Final Score	Final Score	Final Score	Final Score	Final Score	Final Score	Final Score	Final Score			% of maximum score (in case of 'NA' the maximum score was adjusted)	LOW ≥ 70%; MODERATE = 50-69%; HIGH ≤ 49%
1	Aaslyng [2021]	Yes	Yes	Yes	Yes	No	No	Yes	Yes	6	12	75	LOW
2	Andreani [2023]	Yes	Yes	NA	NA	Yes	No	Yes	Yes	5	10	83	LOW
3	Banovic [2021]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8	16	100	LOW
4	Banovic [2022]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8	16	100	LOW
5	Barska [2014]	No	No	Yes	No	No	No	Yes	No	2	4	25	HIGH
6	Brandner [2022]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8	16	100	LOW
7	Brayden [2018]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8	16	100	LOW
8	Bryant [2021]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8	16	100	LOW
9	Clark [2019]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8	16	100	LOW
10	Florença [2021]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8	16	100	LOW
11	Gómez-Luciano [2019]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8	16	100	LOW
12	Grasso [2022]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8	16	100	LOW
13	Henn [2022]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8	16	100	LOW
14	Hoek [2004]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8	16	100	LOW
15	Hoerterer [2022]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8	16	100	LOW
16	Lucas [2019]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8	16	100	LOW
17	Menozzi [2017]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8	16	100	LOW
18	Motoki [2022]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8	16	100	LOW
19	Naranjo-Guevara [2020]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8	16	100	LOW
20	Nevalainen [2023]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8	16	100	LOW
21	Palmieri [2021]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8	16	100	LOW
22	Piha [2018]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8	16	100	LOW
23	Porretta [2018]	No	No	Yes	Yes	No	No	Yes	No	3	6	38	HIGH
24	Ribeiro [2022]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8	16	100	LOW
25	Szendrő [2020]	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7	14	88	LOW
26	Tzompa Sosa [2023]	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	7	14	88	LOW
27	Vartiainen [2020]	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	7	14	88	LOW
28	Verneau [2016]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8	16	100	LOW
29	Verneau [2020]	No	No	Yes	Yes	Yes	Yes	Yes	Yes	6	12	75	LOW
30	Zabrocki [2017]	Yes	Yes	Yes	Yes	No	No	Yes	No	5	10	63	MODERATE

Note:
NA - not applicable
Yes - 2 points
Unclear - 1 point
No - 0 points
In case of NA - the maximum score was adjusted respectively

Maximum score (when all criteria were rated 'Yes') = 16 points
Final score - a score agreed between the two reviewers