D1.1
Alternative protein integration in EU diets

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List of abbreviations

AB – Anna Banik (co-author)
APF – Alternative protein foods
AL - Aleksandra Luszczynska (co-author)
BTN - Bjørn Tore Nystrand (co-author)
CICI – the Context and Implementation for Complex Interventions Framework
COM-B – the Capabilities, Opportunities, Motivation, and Behavior Model
EK - Ewa Kulis (co-author)
FG - Francesca Grossi (co-author)
HZ – Hanna Zaleskiewicz (co-author)
ORE – Open Research Europe Database
MS – Maria Siwa (co-author)
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

This document corresponds to deliverable D1.1, "Alternative protein integration in EU diets" which reviews evidence for key behavioral and socio-cultural determinants of alternative protein choices among European consumers.

More specifically, the report synthesizes empirical evidence for the determinants of the consumer choices of alternative protein food (APF). Specifically, it addresses the associations between APF and: (i) the individual-level determinants (capabilities, perceived opportunities, motivation) from the COM-B model and sociodemographic factors from socio-ecological models of behavior change, such as: age, gender, education, and income, and (ii) indicators of the consumer choices (e.g., intention to eat, buy, pay, acceptance of, intake).

Methods: We conducted a systematic review of reviews (a meta-review), preregistered with the PROSPERO database (#CRD42023388694), involving a systematic search of 13 databases of peer-reviewed journals. Twenty-eight reviews were included. The risk of bias was assessed using the ROBIS tool. Findings were coded as providing strong support for the associations if >66% of reviews (k≥3) indicated significant associations between an individual-level determinant and the consumer choice indicators. Findings were coded as providing preliminary support for the associations if >50% of reviews (k≥3) indicated significant associations.

Results: For *plant-based APF* choices, *strong support* was obtained for associations with the COM-B and sociodemographic determinants, including: (i) capabilities, such as cooking skills, exposure to APF, and related familiarity; (ii) motivations, such as perceived health benefits, pro-environmental and sustainability benefits, animal welfare/empathy towards animals; (iii) sociodemographic factors including younger age and higher education. For *insect-based APF choices*, *strong support* for the associations was obtained for the COM-B determinants, including: (i) capabilities referring to formal knowledge about APF, exposure to APF, and familiarity with APF; (ii) perceived opportunities, referring to positive social norms, perceived positive cultural norms accepting APF, low distrust in technology used in the development of APF; (iii) motivations, such as perceived health benefits, pro-environmental and sustainability benefits, low perceived health risks, feelings of adventurous, daring, excitement, emotion of curiosity, low neophilia, low disgust; (iii) sociodemographic determinants such as male gender and younger age. For *APF from any sources* (including plants, insects, fungi, etc.) either *strong or preliminary support* was obtained for individual-level determinants, such as multiple exposures to APF/ perceived familiarity, positive social norms, distrust in technology used in APF development, pro-environmental and sustainability beliefs, food neophobia.

Conclusions: This study highlights differences in the individual-level determinants that receive strong support in research on choices related to plant-based APF, insect-based APF, and APF from other sources. Strategies applied by the APF producers, awareness raising campaigns, and other actions that aim to mainstream specific APF products may need to address different motivations of the consumers, depending on the source of alternative proteins included in the respective products. Actions aiming at the promotion of alternative proteins from any sources should target consumers characteristics that obtained strong or (at least) preliminary support across all types of APF products, such as positive social norms or distrust in technology used in the development of APF.

1. Introduction

1.1 Background

High-quality protein diet has well-established beneficial effects on human health, contributing to healthy weight management, improved metabolism, and healthy aging (Rodriguez, 2015). In developed countries, animal products, such as meat, eggs, and dairy, are the typical protein choices (Eat-Lancet Commission, 2022). However, the production of meat and dairy is among the largest drivers of environmental degradation, threatening climate stability and ecosystems (Eat-Lancet Commission, 2022). Shifting from traditional, animal-based proteins to alternative proteins becomes a major challenge for global food systems. This transition may have also positive effects on health. For instance, replacing just 3% of energy from animal protein with plant protein is associated with a decrease in overall mortality (10% in both men and women) and cardiovascular disease mortality (11% lower risk in men and 12% lower risk in women) (Huang et al., 2020). Alternative protein food (APF) products may include protein concentrates obtained during the processing of insects, krill, microbial biomass, mushrooms, fungi, or plants such as pea or rapeseed (cf. Grossmann & Weiss, 2021; LIKE-A-PRO Project, 2022). The term "alternative proteins" may refer to sources that have a lower environmental impact compared to traditional protein sources (e.g., beef, pork, poultry, animal dairy) (Grossmann & Weiss, 2021). Thus, APF may exclude cultured meat due to ongoing debates questioning its environmental benefits (Grossmann & Weiss, 2021).

Socio-ecological models, suggest that human behavior, including nutrition behavior, is influenced by individual-level determinants, socio-environmental factors, and policy factors (Bronferbrenner, 1979; the Centers for Disease Control and Prevention, 1977; McLeroy et al., 1988). In line with these models, the majority of health behavior change models suggest that individual-level determinants are the most proximal predictors of behavior change (e.g., Hagger et al., 2020; Luszczynska & Schwarzer, 2020). Michie et al. (2011) proposed the Capabilities-Opportunities-Motivation (COM-B) model, capturing individual, social, and environment-level determinants of human behavior. Since its inception, COM-B has been widely used by researchers and specialists from various disciplines (West & Michie, 2020). To increase its usability in developing interventions for behavior change, the COM-B model has been combined with taxonomies identifying barriers and facilitators that may determine implementation of interventions promoting behavioral shift (Cane et al., 2012, McDonagh et al., 2018).

In accordance with the COM-B model, capabilities (C) refer to individual's physical and psychosocial abilities required to engage in a health behavior, such as nutrition behavior. Opportunities (O) refer to by individual's physical and social environment, while motivations (M) include reflective and automatic factors (Michie et al., 2011, West & Michie, 2022). Capabilities may include knowledge, memory, and attention processes, but also skills, or proficiencies acquired through repeated exposure or practice (Cane et al., 2012; McDonagh et al., 2018; Michie et al., 2011). Opportunities can refer to the physical and social environment, as well as social influences, social pressure norms, or perceptions of the built environment (Cane et al., 2012; McDonagh et al., 2018; Michie et al., 2011). Finally, motivation includes emotions that represent automatic processes, beliefs about consequences of behaviors, identity, values, or personality factors (Cane et al., 2012; McDonagh et al., 2018).

The trans-theoretical and transdisciplinary character of the COM-B model makes it an ideal framework to synthesize existing empirical evidence concerning individual-level determinants of nutrition behaviors, such as APF consumption. Indeed, the model has been previously applied in reviews of individual-level determinants of APF choices (Graça et al., 2019; Nguyen et al., 2022).

In addition to the determinants accounted for in the COM-B model, socio-ecological models of behavior change also highlight the role of the main sociodemographic factors, such as age, gender, education, and income, which can operate as either individual or social-level determinants factors (Bronferbrenner, 1979; the Centers for Disease Control and Prevention, 1977; McLeroy et al., 1988). Sociodemographic characteristics

are also crucial contextual factors to consider when designing health promotion interventions, ensuring the interventions align with the needs of the targeted population (see Context and Implementation of the Complex Interventions model; CICI; Pfadenahuer et al., 2019).

The rapidly increasing number of research on individual-level determinants of the intention (to buy or to try APF), the actual purchase of APF, or intake of APF resulted in a growing number of reviews on this topic (e.g., Dagevos, 2020; Eckl et al., 2021; Hartmann & Siegrist, 2017; Kauppi et al., 2019; Kröger et al., 2022; Nguyen et al., 2022; Onwezen et al., 2021; Szenderák et al., 2022; Toti et al., 2020; Wang et al., 2022; Weinrich, 2019). Many of these reviews focus on specific APF sources, such as insect-based proteins only (Kröger et al., 2022). Other reviews combine evidence for various protein sources (e.g., Nguyen et al., 2022; Onwezen et al., 2021); however, they do not investigate which individual-level determinants may be specific for certain protein sources (such as insects), as opposed to those determinants that are commonly associated with choosing APF from plant-based or other sources. These reviews yield some divergent conclusions, and it remains unclear whether these disparities are due to limited evidence or differences in the types of APF investigated. For instance, some studies report contradictory findings regarding the association between knowledge and indicators of consumer choices of plant-based APF (e.g., Baiano, 2020; Eckl et al., 2021). Finally, although these reviews list numerous potential individual-level determinants, it remains unclear if these determinants are strongly supported by the existing evidence, meaning they exhibit consistent support in the majority of studies, conducted in different contexts, or if they are initially supported and require further evidence to draw definitive conclusions.

In addition to systematic reviews, meta-reviews combining the results of existing systematic, scoping, or realist reviews, represent a valuable approach providing an overarching synthesis of empirical evidence (Hennesy et al., 2019). Considering the varying conclusions in existing systematic reviews concerning sociodemographic, capabilities-, motivation- or opportunity-related individual-level factors associated with choices of APF from different sources (e.g., plants, insects, bacteria, fungi, krill, etc.), a meta-review may be an adequate choice to provide an overarching synthesis of evidence across determinants and the APF-related outcomes. The meta-review may also provide insights that may be used to develop evidence-based strategies to promote APF among consumers via education campaigns, awareness raising campaigns, marketing strategies applied by producers or retailers, etc. A systematic, evidence-based list of the individual-level characteristics of the consumers provides a catalogue of the characteristics of the target population that may be more likely to become early adopters of new APF products. Early adopters may be a prime target of the actions aiming to mainstream APF choices. Increasing APF choices among early adopters may model APF intake in their social networks, and increase the reach of APF across populations and penetration of APF across food systems.

1.2 Study Aims

The purpose of this meta-review was to synthesize the evidence (accumulated in reviews) for the associations between: (i) the individual-level determinants (capabilities, perceived opportunities, motivation) from the COM-B model and sociodemographic factors from socio-ecological models of behavior change (Bronferbrenner, 1979; McLeroy et al., 1988) and from the CICI model (Pfadenahuer et al., 2019), such as age, gender, education, and income, and (ii) indicators of the individuals' choices of alternative protein food. In particular, we investigated which individual-level determinants are consistently identified across the reviews as associated with consumer choices indicators, and therefore they could be considered strongly supported. Second, we studied specific and common individual-level factors that may be associated with a specific type of APF. In particular, we focus on distinguishing between plant-based proteins and insect-based proteins, which are two of the most frequently addressed protein types in APF research. We also explore the individual-level determinants of consumer choices of proteins from any other alternative sources, such as fungi, bacteria, krill, etc.

Given that *individual-level determinants* are the focus of this study, our examination of opportunities addresses individuals' perceptions of and beliefs about social and physical environment. The investigation of the actual characteristics of the physical environment (such as availability of certain types of APF), falls outside the scope of this review. Similarly, the characteristics of the product (not the consumer themselves), such as the price, taste, smell, the shape and color of the product, etc., are outside of the scope of this review. Characteristics of the built environment and geographical factors that may be related to APF choices are reported in D1.2.

2. Methods

We conducted a meta-review (systematic review of reviews; Hennesy et al., 2019), integrating empirical evidence from existing systematic, realist, scoping reviews. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Page et al., 2021) were applied and the study was preregistered with the PROSPERO database, no. CRD42023388694.

2.1 Search Strategy

A systematic search of encompassed 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 conducted using EBSCO platform. The selected databases are either multidisciplinary or address fields of economics 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.

Besides systematic searches of the included databases, two researchers (FG, BTN) manually searched reference lists of reviews. Furthermore, complementary non-systematic searches of published peer-reviewed papers in Google Scholar were conducted using the same keywords as for databases. Finally, CORDIS and Open Research Europe (ORE) databases of open peer-reviewed documents publishing results of European Union's Horizon 2020 and Horizon Europe research projects were searched, using 'alternative protein' keywords (the alteration of the keywords was applied as CORDIS and ORE impose limits for the length of search strings, up to 50 characters).

As suggested by Hennessy et al. (2019), utilizing as many relevant databases as possible is advised, not only to ensure that relevant reviews were retrieved but also to minimize a potential selection bias. The research team (HZ, AB, ZS, EK, MS, AS, FG, PC, TP, AK, BTN) conducted discussions and preliminary searches of the "grey literature" sources. The results of these preliminary searches suggested that the reviews found in the "grey literature" (e.g., identified by Google searches but not published in any peer-review journals, ORE or CORDIS databases) did not meet criteria of systematic, realist, or scoping reviews. In particular, the reviews identified in the "grey literature" sources did not report methods of data search, and/or inclusion criteria, and/or the approaches to data coding. Therefore, these reviews did not provide information allowing to evaluate the possibility of a systematic bias in reported results. Consequently, the research team decided not to conduct systematic searches of the "grey literature" sources.

Figure 1 presents the details of the data selection process.

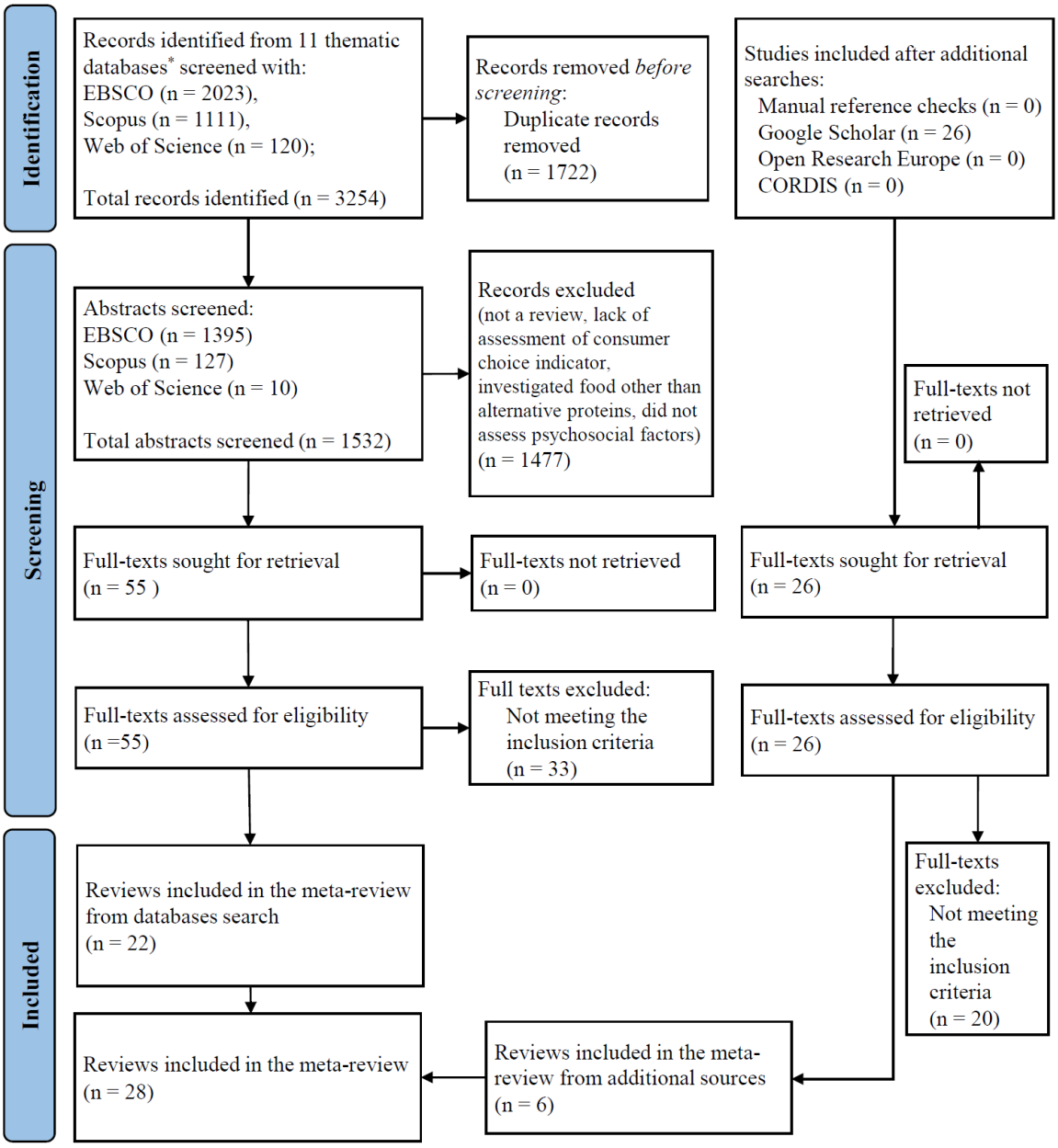

Figure 1. The data selection process.

The systematic search applied a string with three groups of keywords that referred to: (1) indicators of consumers' choices or categories of individual-level determinants (e.g., motivation or belief). The examples of keywords include: accept* OR preference* OR willing* OR buy* OR purchas* OR choice*OR behavio* OR adopt* OR perception* OR access* OR availab* OR affordab* OR belief* OR percep* OR cognit* OR motiv* OR ability OR attitude*; (2) alternative protein indicators (e.g. seaweed* OR alga* OR insect* OR lupin* OR pulse* OR legume* OR bean* OR "dry pea*" OR "cow pea*" OR "pigeon pea*", (3) the terms referring to review as a research method (e.g., meta-synthesis OR meta-review OR "synthesis of data" OR "critical analysis of the literature" OR metaanaly* OR meta-analy* OR "meta analy*" OR "retrospective analysis" OR "qualitative analysis" OR "quantitative analysis"). These keywords were selected using existing reviews on APF (Mancini

et al., 2019; Nguyen, et al., 2022; Onwezen et al., 2021) and research applying COM-B and CICI frameworks (Nguyen et al., 2022; Pfadenhauer et al., 2019). The researchers from consumer sciences, food sciences, and nutrition fields within the LIKE-A-PRO consortium were consulted to determine the keywords referring to APF. The list of keywords proposed by Hennesy et al. (2019) was used to identify reviews.

For this meta-review, the chosen strategy was to use a broad, 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 the string was pretested across the databases, before initiating the search. The decision to use the broad search string increased the number of identified entries, potentially leading to the inclusion of relevant documents during the first stages of the screening process.

The initial search yielded k = 2,023 records obtained in searches of 11 databases using EBSCO search engine, and k = 120 in Web of Science, k = 1,111 in SCOPUS. All identified abstracts were screened by two researchers (randomly assigned from a group of five researchers, HZ, EK, ZS, MS, AB) to elicit potentially relevant studies. Any conflicts related to the potential inclusion of a review 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 match with the inclusion criteria.

Additional searches for peer-reviewed publications presenting reviews, beyond those identified in the database search, involved the following strategies: screening references of evaluated articles (conducted by two reviewers [FG and BTN] independently), and 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 reviews resulted in the inclusion of 28 reviews (see Figure 1).

2.2 Inclusion and Exclusion Criteria

The following inclusion criteria were applied: (1) peer-reviewed systematic, scoping, or realist reviews of quantitative or qualitative studies, (2) reviews addressing APF from any sources, including alternative proteins that are plant-based, fungi-based, bacteria-based, insect-based, krill-based, etc.; or reviews addressing food products that combine meat- and plant-based proteins, (3) reviews investigating individual-level determinants, guided by COM-B model or individual-level characteristics included in sociodemographic domain of the CICI framework (age, gender, education, income), (4) reviews addressing associations between the individual-level determinant and consumer choice indicators (e.g., intention to buy, intention to eat, actual intake, actual purchase, acceptability), (5) reviews published in English language.

The exclusion criteria were: (1) original studies (i.e., research that did not aim at providing a review but focused on reporting new results of an original study), dissertations, protocols, conference materials, and book chapters; (2) reviews that did not provide any empirical evidence for the associations between individual-level determinants and consumer choice indicators (e.g., reviews on influence of APF intake on health outcomes or environment, reviews of policy guidelines), (3) reviews that focused solely on reducing meat intake without addressing the replacement of meat proteins with proteins from alternative sources; (4) reviews that focused on an increase of intake of fruit and/or vegetable (or on vegetarian diet), but did not include results specifically related to alternative protein sources; (5) reviews focusing solely on alternatively grown beef, poultry or pork meat (e.g., laboratory based, in-vitro grown), without any alternative proteins (other than laboratory grown meat) added, (6) reviews focusing on product characteristics, such as sustainability, health influence, production, packaging, and taste, (7) reviews focusing solely on alternative proteins as supplements or as animal feed.

2.3 Data Extraction and Coding

Data necessary for quality evaluation and the assessment of the risk of bias was extracted and coded by two reviewers (FG and BTN). In case of disagreements during this stage a resolution was achieved through arbitration by a third researcher (AB or MS). The remaining data extraction and coding were conducted by two researchers (HZ and AL). Disagreements during these stages were resolved using the consensus method (searching for possible rating errors, followed by discussion and arbitration by a third researcher, AB [(Higgins et al., 2022]).

To address the study objectives the following data were extracted (see Annex 1, Table S1): characteristics of reviews included (number of original studies, design of the original studies, details regarding populations studied, and countries where data were collected), general objectives and results of the reviews, types of APF analyzed in the results section, types of consumer choice indicators addressed in the results section, types of individual-level determinants (categorized based on the COM-B model and the individual-level sociodemographic characteristics) addressed in the results section, and the associations between consumer choice indicators and the individual-level determinants.

The coding process involved categorizing the reviews on the following criteria:

- *Alternative protein food (APF*), if the food products include proteins obtained from land plants, or sea plants such as algae, fungi, and insects, as these sources have been shown to have low environmental impact (Grossman & Weiss, 2021). Consistently with this definition, cultured meat was excluded because the technology is still in its early stages and its potential environmental benefits have been questioned (Grossman & Weiss, 2021). For the purpose of this review, 4 broader groups of APF were distinguished, guided by results presented in included reviews: (i) plant-based APF, including microalgae-based APF; (ii) insect-based APF; (iii) mushroom/fungi-based APF; (iv) AFP from various sources, including plant-, insect, -fungi/mushroom-based proteins. The final category refers to cases where the results presented in the included reviews pertained to various alternative proteins, without specifying if the respective results are related, e.g., to plant-based APF only.
- The *APF choice indicators* included behavior indicators and its most proximal determinant, intention (Theory of Planned Behavior [Ajzen & Schmid, 2020] or Social Cognitive Theory [Luszczynska & Schwarzer, 2020]). Specifically, we included (1) intention to buy, intention to eat, and intention to pay; (2) self-reported behavior, including self-reported intake, or "adoption" defined as an incorporation of APF into own diet (Rogers, 2003); (3) the actual performance of a behavior (e.g., the number of times the product was actually purchased); (4) a broader category of "acceptance" of APF (cf. Onwezen et al. 2021), used in reviews summarizing purchase-related or intake-related behaviors and intentions, without specifying which is actually considered in a specific study.
- The *individual-level determinants*, included in the COM-B model (broad categories of capabilities, perceived opportunities, and motivations) or the sociodemographic individual-level characteristics, such as: age, gender, income, and education (cf. CICI framework). When a determinant was named using a very broad term, e.g., an "attitude" and a specific definition or a reference to a definition was not provided, the findings were excluded due to the ambiguity of the construct. The examples are: "attitudes" or "persuasion drivers." Other health behaviors, such as alcohol intake, exercise, but also vegetarian or vegan diet were excluded as the determinants, as behaviors or behavioral patterns are the outcomes of the determinants in the COM-B model. Actual environmental determinants (e.g., the ways the product is exposed in the supermarkets) or product-related determinants (e.g., its sensory characteristics, price) were excluded and are beyond the scope of this review.
- Reviews were *coded as providing evidence for the association* (see reviews coded as "+" or "-" in Table 1) if the results of the included review reported significant associations between the choice indicator (e.g., intention to buy, pay, or eat, acceptability, and adoption) and an individual-level determinant (e.g., emotion-related determinants such as neophobia, disgust, and curiosity). In case the results reported in

the review were indicated as significant for some original studies, but not significant in case of other studies, the reviews were coded as providing mixed/non-significant evidence (see reviews coded as "0" in Table 1). As the included reviews did not separate results and conclusions for correlational studies versus experimental studies (comparing an experimental manipulation condition with a control condition), the causal vs. correlational character of the association was not coded.

2.4 Quality Assessment Methods

The quality assessment of the included reviews was performed by two researchers (FG and BTN or AB and MS) independently. The assessment was based on criteria from the ROBIS tool, which is used to evaluate the risk of bias in systematic reviews (Whiting et al., 2016). Thresholds for categorizing reviews as having low, moderate, or high risk of bias were defined in accordance with the rules indicated in the respective assessment tools (Whiting et al., 2016). 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. The values of the weighted Cohen's kappa indicated a moderate agreement between raters, with $k = 0.88$ (95 CI: [0.74, 1.00]).

2.5 Data Analysis and Synthesis

We used a narrative synthesis method, based on the Economic and Social Research Council guidance of narrative synthesis (Campbel et al., 2019; Popey et al., 2006). First, a narrative synthesis uses a theoretical model to provide the underpinnings for the analyzed patterns of associations (Campbel et al., 2019; Popey et al., 2006). This review used the COM-B model and CICI framework (Pfadenhauer et al., 2019) as the theoretical underpinnings. Second, the preliminary synthesis should be provided, including an initial description of the results of included studies (e.g., their textual description, and characteristics of included reviews. In the present meta-review, we coded included studies along several categories (e.g., type of APF, the breadth of the determinants included) and provided a description of initial results. The third step of the narrative synthesis accounts for exploring the relationships in the data to identify patterns of associations and explain differences in association directions. 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. This meta-review addressed the heterogeneity of included reviews in reference to the quality of included papers.

Next, the obtained results were summarized as *providing preliminary support* or *providing strong support*. In case the individual-level determinants were addressed in $k \geq 3$ reviews and at least between ≥ 51% and ≤66% of included reviews indicated a significant association (in the same direction), then the association between a respective individual-level determinant and a respective APF choice indicator was considered *preliminarily supported* by the analyzed data. The associations were also preliminarily supported if only two included reviews addressed respective associations, with both of them (two out of two) indicating consistent significant associations (in the same direction).

The association between an individual-level determinant and an APF choice indicator was considered *strongly supported* if > 66% of included reviews ($k \geq 3$) indicated a significant association (in the same direction). For example, three out of four reviews studying respective associations indicated positive links between the two indices. These thresholds did not account for the number or quality of the original studies included in the respective review. Similar thresholds were applied in previous meta-reviews conducted in the context of nutrition behaviors or healthy diet (e.g., Cislak et al., 2012; Horodyska et al., 2015).

Table 1. - Results of coding of the associations between the determinants (the COM-B model dimensions and sociodemographic characteristics) and alternative protein food (APF) choice indicators among consumers.

COM-B model and sociodemografic individual-level determinants of APF choice	APF choice indicators	Plant-based APF: reviews providing evidence for the association	Insect-based APF: reviews providing evidence for the association	Food made with any alternative proteins (e.g., based on sources from plants, insects, mycoproteins, etc.): reviews providing evidence for the association
COM-B: CAPABILITIES				
Perceived cooking skills (referring to preparing meals with respective alternative protein components)	Intention to eat			+ (Nguyen et al., 2022)
	Acceptability	+ (Onwezen et al., 2021)		
	Self-reported intake or adoption of a diet	+ (Eckl et al., 2021) + (Graça et al., 2019) + (He et al., 2020)		+ (Nguyen et al., 2022)
Purchase activism (a trait describing customers' motivation to express opinions and influence the marketplace via purchases)	Intention to buy		+ (Kröger et al., 2022)	
Mindfulness	Acceptability		0 (Dagevos, 2020) 0 (Kröger et al., 2022)	
Easiness to replace meat with AFP (perceived convenience)	Intention to buy			+ (Siddiqui, Bahmid et al., 2022)
	Acceptability		+ (Onwezen et al., 2021)	+ (Siddiqui, Bahmid et al., 2022)
	Various indicators (intention to: consume, try, pay for)		0 (Wassmann, et. al., 2021)	
	Self-reported intake/ adoption of a diet	+ (Graça et al., 2019)	+ (Florença et al., 2022)	
Formal knowledge about the positive effects of food consumption and the respective types of food	Intention to eat		+ (Ardoin & Prinyawiwatkul, 2021) + (Kauppi et al., 2019) + (Mancini et al., 2019) + (Siddiqui, Alvi et al., 2022)	
	Intention to buy	+ (Eckl et al., 2021)	+ (Ardoin & Prinyawiwatkul, 2021)	
	Intention to pay	+ (Eckl et al., 2021)	+ (Siddiqui, Alvi et al., 2022)	
	Acceptability of food	0 (Baiano, 2020) 0 (Eckl et al., 2021)	+ (Batat & Peter, 2020) + (Mina et al., 2023) + (Siddiqui, Alvi et al., 2022) + (Weinrich, 2019) 0 (Wendin & Nyberg, 2021)	+ (mushroom-based products; De Cianni et al., 2023) 0 (novel food; Giordano et al., 2017)

	Adoption of a diet		+ (Eckl et al., 2021) + (Florença et al., 2022)	
Perceived process of getting more information	Self-reported adoption of a diet	+ (Graça et al., 2019)		
Information provided to those interested in nutritional or ecological benefits of eating behavior (information provided to susceptible people)	Intention to eat		+ (Dagevos, 2020)	
Perceived familiarity/multiple exposures to APF	Intention to eat		+ (Kauppi et al., 2019) + (Wendin & Nyberg, 2021)	
	Intention to buy	+ (Szenderák et al., 2022)		
	Acceptability of food	+ (Baiano, 2020) + (He et al., 2020) + (Onwezen et al., 2021)	+ (Ardoin & Prinyawiwatkul, 2021) + (Dagevos, 2020) + (Hartmann & Siegrist, 2017) + (Kröger et al., 2022) + (Mancini et al., 2019) + (Mina et al., 2023) + (Onwezen et al., 2021) + (Toti et al., 2020) + (Wendin & Nyberg, 2021)	+ (mushroom-based products; De Cianni et al., 2023) + (Hartmann & Siegrist, 2017) + (Siddiqui, Bahmid et al., 2022) + (Siddiqui, Zannou et al., 2022)
	Various indicators (intention to: consume, try, pay for)		+ (Wassmann et al. 2021) – (meta-analysis - Wassmann et al. 2021) + (for past experience; meta-analysis – Wassmann et al. 2021) 0 (for mere familiarity; meta-analysis - Wassmann et al. 2021)	
	Self-reported intake/adoption of a diet	+ (Graça et al., 2019)		
	Reduced neophobia		+ (Wendin & Nyberg, 2021)	
	Adoption of a diet		+ (Florença et al., 2022)	+ (Nguyen et al., 2022)
	Early adopters (intention to try, but not necessarily maintain)		+ (Dagevos, 2020)	
COM-B: OPPORTUNITIES				
Positive social norms (food accepted by peers, family or experts)	Intention to try	+ (Graça et al., 2019)	+ (Mina et al., 2023) + (Wendin & Nyberg, 2021)	
	Intention to eat		+ (Ardoin & Prinyawiwatkul, 2021)	

			+ (Kauppi et al., 2019)	
	Acceptability of specific types of food	+ (Onwezen et al., 2021)	+ (Kröger et al., 2022) + (Mancini et al., 2019) + (Mina et al., 2023) + (Onwezen et al., 2021) + (Siddiqui, Alvi et al., 2022) + (Wendin & Nyberg, 2021)	+ (mushroom-based products; De Cianni et al., 2023) + (mushroom-based product; Eckl et al., 2021) + (Giordano et al., 2017) + (Nguyen et al., 2022) + (Siddiqui, Bahmid et al., 2022)
	Various indicators (intention to: consume, try, pay for)		+ (Wassmann, et al., 2021)	
	Adoption of a diet		+ (Florença et al., 2022)	
Positive social norm regarding eating meat	Acceptability of intake	– (He et al., 2020)		– (Nguyen et al., 2022)
Social support from family and friends to follow a meatless diet	Self-reported intake	+ (Graça et al., 2019)		
Social identity (sociability and positive social image of non-eating meat)	Intention to eat			+ (Nguyen et al., 2022)
Positive cultural norms	Intention to eat		+ (Toti et al., 2020)	
	Intention to eat		+ (Siddiqui, Alvi et al., 2022)	
	Acceptability of food		+ (Batat & Peter, 2020) + (novel insect-based food; Giordano et al., 2017) + (Kauppi et al., 2019) + (Hartmann & Siegrist, 2017) + (Mancini et al., 2019) + (Onwezen et al., 2021) + (Toti et al., 2020) + (Wendin & Nyberg, 2021)	+ (mushroom-based products; De Cianni et al., 2023) + (Nguyen et al., 2022) + (Siddiqui, Zannou et al., 2022)
	Self-reported intake		+ (Toti et al., 2020)	
	Adoption of a diet		+ (Florença et al., 2022)	
Incompatibility with local food	Adoption			– (Weinrich, 2019)
Perceived as unsafe	Acceptability of food	– (Baiano, 2020)	– (Wendin & Nyberg, 2021)	– (Siddiqui, Zannou et al., 2022)
Perceived as safe	Intention to eat		+ (Wendin & Nyberg, 2021)	
	Intention to buy		+ (Wendin & Nyberg, 2021)	
Perceived artificialness, technology distrust/food technology neophobia	Intention to purchase	– (Szenderák et al., 2022)		– (Siddiqui, Zannou et al., 2022)
	Acceptability	– (Onwezen et al., 2021)	– (Kröger et al., 2022)	– (Eckl et al., 2021) – (Giordano et al., 2017)

	Various indicators (intention to: consume, try, pay for)		– (Wassmann et al., 2021)	
	Adoption of a diet		– (Florença et al., 2022) – (Wendt & Weinrich, 2023)	
Low perceived uncertainty/high trust (in research, science, independent promoters/organizations)	Acceptability	+ (algae-based only; Onwezen et al., 2021)	+ (Onwezen et al., 2021)	+ (novel food; Giordano et al., 2017) + (Siddiqui, Zannou et al., 2022)
COM-B: MOTIVATIONS				
Health benefits, perceived healthiness	Intention to eat		+ (Toti et al., 2020)	+ (Siddiqui, Bahmid et al., 2022)
	Intention to buy	+ (Szenderák et al., 2022)		+ (Siddiqui, Bahmid et al., 2022)
	Acceptability of food	+ (Graça et al., 2019) + (Onwezen et al., 2021) + (Szenderák et al., 2022) + (algae-based only; Wang et al., 2022)	+ (Dagevos, 2020) 0 (Kröger et al., 2022) + (Onwezen et al., 2021) + (Wendin & Nyberg, 2021)	+ (Onwezen et al., 2021) + (Nguyen et al., 2022) + (Siddiqui, Bahmid et al., 2022)
	Various indicators (intention to: consume, try, pay for)		0 (Wassmann et al., 2021)	
	Self-reported intake	+ (Siddiqui, Alvi et al., 2022)		+ (mushroom-based products; De Cianni et al., 2023)
	Adoption	+ (Eckl et al., 2021) + (Weinrich, 2019)	+ (Florença et al., 2022)	
Positive expected outcomes (well-being related)	Self-reported intake/ adoption of a diet	+ (Graça et al., 2019)		
High nutritional value	Intention to eat		– (Wendin & Nyberg, 2021)	
	Acceptability of food	+ (algae-based only; Wang et al., 2022)	0 (Wang et al., 2022) + (Wendin & Nyberg, 2021)	
Perceived health risks	A perceived barrier for intake		– (Siddiqui, Alvi et al., 2022)	
	Acceptability		– (Batat & Peter, 2020) – (Onwezen et al., 2021)	
	Various indicators (intention to: consume, try, pay for)		– (Wassmann, et. Al., 2021)	+ (Giordano et al., 2017)
	Adoption of a diet	– (He et al., 2020)	– (Florença et al., 2022)	
Perceived unhealthiness	Acceptability of food	– (Baiano, 2020)		

Beliefs about meat healthiness	Intention to eat			– (Nguyen et al., 2022)
Perceived pro-environmental beliefs and sustainability motives	Intention to eat	+ (Szenderák et al., 2022)	0 (Kröger et al., 2022) 0 (Mina et al., 2023) + (Siddiqui, Alvi et al., 2022) 0 (Weinrich, 2019) 0 (Wendin & Nyberg, 2021)	+ (mushroom-based products; De Cianni et al., 2023) 0 (Nguyen et al., 2022) + (Siddiqui, Bahmid et al., 2022)
	Intention to buy	0 (Szenderák et al., 2022)	+ (Wendin & Nyberg, 2021)	+ (mushroom-based products; De Cianni et al., 2023) + (Siddiqui, Bahmid et al., 2022)
	Intention to pay		0 (Kröger et al., 2022)	
	Acceptability of food	+ Onwezen et al., 2021	0 (Dagevos, 2020) 0 (Kröger et al., 2022) + (Mancini et al., 2019) 0 (Mina et al., 2023) + (Onwezen et al., 2021) + (Toti et al., 2020) 0 (Wendin &Nyberg, 2021)	+ (Siddiqui, Bahmid et al., 2022)
	Various indicators (intention to: consume, try, pay for)		+ (Wassmann, et. Al., 2021)	
	Higher intake	+ (Eckl et al., 2021) + (Graça et al., 2019)	+ (Siddiqui, Alvi et al., 2022) + (Toti et al., 2020)	+ (Eckl et al., 2021) 0 (Nguyen et al., 2022) + (Siddiqui, Bahmid et al., 2022)
	Actual purchase	0 (Szenderák et al., 2022)		
	Adoption, regular purchase		+ (Florença et al., 2022)	+ (Weinrich, 2019)
Climate change skepticism	Self-reported intake/ adoption of a diet	– (Graça et al., 2019)		
Concerns about animal suffering/empathy towards animals	Intention to eat	+ (Eckl et al., 2021)		
	Self-reported intake/ adoption of a diet	+ (Graça et al., 2019)	+ (Florença et al., 2022)	+ (Siddiqui, Bahmid et al., 2022)
Moral or ethical motives	Acceptance	+ (Onwezen et al., 2021)		
	Various indicators (intention to: consume, try, pay for)		+ (Wassmann, et. Al., 2021)	
Moral disengagement	Self-reported intake/ adoption of a diet	– (Graça et al., 2019)		
	Acceptability			– (Onwezen et al., 2021)

Following conservative values/conseervative views	Self-reported intake/ adoption of a diet	0 (Graça et al., 2019) 0 (Szenderák et al., 2022)		
Religion	Acceptability		0 (Kröger et al., 2022)	
Being daring, adventurous, sensation seeking, extreme emotions	Intention to eat		+ (Kauppi et al., 2019) + (sustainability; Siddiqui, Alvi et al., 2022) + (younger men; Wendin & Nyberg, 2021)	
	Acceptance		+ (Ardoin & Prinyawiwatkul, 2021) + (Kröger et al., 2022)	
	Various indicators (intention to: consume, try, pay for)		+ (meta-analysis – Wassmann et al., 2021)	
	Adoption of a diet		+ (Florença et al., 2022)	
	Early adopters, ready to try (but not necessary to maintain)		+ (Dagevos, 2020)	
Curiosity	Intention to try		+ (Wendin & Nyberg, 2021)	
	Acceptability		+ (Ardoin & Prinyawiwatkul, 2021) + (Dagevos, 2020) + (Onwezen et al., 2021)	
	Adoption of a diet		+ (Toti et al., 2020) + (Florença et al., 2022)	
Food neophilia	Acceptance		+ (Kröger et al., 2022) + (Dagevos, 2020)	
Meat attachment and positive emotions while eating meat	Intention to eat	– (Szenderák et al., 2022)		
	Purchase likelihood	0 (Szenderák et al., 2022)		
	Self-reported intake/ adoption of a diet	– (Graça et al., 2019) – (Szenderák et al., 2022)		– (Nguyen et al., 2022)
	Adoption	– (plant-based meat alternatives; He et al., 2020)	0 (Kröger et al., 2022)	
Worry and guilt towards eating meat	Self-reported intake/ adoption of a diet	+ (Graça et al., 2019)		+ (Nguyen et al., 2022)
Neophobia	Intention to try/eat		–– (Nguyen et al., 2022) – (Siddiqui, Alvi et al., 2022) – (Toti et al., 2020)	
	Intention to pay		– (Toti et al., 2020)	

	Acceptance	– (only algae based-food and plant-based meat alternatvies; Onwezen et al., 2021)	– (Ardoin & Prinyawiwatkul, 2021) – (Batat & Peter, 2020) – (Dagevos, 2020) – (Kröger et al., 2022) – (Mina et al., 2023) – (Nguyen et al., 2022) – (Onwezen et al., 2021) – (Toti et al., 2020) – (Wendin & Nyberg, 2021)	– (various meat replacement alternatives; Eckl et al., 2021) – (Siddiqui, Zannou et al., 2022)
	Intake self-reported	– (Graça et al., 2019) 0 (Szenderák et al., 2022)	– (Siddiqui, Alvi et al., 2022) – (Toti et al., 2020)	
	Various indicators (intention to: consume, try, pay for)		(meta-analysis – Wassmann et al., 2021)	
	Adoption of a diet		– (Florença et al., 2022)	
	Early adopters (willing to try, but not necessarily to maintain)		– (Dagevos, 2020)	
Disgust (general disgust and food disgust, insect-related disgust)	Intention to try		– (Siddiqui, Alvi et al., 2022)	
	Acceptance	– (only algae based-food and plant-based meat alternatvies; Onwezen et al., 2021)	– (Ardoin & Prinyawiwatkul, 2021) – (Batat & Peter, 2020) – (Deroy et al., 2015) – (tendency to react with disgust on various stimuli; Kröger et al., 2022) – (Mina et al., 2023) – (Onwezen et al., 2021) – (Toti et al., 2020) – (Wendin & Nyberg, 2021)	
	Various indicators (intentio to: consume, try, pay for)		– (meta-analysis – Wassmann et al., 2021)	
	Adoption of a diet		– (Florença et al., 2022)	
Self-efficacy for dietary change	Intention to eat/ intention to buy		+ (Ardoin & Prinyawiwatkul, 2021)	
	Acceptability		+ (Kröger et al., 2022)	+ (Onwezen et al., 2021)
	Self-reported intake/ adoption of a diet	+ (Graça et al., 2019)		+ (Giordano et al., 2017)
Openness to novelty	Intention to try			+ (Nguyen et al., 2022)

	Initial adoption of a diet (but not maintenance)			+ (Nguyen et al., 2022)
Extraversion, openness	Intention to pay, intention to eat		+ (Kröger et al., 2022)	
Agreeableness, neuroticism	Intention to pay, intention to eat		0 (Kröger et al., 2022)	
CICI CONEXT: SOCIODEMOGRAPHIC DETERMINANTS				
Gender: women	Intention to eat	+ (Graça et al., 2019)	– (Siddiqui, Alvi et al., 2022) 0 (Toti et al., 2020)	
	Intention to buy	0 (Szenderák et al., 2022)		
	Intention to pay	0 (Szenderák et al., 2022)		
	Acceptability	+ (Graça et al., 2019)	– (Dagevos, 2020) – (Kauppi et al., 2019) – (Kröger et al., 2022) – (Mina et al., 2023) 0 (Mancini et al., 2019) – (Siddiqui, Bahmid et al., 2022) – (Wendin & Nyberg, 2021)	
	Various indicators (intention to: consume, try, pay for)		– (Wassmann, et. al., 2021)	
	Intake	+ (Siddiqui, Alvi et al., 2022) + (Siddiqui, Bahmid et al., 2022)		0 (mushroom-based products; De Cianni et al., 2023) 0 (mushroom-based products Eckl et al., 2021)
	Early adopters (willing to try, but not necessarily to maintain)		– (Dagevos, 2020)	
	Adoption of a diet	0 (Nguyen et al., 2022)	– (Florença et al., 2022) 0 (Nguyen et al., 2022) – (Weinrich, 2019)	
	Self-reported intake	– (Szenderák et al., 20220		
Gender/age as moderator	Acceptability	+ (older women; Szenderák et al., 2022)	– (no gender differences for unprocessed APF, gender differences in case of processed APF; Kröger et al., 2022)	
	Trying (initial adoption)		+ (younger men; Kauppi et al., 2019)	

Gender as a moderator	Health, production type and nutrition motivation (important among women but not men)			+ (Eckl et al., 2021)
Age/gender as a moderator of the effectiveness of education interventions	Intention to adopt a diet	+ (younger women; Nguyen et al., 2022)	+ (younger men; Kauppi et al., 2019)	
Age: younger consumers	Intention to eat	0 Nguyen, 2022		
	Acceptability	0 (Graça et al., 2019)	0 (Kröger et al., 2022) + (Mina et al., 2023) + (Toti et al., 2020) + (Weinrich, 2019) + (Wendin & Nyberg, 2021)	+ (mushroom-based products; Eckl et al., 2021) 0 (Nguyen et al., 2022)
	Various indicators (intention to: consume, try, pay for)		0 (meta-analysis - Wassmann, et. al., 2021)	
	Trying (not maintenance)	+ (Szenderák et al., 2022)	– (in children; Kröger et al., 2022)	
	Intake	+ (Siddiqui, Alvi et al., 2022) + (Siddiqui, Bahmid et al., 2022) + (Szenderák et al., 2022)		0 (mushroom-based products; De Cianni et al., 2023)
	Early adopters (willing to try, but not necessary maintain)		+ (Dagevos, 2020)	
	Intention to adopt		+ (Eckl et al., 2021)	
	Adoption of a diet		+ (Florença et al., 2022)	
Higher education status	Acceptability	+ (Graça et al., 2019); + (higher plant intake; Siddiqui, Bahmid et al., 2022) (higher plant intake); + (Szenderák et al., 2022)	0 (Eckl et al., 2021); 0 (Kauppi et al., 2019); 0 (Kröger et al., 2022); + (Mina et al., 2023); + (Wendin & Nyberg, 2021)	0 (mushroom-based products; De Cianni et al., 2023) 0 (mushroom-based products; Eckl et al., 2021) 0 (Nguyen et al., 2022)
	Various indicators (intention to: consume, try, pay for)		0 (meta-analysis -Wassmann, et.al., 2021 – meta- analysis)	
	Early adopters (willing to try, but not necessarily maintain)		+ (Dagevos, 2020)	
	Intake	+ (Szenderák et al., 2022)		
	Intention to pay	0 (Szenderák et al., 2022)		

Higher income status	Acceptability	+ (Graça et al., 2019)		0 (mushroom-based products; Eckl et al., 2021)
	Intake	+ (Siddiqui, Bahmid et al., 2022); 0 (Szenderák et al., 2022)		
	Adoption		+ (Florença et al., 2022)	

Note. 0 – the review is providing mixed/non-significant evidence; - the review is providing evidence for the negative association; +- the review is providing evidence for the negative association. APF – alternative protein food; mushroom-based products - the reviews addressing mushroom and fungi-based alternative proteins only.

3. Results

3.1 Descriptive Results

A total of $k = 28$ reviews were included. The reviews reported findings from a total of 1,014 original studies (six reviews did not provide information about the number of included studies). Annex 1 (Supplementary Table S1) presents the details of the populations analyzed, designs, APF investigated, and their individual-level determinants. The majority of included reviews synthesized data collected in Europe, North America, and Australia/New Zealand ($k = 21$, 75% out of 28). Seven reviews (25% out of 28) did not provide information regarding the countries of origin; however, the screening of included references suggests that these reviews provided data from developed countries (including European countries, North American countries, Australia, New Zealand, and Japan).

Across the reviews, $k = 4$ specifically focused on plant-based APF (Baiano, 2020; Graça et al., 2019; He et al., 2020; Szenderák et al., 2022), $k = 13$ specifically addressed insect-based proteins (Ardoin & Prinyawiwatkul, 2021; Batat & Peter, 2020; Dagevos, 2020; Deroy et al., 2015; Florença et al., 2022, Kauppi et al., 2019; Kröger et al., 2022; Mancini et al., 2019; Mina et al., 2023; Toti et al., 2020; Wassmann et al., 2021; Wendin & Nyberg, 2022; Wendt, 2023), whereas $k = 10$ investigated APF from various sources, including plant-based, insect-based, mushroom/fungi-based, and other APF (Eckl et al., 2021; Giordano et al., 2017; Hartmann & Siegrist, 2017; Nguyen et al., 2022; Onwezen et al., 2021; Siddiqui, Alvi et al., 2022; Siddiqui, Bahmid et al., 2022; Siddiqui, Zannou et al., 2022; Wang et al., 2022; Weinrich, 2019). Only $k = 2$ addressed mushroom/fungi-based proteins (De Cianni et al., 2023; Eckl et al., 2021).

All reviews addressed a combination of various individual-level determinants, related to at least two areas of the COM-B model, whereas $k = 17$ reviews (Dagevos, 2020; De Cianni et al., 2023; Eckl et al., 2021; Florença et al., 2022; Graça et al., 2019; Kauppi et al., 2019; Kröger et al., 2022; Mancini et al., 2019; Mina et al., 2023; Nguyen et al., 2022; Siddiqui, Alvi et al., 2022; Siddiqui, Bahmid et al., 2022; Szenderák et al., 2022; Toti et al., 2020; Wassmann et al., 2021; Weinrich, 2019; Wendin & Nyberg, 2022) directly analyzed the associations between APF and gender, age, income, or education. The vast majority of included reviews (26 out of 28) did not limit their scope to individual-level COM-B determinants and sociodemographic variables alone. Instead, they encompassed a broader range of determinants, including those related to the physical and social environment (i.e., product characteristics, sensory characteristics related to APF intake, production-related safety, physical environment characteristics, etc.).

Across the reviews, only $k = 1$ reported results of a meta-analysis (Wassmann et al., 2021). Additionally, only four studies (Eckl et al., 2021; Hartmann & Siegriest, 2017; Kroger et al., 2022; Wendt & Weinrich, 2023) provided some descriptive statistics, clarifying a proportion of studies that indicated the associations between APF choice indicator and a respective individual-level determinant, compared with the total number of relevant original studies. The remaining $k = 23$ reviews provided a narrative synthesis of the associations, without any quantitative summary.

The risk of bias scores obtained using ROBIS are reported in Annex 1, (Supplementary Table S2). Across the reviews, 53.5% ($k = 15$) were evaluated as representing a low risk of bias across five criteria of ROBIS (Eckl et al., 2021; Florença et al. 2022; Giordano et al., 2017; Graça et al., 2019; Hartmann & Siegriest, 2017; Kröger et al., 2022; Mancini et al., 2019; Mina et al., 2023; Nguyen et al., 2022; Onwezen et al., 2021; Siddiqui, Bahmid et al., 2022; Szenderák et al., 2022; Wassmann et al., 2021; Weinrich, 2019; Wendt & Weinrich, 2023), 3.5% ($k = 1$) was considered to represent low risk across four criteria (De Cianni et al., 2023), and 3.5% ($k = 1$) had low risk in three criteria (Dagevos, 2020). The remaining 39.2% ($k = 11$) of the reviews were evaluated as having high or unclear risk in ≥ 3 criteria.

3.2 Main Findings for the Individual-Level Determinants of Consumer Choices of Alternative Proteins

3.2.1 COM-B Capabilities: Skills, Formal and Informal Knowledge

3.2.1.1 Skills

Four out of four (100%) reviews focusing on consumers' *cooking skills*, found that, higher perceived cooking skills were associated with a higher level of acceptance or adoption of *plant-based APF* (Eckl et al., 2021; Graça et al., 2019; He et al., 2020; Onwezen et al., 2021). Additionally, one review addressing *APF from various sources* also reported similar findings (Nguyen et al., 2022).

A capability to replace proteins from animal sources with APF, in particular perceived *easiness* and *convenience to replace meat* with APF were associated with higher intention to buy and acceptance of *APF from various sources* (Siddiqui, Bahmid et al., 2022) and a higher likelihood of self-reported intake adopting *plant-based APF* (Graça et al., 2019). However, the findings referring to *insect-based APF* were mixed, with one review of high quality yielding null results for intention to buy/pay/eat insect-based APF (Wassmann et al., 2021), and two out of three reviews (66%) indicating associations between acceptance, self-reported intake, and adoption (Florença et al., 2022; Onwezen et al., 2021).

Capabilities referring to active promotion of APF in one's own social network may be related to APF choices. For example, *purchase activism*, defined as consumers' ability to express their own opinions, and willingness to take action that impacts the marketplace and affects the food system via active choices, was associated with the intention to buy *insect-based APF* in one review (Kröger et al., 2022).

Two reviews investigated if using *mindfulness* practices (practicing an ability to be in the present moment through non-judgmental attention and awareness) may be associated with the acceptance of *insect-based APF*. Both reviews yielded similar conclusions, indicating null or inconsistent findings in the original research (Dagevos, 2020; Kröger et al., 2022).

3.2.1.2 Formal knowledge and informal knowledge (familiarity and previous exposure)

Formal knowledge (knowing nutrition values, evidence-based effects of protein intake on individual health and environment, cf. Eckl et al., 2021) exhibits inconsistent associations with the intention to buy/pay or acceptance of *plant-based APF* (two reviews; Baiano, 2020; Eckl et al., 2021). Furthermore, formal knowledge was unrelated or inconsistently related to the acceptance of *APF from various sources* (Giordano et al., 2017). One review addressing *mushroom/fungi APF* (De Cianni et al., 2023) indicated positive associations between formal knowledge and acceptance of this APF.

In case of *insect-based APF*, nine out of ten (90%) reviews suggest that there is a positive association between *formal knowledge* and intention to buy/pay/try, acceptance and adoption of insects as diet components (Ardoin & Prinyawiwatkul, 2021; Batat & Peter, 2020; Eckl et al., 2021; Florença et al., 2022; Kauppi et al., 2019; Mancini et al., 2019; Mina et al., 2023; Siddiqui, Alvi et al., 2022; Weinrich, 2019). One review suggested mixed effects or no associations between formal knowledge and acceptance of insect-based APF (Wendin & Nyberg, 2021). Importantly, as indicated in one review (Ardoin & Prinyawiwatkul, 2021) formal knowledge may increase the intention to buy, but as the intention to eat is still low, it is unlikely that mere formal knowledge will prompt people to actually eat regularly, adopt insect-based APF into a daily diet. Additionally, one review suggested no direct effects of formal knowledge, but a moderated association (Dagevos, 2020). Specifically, formal knowledge (e.g., an education intervention) may have an effect on insect-based APF intake, but only in case it is delivered to consumers who are interested in the nutritional, health, or sustainability benefits of APF.

The process of acquiring informal knowledge (defined as multiple exposures to the product, resulting in perceived familiarity, cf. Eckl et al., 2021) seems to be consistently associated with APF choices. Five out of five reviews (100%) addressing *plant-based APF* suggested that acquiring *informal knowledge* is associated with intention to buy, acceptance, self-reported intake, or adoption (Baiano, 2020; Graça et al., 2019; He et al., 2020; Onwezen et al., 2021; Szenderák et al., 2022). Four out of four (100%) reviews addressing acceptance or adoption of *APF from various sources* also suggest a positive association with perceived familiarity/exposure (Hartmann & Siegrist, 2017; Nguyen et al., 2022; Siddiqui, Bahmid et al., 2022; Siddiqui, Zannou et al., 2022). The significant positive associations were also found for mushroom-based APF (one review; De Cianni, 2023).

Furthermore, 12 out of 12 (100%) reviews suggest that informal knowledge is associated with intention to buy, pay, try, acceptance, self-reported intake and adoption of *insect-based APF* (Ardoin & Prinyawiwatkul, 2021; Dagevos, 2020; Florença et al., 2022; Hartmann & Siegrist, 2017; Knaupi et al., 2019; Kröger et al., 2022; Mancini et al., 2019; Mina et al., 2023; Onwezen et al., 2021; Toti et al., 2020; Wassmann et al., 2021; Wendin & Nyberg, 2022). However, three reviews indicated some limitations for these associations. For example, the type of the product may be important: including insect-based proteins to popular products like hamburgers may be the most effective strategy to increase acceptance (Mancini et al., 2019). The association with insect-based APF acceptance may be significant for the number of past exposures (e.g., trying several times), whereas it may be non-significant for feelings of familiarity (Wassmann et al., 2021). Familiarity and exposure may be sufficient triggers to try insect-based APF, but not sufficient to maintain it as a regular food habit (Dagevos, 2020).

3.2.2 COM-B Opportunities: Individual-level Determinants Related to the Perceptions of the Environment

3.2.2.1 Perceptions of social norms and cultural norms

Positive social norms, which refer to individual's beliefs that APF is accepted by their peers, family, or important others, were consistently associated with APF choices across included reviews. Two out of two (100%) reviews addressing social norms and *plant-based APF* indicated that positive social norms are associated with intention to eat and acceptance of these types of foods (Graça et al., 2019; Onwezen et al., 2021). Furthermore, these associations were also positive and significant across three out of three reviews (100%) addressing acceptance of *APF from various sources* (Giordano et al., 2017; Nguyen et al., 2022; Siddiqui, Bahmid et al., 2022) and in two out of two (100%) reviews addressing *mushroom/fungi-based APF* (De Cianni et al., 2023; Eckl et al., 2021).

Regarding *insect-based APF*, 12 out of 12 (100%) reviews indicated significant associations between positive social norms and higher intention to try and to eat (Ardoin & Prinyawiwatkul, 2021; Kauppi et al., 2019; Mina et al., 2023; Wassmann et al., 2021; Wendin & Nyberg, 2021), acceptance of (Kröger et al., 2022; Mancini et al., 2019; Mina et al., 2023; Onwezen et al., 2021; Siddiqui, Alvi et al., 2022; Wendin & Nyberg, 2021), or adoption of a diet including such proteins (Florença et al., 2022).

Three reviews indicated that other social determinants were consistently positively associated with APF choices. *Social support from family and friends* to follow a specific diet was associated with higher self-reported intake of *plant-based APF* (one review; Graça et al., 2019). Having a *positive social image and perceived high sociability of eating meat* was associated with lower intention to eat *APF from various sources* (one review; Nguyen et al., 2022). Additionally, perceiving *eating meat as a positive social norm* was associated with a lower intake *of plant-based APF* (He et al., 2020).

Positive perceived cultural norms, which refer to the perception that APF fits the cuisine of a region or food culture/dietary patterns typical of specific culture, were positively associated with intention to try, acceptance, self-reported intake and adoption of a diet including *insect-based APF* (Batat & Peter, 2020; Florença et al., 2022; Giordano et al., 2017; Hartmann & Siegrist, 2017; Kauppi et al., 2019; Mancini et al., 2019;

Onwezen et al., 2021; Siddiqui, Alvi et al., 2022; Toti et al., 2020; Wendin & Nyberg, 2021). In sum, ten out of ten (100%) reviews suggest significant associations. The same was true in case of three reviews on *APF from various sources* (De Cianni, 2023; Nguyen et al., 2022; Siddiqui, Zannou et al., 2022). In line with these findings, *perceived incompatibility with local food* was associated with a lower likelihood of adopting *APF from various sources* (one review; Weinrich, 2019).

3.2.2.2 Safety and trust in the APF food system stakeholders

Reviews showed that *distrust in the technology used in the development of food products* (also known as food technology neophobia) is associated with a lower level of intention to buy and acceptance of *plant-based APF* (two reviews; Onwezen et al., 2021; Szenderák et al., 2022). Additionally, it is associated with the intention to buy, pay, acceptance, and adoption of *insect-based APF* (four reviews; Florença et al., 2022; Kröger et al., 2022; Wassmann et al., 2020; Wendt & Weinrich, 2023). Three other reviews that addressed *APF from various sources* also found an association between intention to buy and acceptance (Eckl et al., 2021; Giordano et al., 2017; Siddiqui, Zannou et al., 2022).

Perceived unsafety of food production, retail, storage, etc. is another belief that has been investigated in the context of APF. Three reviews addressing this issue indicated that a lower perceived safety was associated with lower acceptance of either *insect-based APF* (Wendin & Nyberg, 2021), or *plant-based APF* (Baiano, 2020), or *APF from various sources* (Siddiqui, Zannou et al., 2022).

Finally, three reviews provided insights into the role of *low trust in/uncertainty of research, science, independent food promoters, or organizations*. Three out of three reviews (100%) concluded that this type of low trust is associated with lower acceptance of *APF from various sources* (Giordano et al., 2017; Onwezen et al., 2021; Siddiqui, Zannou et al., 2022).

3.2.3 COM-B Motivation: Determinants Related to Beliefs, Attitudes, Emotions

3.2.3.1 Beliefs about health benefits and health risks of alternative proteins

All included reviews (eight out of eight, 100%) referring to *health as a motive* in consumers' decisions to choose *plant-based APF* products indicate positive associations. People reporting higher beliefs in the healthiness of APF, and positive health consequences of eating plant-based APF, reported stronger intentions to buy and consume, declared acceptance or adoption of plant-based APF (Eckl et al., 2021; Graça et al., 2019; Nguyen et al., 2022; Onwezen et al., 2021; Siddiqui, Alvi et al., 2022: Szenderák et al., 2022; Wang et al., 2020; Weinrich, 2019). *Perceiving high nutritional value* of plant-based food was associated with higher acceptance of a plant-based APF (one review; Wang et al.,2020). Finally, one review indicated that beliefs that switching to a meatless plant-only diet is *a health risk* was related to a lower likelihood of an adoption of plant-based APF (He et al., 2020). Finally, beliefs about the unhealthiness of novel food were associated with lower acceptability of 3-D printed novel plant-based APF foods (Baiano, 2020).

Regarding *mushroom-based APF*, only one review addressed this issue and found that consumers' beliefs about positive health consequences were associated with higher intake of respective APF (De Cianni et al., 2023).

In case of *insect-based APF*, two high-quality reviews indicated mixed or non-significant associations between *perceived health benefits* and intention to pay/eat and acceptance of insect-based APF (Kröger et al., 2022; Wassmann et al., 2021). Five out of eight (62,5%) reviews suggest significant associations between perceived health benefits and insect-based APF choices (Dagevos, 2020; Florença et al., 2022; Onwezen et al., 2021; Toti et al., 2020; Wendin & Nyberg, 2021). Furthermore, two reviews addressing perceived *nutritional value* of APF indicated mixed/non-significant associations between perceptions of nutritional value and acceptance of insect-based food (Wang et al., 2022; Wendin & Nyberg, 2021). The mixed results for links

between perceived healthiness and insect-based APF are consistent with associations reported for beliefs that intake of insect-based food constitutes a *health risk*. Five out of five (100%) reviews indicated that perceiving *insect intake-related health risks* was related to lower levels of intention to buy/pay, acceptance, and adoption of an insect-based APF (Batat & Peter, 2020; Florença et al., 2022; Onwezen et al., 2021; Siddiqui, Alvi at al., 2022; Wassmann et al., 2021).

Finally, three reviews that addressed *various types of APF* indicated that perceived healthiness or *perceived health benefits* are associated with the intention to buy, intention to eat, and acceptability of APF (Nguyen et al., 2022; Onwezen et al., 2021, Siddiqui, Bahmid et al., 2022). Similarly, *perceived health risks* were indicated as a barrier for the intake of various types of novel APF products (Giordano et al., 2017). One review addressing beliefs about healthiness of meat indicated that they were a barrier to the intention to eat various APF (Nguyen et al., 2022).

3.2.3.2 Beliefs about environmental impact, sustainability and animal welfare

Pro-environmental and sustainability-related beliefs and motives were studied as correlates *of plant-based and mushroom/fungi-based APF* choices. Three in four (75%) reviews indicated that such reasons are related to higher intention to try/eat, acceptance, and self-reported intake of the plant-based APF (Eckl et al., 2021; Graça et al., 2019; Onwezen et al., 2021), one showed mixed findings for intention to buy, eat and try (Szenderák et al., 2020). One review indicated positive associations for intention to buy, eat and try *mushroom/fungi-based APF* (De Cianni et al., 2023). Regarding reviews addressing *various APF*, including plants and insect-based two yielded positive associations with pro-environmental/sustainability motives and intention to eat, try, acceptance, and self-reported intake (Siddiqui, Bahmid et al., 2022; Weinrich, 2019) and one indicated mixed/null findings for intention to try, eat and self-reported intake (Nguyen et al., 2022). Nguyen et al. (2022) suggested that the potential explanation for inconsistent results may refer to the weakness of the associations with self-reported intake indicators, which do not translate to the actual purchase. Finally, one review suggested that high *climate change skepticism* is related to a lower likelihood of self-reported intake and adoption of plant-based APF (Graça et al., 2019).

Regarding *pro-environmental and sustainability beliefs*, the pattern of associations is mixed for the *insect-based APF*. Six reviews concluded that there are positive associations between environment/sustainability- related beliefs and intention to buy and try, acceptance, self-reported intake and adoption of insect-based APF (Florença et al., 2022; Mancini et al., 2019; Onwezen et al., 2021; Siddiqui, Alvi et al., 2022; Toti et al., 2020; Wassmann et al., 2021). Five reviews indicated mixed, inconclusive findings (Dagevos, 2020; Kröger et al., 2022; Mina et al., 2023; Weinrich, 2019; Wendin & Nyberg, 2021) for intention to pay and try, and acceptance. In sum, six out of eleven reviews (54.5%) supported the associations.

3.2.3.3 Animal welfare, ethical and moral motives, conservative values and religion

Regarding *concerns about animal welfare and empathy* towards animals three out of three (100%) reviews consistently showed that welfare beliefs are related to a higher likelihood of adoption of *plant-based APF* (Eckl et al., 2021; Graça et al., 2019; Siddiqui, Bahmid et al., 2022). Only one review addressed insects; it suggested an association between animal welfare concerns and higher self-reported intake or adoption of *insect-based APF* (Florença et al., 2022).

Regarding reviews investigating *more general* (i.e., not only related to animal welfare) *moral and ethical motives*, reviews suggested that *moral disengagement* was related to a lower likelihood of adopting *plant-based APF* (Graça et al., 2019). Furthermore, indicating *moral and ethical motives* as guiding dietary choices was related to acceptance of plant-based APF (Onwezen et al., 2021) and to a stronger intention to pay, eat, and adopt insect-based *APF* (Wassmann et al., 2021).

Following conservative views or values and being religious was unrelated to the adoption *of plant-based APF* into nutrition behaviors in two reviews (Graça et al., 2019; Szenderák et al., 2022). *Religiousness* was unrelated to acceptance of *insect-based APF*, except for findings from India (probably, related to beliefs about the holiness of certain animals; Kröger et al., 2022). In contrast, Owenzen et al. (2021) suggested associations between stronger conservative beliefs and weaker acceptance of APF from various sources. The discrepancy in findings may result from the differences in the conceptualization of the conservativeness, e.g., either as a construct closer to following religious codes of conduct or as a construct related to environmental skepticism, which in turn may be related to lower acceptance of APF.

3.2.3.4 Emotions

Reviews addressing positive emotions focused entirely on *insect-based APF*. *Feeling adventurous, daring, excitement accompanying sensation seeking, and positive emotion excitement* were consistently associated with the intention to eat and try, acceptance and adoption of insect-based APF, as indicated in eight out of eight (100%) reviews (Ardoin & Prinyawiwatkul, 2021; Dagevos, 2020; Florença et al., 2022; Kauppi et al., 2019; Kröger et al., 2022; Siddiqui, Alvi et al., 2022; Wassmann et al., 2021; Wendin & Nyberg, 2021). One review highlighted that these associations may be typical of young men (Kauppi et al., 2019). In six out of six (100%) reviews, *curiosity* showed positive associations with the intention to try, acceptance, and adoption of insect-based APF (Ardoin, 2021; Dagevos, 2020; Florença et al., 2022; Onwezen et al., 2021; Toti et al., 2020; Wendin & Nyberg, 2021).

Regarding food *neophilia* (liking new types of food) two out of two (100%) reviews suggest that it is associated with acceptance of *insect-based APF* (Dagevos, 2020; Kröger et al., 2022).

Attachment and positive emotions towards meat was related to lower intention to eat, likelihood of a purchase, self-reported intake, and adoption of *plant-based APF* in two out of two (100%) reviews addressing this type of proteins (Graça et al., 2019; He et al., 2020), and in one review addressing *APF from various sources* (Nguyen et al., 2022). When intention to eat, the likelihood of actual purchase, or the adoption of *plant-based APF* were investigated, the associations were inconclusive (Szenderák et al., 2022). Only one review, albeit of high quality, tested associations between meat attachment and adoption of *insect-based APF*, concluding that findings are inconsistent (Kröger et al., 2022).

Other meat-related emotions, namely *worry and guilt towards eating meat* are associated with higher self-reported intake or adoption of *plant-based APF* (Graça et al., 2019) or *APF from various sources* (Nguyen et al., 2022).

Food neophobia, which refers to aversion or anxiety experienced when exposed to a novel food, was addressed in three reviews of *plant-based APF*. Overall, the results suggest food neophobia may be relevant, with two out of three (66%) reviews yielding conclusions about negative associations with acceptance and self-reported intake of plant-based APF (Graça et al., 2019; Onwezen et al., 2021) and one indicating non-significant or inconsistent relationships with self-reported intake (Szenderák et al., 2022). Two reviews that addressed acceptance of *APF from various sources* suggested that APF acceptance is associated with lower levels of food neophobia (Eckl et al., 2021; Siddiqui, Zannou et al., 2022). Regarding *insect-based APF*, the findings are consistently showing significant associations (twelve out of twelve reviews, 100%) between low neophobia and intention to pay, try, eat, acceptance, self-reported intake, and early adoption of this type of APF (Ardoin & Prinyawiwatkul, 2021; Batat & Peter, 2020; Dagevos, 2020; Florença et al., 2022; Kröger et al., 2022; Mina et al., 2023; Nguyen et al., 2022; Onwezen et al., 2021; Siddiqui, Alvi et al., 2022; Toti et al., 2020; Wassmann et al., 2021; Wendin & Nyberg, 2021).

Disgust, including general emotion of disgust, food disgust and insect disgust, is related to lower intention to pay or try, acceptance and adoption of *insect-based APF*. The associations were consistent and found in 11 out of 11 reviews (Ardoin & Prinyawiwatkul, 2021; Batat & Peter, 2020; Deroy et al., 2015; Florença et al., 2022; Kröger et al., 2022; Mina et al., 2023; Onwezen et al., 2021; Siddiqui, Alvi et al., 2022; Toti et al.,

2020; Wassmann et al., 2021; Wendin & Nyberg, 2021). Only one review addressed acceptance of *plant-based APF* (algae) and indicated negative associations with disgust (Onwezen et al., 2021).

3.2.3.5 Self-efficacy and personality

Self-efficacy beliefs and perceived behavioral control are two closely related constructs that refer to individual's beliefs about the ability to act and control oneself and external circumstances, which facilitates acting upon their intentions and goals (Bandura, 1997). Higher self-efficacy or beliefs about behavioral control were associated with self-reported intake or adoption of *plant-based APF* in one review (Graça et al., 2019). Higher self-efficacy was related to self-reported intake and acceptance of *AFP from various sources* (two out of two reviews; Giordano et al., 2017; Onwezen et al., 2021), and a higher intention to try, buy, and acceptance of *insect-based APF* (two out of two reviews; Ardoin & Prinyawiwatkul, 2021; Kröger et al., 2022).

Only two reviews provide information on any personality traints that are associated with consumers' APF choices. *Openness,* referring to intellectual curiosity, and challenging authority, was related with the intention to try and initial adoption of *APF from various sources* (Nguyen et al., 2022). *Openness and extraversion* were also related to the intention to pay and eat and *insect-based APF* (Kröger et al., 2022). However, in case of *neuroticism* and *agreeableness*, mixed or null findings between intention to pay and eat were observed for *insect-based APF* (one review; Kröger et al., 2022).

3.2.4 Individual-level Context Determinants: The Role of Sociodemographic Characteristics

3.2.4.1 Gender and age

Three out of five (60%) reviews suggested that *women* are more likely to report an intention to eat, higher acceptability or greater intake of *plant-based APF* (Graça et al., 2019; Siddiqui, Alvi et al., 2022; Siddiqui, Bahmid et al., 2022). Two reviews suggested inconclusive findings for intention to buy or pay and acceptance for plant-based APF, depending on gender (Nguyen et al., 2022; Szenderák et al., 2022). Mixed or non-significant associations were also reported in two out of two (100%) reviews addressing the intake of *fungi or mushroom-based APF* (De Cianni et al., 2023; Eckl et al., 2021). Two reviews suggested that gender operates forming interactions with age: (i) acceptance of plant-based APF is higher only among older women (Szenderák et al., 2022); (ii) educational interventions may be effective in influencing intention to adopt plant-based APF among younger women only (Nguyen et al., 2022).

Regarding *insect-based APF*, the results are more consistent. In nine out of 12 reviews *men* were more willing to pay or eat, reported higher acceptance and were more likely to adopt insect-based APF (Dagevos, 2020; Florença et al., 2022; Kauppi et al., 2019; Mina et al., 2023; Siddiqui, Alvi et al., 2022; Siddiqui, Bahmid et al., 2022; Wassmann et al., 2021; Weinrich, 2019; Wendin & Nyberg, 2021). No associations or mixed effects were found in three reviews, addressing intention to eat and acceptance of insect-based APF (Mancini et al., 2019; Nguyen et al., 2022; Toti et al., 2020). Additionally, three reviews suggested that gender forms interactions with other determinants predicting consumers' choices of insect based APF: (i) its effect on acceptance depends on the type of insects or the types of food processing involved (Kröger et al., 2022); (ii) the effect of education interventions on intention to adopt a diet may be significant among younger men (Kauppi et al., 2019).

Age is another sociodemographic variable that is associated with APF choices. Regarding *plant-based APF*, younger age was associated with higher intake and more frequent trying in three out of four (75%) reviews (Siddiqui, Alvi et al., 2022; Siddiqui, Bahmid et al., 2022; Szenderák et al., 2022), while one review reported mixed or non-significant findings for intention to try and acceptance of plant based APF (Graça et al., 2019). Similarly, mixed or non-significant findings were reported in two out of two (100%) reviews addressing acceptance and intake of *mushroom/fungi-based APF* (De Cianni et al., 2023, Eckl et al., 2021).

Regarding *insect-based APF*, significant associations with *younger age* were reported in the majority (seven out of ten, 70%) of the reviews, addressing acceptance, trying, and adoption of such diet (Dagevos, 2020; Eckl et al., 2021; Florença et al., 2022; Mina et al., 2023; Toti et al., 2020; Weinrich, 2019; Wendin & Nyberg, 2021). However, two reviews indicated mixed or nonsignificant associations between intention to pay or eat and acceptance (Kröger et al., 2022; Wassmann et al., 2021). One review highlighted that in the case of adolescents, older are more likely to try insect-based APF than younger adolescents/children (Kröger et al., 2022).

Finally, one review addressing acceptance of *APF from various sources* indicated mixed results with age (Nguyen et al., 2022).

3.2.4.2 Education and income

Three out of three (100%) reviews suggested that *higher education* is associated with indicators of acceptance and self-reported intake of *plant-based APF* (Graça et al., 2019; Siddiqui, Bahmid et al., 2022; Szenderák et al., 2022). One review addressing various types of APF, including plant- and insect-based suggested mixed or non-significant results (Nguyen et al., 2022). Notably the associations may be negative (higher education- less likely APF choices) in developing countries in Africa or Asia (Szenderák et al., 2022). For mushroom/fungi-based APF, there were mixed findings or no association between education level and acceptance (2 out of 2 reviews, 100%; (De Cianni et al., 2023; Eckl et al., 2021).

Regarding *insect-based APF*, only three out of seven reviews showed *that higher education* is associated with acceptance or early adoption of insect-based APF (Dagevos, 2020; Mina et al., 2023; Wendin & Nyberg, 2021). Four reviews, including two of high quality, suggested mixed or non-significant findings for intention to buy or pay, or acceptance of this type of APF (Eckl et al., 2021; Kauppi et al., 2019; Kröger et al., 2022; Wassmann et al., 2021).

Regarding *higher income* levels, two out of three (66%) reviews found significant correlations between this determinant and adoption of *plant-based APF* (Graça et al., 2019; Siddiqui, Bahid et al., 2022). One review indicated no associations with intention to pay or intake of plant-based APF (Szenderák et al., 2022). There were no associations between income and acceptance of *mushroom/fungi-based APF* (one review; Eckl et al., 2021). One review suggested that adoption of *insect-based APF* is associated with higher income (Florença et al., 2022).

3.2.5 Summary of the Results: Differences Between Determinants of Plant-based APF, Insect-based APF, and APF from Other Sources

Our findings provide evidence for preliminary support (51-66% of k≥3 reviews addressing the respective associations indicated significant effects) or strong support (> 66% of k≥3 reviews addressing the respective associations indicated significant effects) for the relationships between respective determinants and consumers' choice indicators (Table 2). Importantly, the determinants supported for plant-based APF differed from those supported for insect-based APF.

In particular, the existing evidence suggests that *plant-based APF* choices may be related to COM-B determinants, including: (i) capabilities, such as cooking skills, exposure to APF and related familiarity; (ii) perceived opportunities, including positive social norms, low distrust in technology used in the development of APF; (iii) motivations, such as perceived health benefits, pro-environmental and sustainability benefits, animal welfare/empathy towards animals, low attachment towards meat, low food neophobia. Female gender, younger age, higher education and higher income are also associated with plant-based APF choices (See Table 2, Figure 2).

Regarding *insect-based APF* choices, preliminary support or strong support was obtained for the associations with such COM-B determinants as: (i) capabilities referring to formal knowledge about APF,

exposure to APF and related familiarity; (ii) perceived opportunities, referring to positive social norms, perceived positive cultural norms accepting APF, low distrust in technology used in development of APF; (iii) motivations, such as perceived health benefits, pro-environmental and sustainability benefits, low perceived health risks, feelings of adventurous, daring, excitement, emotion of curiosity, liking new food (neophilia), low neophilia, low disgust, and high self-efficacy beliefs. Male gender and younger age are also associated with *insect-based APF* consumers' choices (See Table 2, Figure 3).

Considering *APF from any sources* (including plants, insects, fungi, etc.) either *strong or preliminary support* was obtained for individual-level determinants, such as: (i) multiple exposures to APF/ perceived familiarity (a Capability-related determinant), (ii) positive social norms (an Opportunity-related determinant), (iii) distrust in technology used in APF development, pro-environmental and sustainability beliefs, food neophobia (Motivation-related determinants). These determinants were supported in reviews that addressed plant-based APF, insect-based APF, and APF from various sources (see Table 2).

Table 2. Summary of the meta-review findings for individual-level determinants of alternative protein food (APF) choices by consumers.

Individual determinants of APF choice (according to COM-B model and CICI framework's context domain)	Plant-based APF	Insect-based APF	Mushroom-/fungi-based APF	APF from various sources (incl. plants, insects, and proteins form other sources)
COM- B: CAPABILITIES				
Cooking skills	**+++**			?
Easiness to replace meat and convenience to replace meat	?	+ +?	++?	?
Purchase activism		?		
Mindfulness training		– –?		
Formal knowledge	0	**+++**	?	?
Multiple exposures to APF, perceived familiarity	**+++**	**+++**	?	**+++**
COM-B: OPPORTUNITIES				
Positive social norms	++?	**+++**	++?	**+++**
Social support from family and friends	?			
Positive social image and perceived high sociability of eating meat				?
Eating meat as a positive social norm	?			
Positive perceived cultural norms		**+++**		**+++**
Perceived incompatibility with local food				?
Distrust in technology used in APF development	– –?	**– – –**		**– – –**
Perceived unsafety of the food production, retail, storage	?	?		?
Low trust in/uncertainty of research, science, independent food promoters or organizations				**– – –**
COM-B: MOTIVATION				
Perceived health benefits, perceived healthiness	**+++**	**+++***		
Perceived high nutritional value	?	0		
Health risk	?	**– – –**		?

Individual determinants of APF choice (according to COM-B model and CICI framework's context domain)	Plant-based APF	Insect-based APF	Mushroom-/fungi-based APF	APF from various sources (incl. plants, insects, and proteins form other sources)
Pro-environmental and sustainability benefit	**+++**	++?	?	++?
Climate change skepticism	?		?	
Animal welfare/empathy towards animals	**+++**	?		
Moral disengagement	?			
Moral and ethical motives	?	?		
Worldview conservatism	0			
Religiousness		?		
Feeling adventurous, daring, excitement accompanying sensation-seeking		**+++**		
Curiosity		**+++**		
Neophilia (liking new food)		++?		
Attachment and positive emotions towards meat	– –?			?
Worry or guilt towards eating meat	?			?
Food neophobia	– –?	**– – –**		– –?
Disgust	?	**– – –**		
Self-efficacy	?	++?	?	++?
Openness		?		?
Neuroticism		?		
Agreeableness		?		
CONTEXT: SOCIOECONOMIC DETERMINANTS				
Female gender	++?	**– – –**	00?	
Younger age	**+++**	**+++**	00?	
Education	**+++**	00	0	?
Income	++?	?	?	?

Table Note. +++ - results indicating strong support with > 66% of positive association reviews (k ≥ 3), e.g., 3 out of 3, 3 out of 4 etc.;
– – – - results indicating strong support for > 66% of negative association reviews (k ≥ 3), e.g., 3 out of 3, 3 out of 4 etc.;
++? - results indicating preliminary support between 51% and 66% of reviews show positive association (k ≥ 3), e.g., 2 out of 3, 4 out of 6; or 2 out of 2 indicating positive association;
– –? - results indicate preliminary support with 51-66% of reviews show negative association (k ≥ 3), e.g., 2 out of 3, 4 out of 6; or 2 out of 2 yielding negative association;
00 - for ≥ 51% reviews indicating no or mixed associations (k ≥ 4), e.g., 3 out of 4, 3 out of 5; or 3 out of 3 null/mixed association;
0 - results indicate null associations for 2 out of 3 reviews, or 2 out of 2 reviews indicating null/mixed findings;
? - one review only, regardless of whether findings are mixed or significant and positive/negative.
APF - alternative protein food

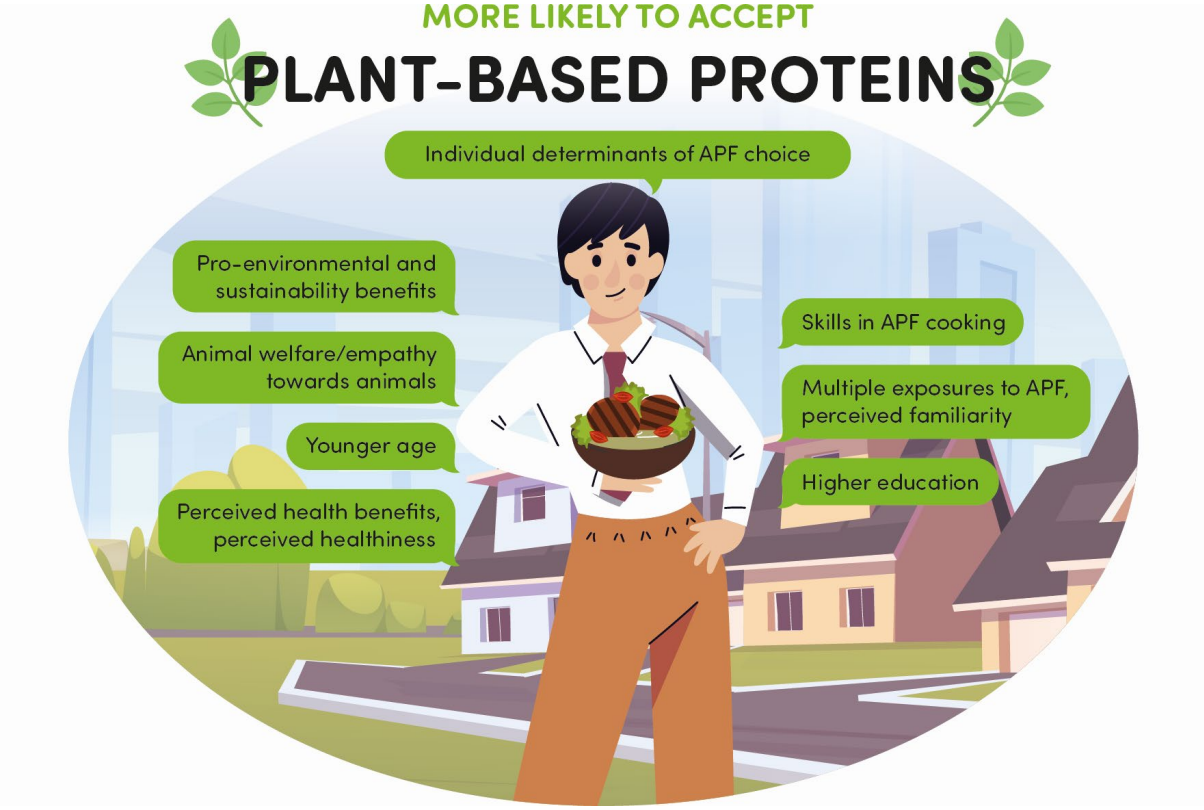

Figure 2. Summary of the individual-level determinants of consumer choices of plant-based alternative protein food (APF).

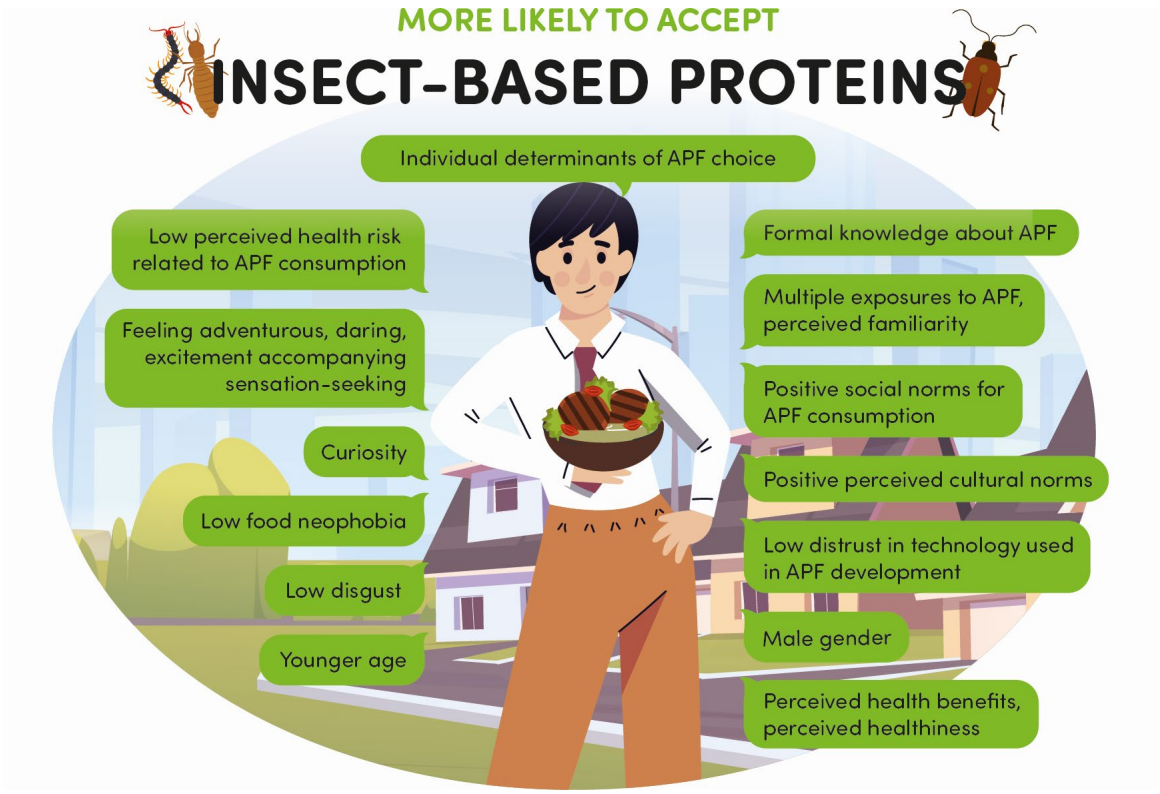

Figure 3. Summary of the individual-level determinants of consumer choices of insect-based alternative protein Food (APF).

4. Discussion

This study provides a theory-based synthesis of evidence concerning the associations between individual-level determinants and indicators of consumer choices of alternative proteins. The results identify which individual-level factors consistently associated with APF choices and highlight differences in association patterns, depending on the source of alternative proteins (plant-based, insect-based, or proteins from other sources).

Considering the three domains of the COM-B model (Cane et al., 2012; McDonagh et al., 2018; Michie et al., 2011), it becomes evident that compared to other fields, the number of studies addressing the *Capability* domain is small. This limited evidence may be attributed to the novelty of APF which have been present in the market for a relatively short period compared to traditional protein sources. Additionally, consumer awareness of APF and the availability of APF in food environment is limited (Aaslyngn & Højer, 2021; Brooker et al., 2022; Clark & Bogdan, 2019; Gravely & Fraser, 2018). Thus, many consumers probably have had limited opportunities to develop skills relevant for choosing APF that match their needs or to prepare meals with such products. Importantly, multiple exposures to APF products and familiarity with APF acquired through repeated exposure emerged as the common individual-level correlate of plant-based and insect-based APF choices. Increasing awareness of APF and their presence in the food environment may be a potential strategy to promote wider APF consumption. Research has shown that making APF more available can lead to increased APF intake or replacing meat with plant-based proteins (Bianchi et al., 2018; Stiles et al., 2021).

Cooking skills represent the second strongly supported determinant within the C*apability* domain. The support was obtained for plant-based APF only. Future interventions aimed at promoting plant-based APF consumption could include cooking workshops at schools or other public institutions to enhance cooking skills. Besides, they can provide the opportunity for an exposure to APF, and thus increase the familiarity with these products. Additionally, such workshops may leverage the so-called ”IKEA effect”, where active participation in the preparation process increases liking of the prepared food, which subsequently increases consumption (Radtke et al., 2019). Furthermore, improving plant-based APF cooking skills may serve as a “mastery experience” (e.g., “I have done it successfully!”). This can, in turn, enhance consumers’ confidence or self-efficacy beliefs about the ability to adopt a regular APF intake (for research linking self-efficacy and dietary changes see e.g., Luszczynska & Schwarzer, 2020).

Our review addressed individual’s perceptions and beliefs about social and physical environment, which constitute *the Opportunity domain in the COM-B model* (Cane et al., 2012; McDonagh et al., 2018; Michie et al., 2011). Regarding insect-based APF, consistent evidence emerged for social norms, cultural norms, and distrust in technology used in APF development. Previous research has shown that when individuals were asked how they would eat insect-based APF products, their response was “with either an expert” or “with someone who knows how to cook them” (Bisconsin-Júnior, 2022). Identifying such experts who are relevant role models for the consumers may enhance consumers’ confidence in insect-based APF as socially approved products and thus increase adoption of respective products.

Cultural norms referring to the fit between the protein source and the culinary traditions or food environment in a respective country or culture were also identified as a relevant determinant of insect-based APF choices. Strong food culture and culinary traditions, awarding Protected Designation of Origin (PDO) certificates to many animal-based protein products, may hinder the initiation of APF consumption. Research conducted across European countries suggested that Italy, a country with strong culinary norms, is characterized by low readiness to adopt insect-based APF (cf. Mancini & Antonioli, 2022).

Regarding insect-based APF, another significant determinant factor from the *Opportunity* domain of the COM-B model is a lack of trust in the technology used to develop alternative proteins. Distrust may be associated with limited knowledge about insect-based APF (a *Capability* factor hindering APF intake) and negative emotion-related factors (such as neophobia, a *Motivation* factor). Previous research has suggested that high trust in actions of food system stakeholders, including food developers and producers, scientists,

organizations, may be considered one of the key potential determinants of consumers' choices of novel types of APF (Siegrist & Hartman, 2020). Our study points out that the trust factor may be specifically relevant for insect-based APF.

Our research did not provide strong support for the individual-level factors from the *Opportunity* domain as correlates of plant-based APF choices. However, we obtained preliminary support for positive social norms and distrust in technology, which were also identified as determinants of insect-based APF choices. Future research should further test if the studies were just addressing these factors less frequently or if they form weaker links with plant-based APF. Social norms may also operate differently within certain subgroups. For example, among meat-eating men the presence of other men (e.g., in restaurants) may be a barrier to choosing plant-based APF products due to the influence of masculinity norms (Bogueva et al., 2022). Regarding women, frequent dining out in restaurants with friends promotes positive social norms towards plant-based APF, which in turn may be associated with higher plant-based APF choices (Weinrich & Elshiewy, 2023).

The *Motivation* domain of the COM-B model yielded the largest number of strongly supported factors, with a majority of these factors forming a distinctive set of individual-level correlates of either plant-based or insect-based APF. However, perceived health benefits constitute the only determinant in this domain, that was strongly supported for both plant-based and insect-based APF. Some previous research has argued that addressing health benefits in promoting the consumption of insect-based APF may have a limited effect due to the temporally distant character of health-related goals (Berger et al., 2018). It is possible that perceived health benefits are mostly associated with an intention to change, but unrelated to the actual consumption (so-called intention-behavior gap). Additionally, for insect-based APF, health risks and related negative emotions, such as food neophobia or distrust, emerged as strongly supported correlates. Previous research has shown that beliefs about health-related risks may have an emotional component of fear or anxiety (Ruiter et al., 2001). Fear and anxiety are central components of general, food-specific, or insect-specific neophobia. As a result, health risk perceptions and neophobia may be interconnected, creating a vicious cycle that reduces the likelihood of adopting novel or insect-based APF foods. Beliefs about higher health risks may be also related to lower individual's familiarity with novel APF products (Tuorila & Hartmann, 2020).

Our findings within the *Motivational* domain highlight the crucial role of automatic regulatory processes in the adoption of insect-based APF into consumers' diet. This contrasts with traditional models of health behavior change, which mostly emphasize the effortful self-regulatory processes involved in changing an individual's beliefs (Hagger et al., 2020; Luszczynska & Schwarzer, 2020). Besides negative emotions, our findings underscore the pivotal role of positive emotions such as curiosity or feeling adventurous, daring, seeking excitement, and sensations in the adoption of dietary shifts, including insect-based APF. These findings may have some practical implications, suggesting that interventions prompting curiosity and excitement, should be implemented with the presence of experts whose knowledge and skills would guarantee safety and low health risks. Food events or food festivals may constitute an intervention setting where curiosity and excitement may prompt individuals to try novel insect-based APF. Recent research has highlighted the role of food events or food festivals as the most approved environment to try APF (Motoki et al., 2022; Palmieri & Forleo, 2021).

In contrast, a different set of *Motivation*-related factors emerged as strongly supported correlates of plant-based APF. These factors include pro-environmental and sustainability beliefs, animal welfare, and empathy towards animals. Interventions promoting plant-based APF should target sustainability beliefs or animal welfare issues, whereas interventions promoting insect-based APF should address different motivation-related determinants, such as curiosity, or familiarize consumers with insect-based food to reduce their neophobia.

Finally, our meta-review points towards the specificity of the sociodemographic factors associated with plant -based and insect-based APF choices. For insect-based APF, men are more likely to choose such products, whereas the education level is unlikely to hinder or promote insect-based APF choices. These

findings are of particular relevance, as men and lower education groups are in need for nutrition interventions but are often harder to reach (Darmon & Drewnowski, 2008; Deeks et al., 2009). For plant-based APF, the correlates of consumer choices include higher education (strongly supported factor) and female gender (preliminary support). Although men are less likely to choose plant-based APF than women, man may be influeced by their female partners and choose plant-based APF when dining out with the romantic partners, according to prior research (Bogueva et al., 2022).

One important finding is the lack of research on individual-level determinants of actual trying or actual intake of APF. The majority of reviews focus on research addressing intentions, acceptability; self-reported intake is measured less frequently, and experimental research measuring the actual intake of APF is rare. Further evidence confirming the links between the individual-level determinants discussed in our review, and acts of purchase, trying, or regular intake of APF is needed.

The findings of this study have implication for practice. Marketing and sales strategies applied by the APF producers or retailers, APF awareness raising campaigns, APF-promoting educational interventions and any other actions that aim to mainstream APF may need to address different characteristics of the consumers, depending on the source of alternative proteins included in the promoted APF products. Tailoring the APF promotion to individual-level characteristics of potential consumers may result in a better fit between consumer characteristics and the type of APF product, and consequently mainstreaming APF choices. For example, a marketing strategy involving a combination of sustainability-oriented female consumer model and curios, explorer-type male consumer model might promote plant-and insect-based APF choices. Actions aiming at the promotion of alternative proteins from any sources may need to target consumers characteristics that obtained strong or (at least) preliminary support across all types of APF products, such as positive social norms related to APF intake or act to reduce the distrust in technology used in the development of APF.

Beyond its strengths, the present study has several limitations. The majority of original studies analyzed in the included reviews provides evidence for correlations between individual-level “determinants” and the indicators of APF choices. Thus, any causal conclusions should be made with caution as such evidence is still limited. The category of the consumer choice indicators was very broad and varied from intentions to actual intake. Additionally, the coding of the consumer-choice indicators relied on specificity of the operationalization and description respective factors in the included reviews. A limited number of reviews addressing other APF than plant-based or insect-based does not allow to draw conclusions regarding the specificity of correlates that may be significant, e.g., in case of fungi- mushroom-, or microbial-based APF. Keeping in mind the differences in definitions and ways of measurement of the individual-level determinants (e.g., perceived environmental benefits), any conclusions should be considered with caution. The results of the quality evaluation indicated that only a half of reviews presented a low risk of bias due to high quality of applied review methods. These findings should inspire a consideration on the insufficient quality of many reviews and potentially flawed results. Furthermore, the included reviews were heterogeneous in terms of the quality (risk of bias), reviews’ objectives, their target groups, and settings, therefore any conclusions should be treated as preliminary. The conclusions of any meta-review may be biased if there is an overlap in original studies analyzed in the included reviews (Hennessy et al., 2019). The heterogeneity of the aims of reviews included in this meta-review reduces the likelihood of such overlap, yet some overlap is certainly expected. Effects of the overlap were not investigated systematically. In line with previous reviews (Horodyska et al., 2015; Lobczowska et al. 2022),we used a threshold of 66% as indicating strong support and 50% as indicating preliminary support for an analyzed determinant. The distinction between these two thresholds is arbitrary and the pattern of the associations should be confirmed further in a meta-analysis of original research presenting quantitative results. As a limited number of included reviews reported any quantitative results for any of the determinants, conducting a meta-analysis was not feasible.

5. Conclusions

As the research has demonstrated, this study offers theory-based synthesis of evidence on individual-level determinants of APF choices. Our findings may inform policymakers, implementers, and researchers, to the need for accounting for consumers' capabilities, motivations, sociodemographic characteristics and perceived opportunities, when making plans for the development or implementation of programs promoting APF intake. Finally, it underscores the substantial differences in the determinants of APF, depending on the source of the proteins (e.g., plants, insects, fungi, etc.).

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*Szenderák, J., Fróna, D., & Rákos, M. (2022). Consumer Acceptance of Plant-Based Meat Substitutes: A Narrative Review. *Foods*, *11*(9), 1274. https://doi.org/10.3390/foods11091274

*Toti, E., Massaro, L., Kais, A., Aiello, P., Palmery, M., & Peluso, I. (2020). Entomophagy: A Narrative Review on Nutritional Value, Safety, Cultural Acceptance and A Focus on the Role of Food Neophobia in Italy. *European Journal of Investigation in Health, Psychology and Education*, *10*(2), 628–643. https://doi.org/10.3390/ejihpe10020046

Tuorila, H., & Hartmann, C. (2020). Consumer responses to novel and unfamiliar foods. *Current Opinion in Food Science*, *33*, 1–8. https://doi.org/10.1016/j.cofs.2019.09.004

*Wang, M., Zhou, J., Tavares, J., Pinto, C. A., Saraiva, J. A., Prieto, M. A., Cao, H., Xiao, J., Simal-Gandara, J., & Barba, F. J. (2022). Applications of algae to obtain healthier meat products: A critical review on nutrients, acceptability and quality. *Critical Reviews in Food Science and Nutrition*, 1–18. https://doi.org/10.1080/10408398.2022.2054939

*Wassmann, B., Siegrist, M., & Hartmann, C. (2021). Correlates of the willingness to consume insects: A meta-analysis. *Journal of Insects as Food and Feed*, *7*(5), 909–922. https://doi.org/10.3920/JIFF2020.0130

*Weinrich, R. (2019). Opportunities for the Adoption of Health-Based Sustainable Dietary Patterns: A Review on Consumer Research of Meat Substitutes. *Sustainability*, *11*(15), 4028. https://doi.org/10.3390/su11154028

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

*Wendt, M.-C., & Weinrich, R. (2023). A systematic review of consumer studies applying the Food Technology Neophobia Scale: Lessons and applications. *Food Quality and Preference*, *106*, 104811. https://doi.org/10.1016/j.foodqual.2023.104811

West, R., & Michie, S. (2020). A brief introduction to the COM-B Model of behaviour and the PRIME Theory of motivation. *Qeios*. https://doi.org/10.32388/WW04E6

Whiting, P., Savović, J., Higgins, J. P. T., Caldwell, D. M., Reeves, B. C., Shea, B., Davies, P., Kleijnen, J., & Churchill, R. (2016). ROBIS: A new tool to assess risk of bias in systematic reviews was developed. *Journal of Clinical Epidemiology*, *69*, 225–234. https://doi.org/10.1016/j.jclinepi.2015.06.005

7. Annexes

7.1 Annex I. Characteristics of Included Reviews (Table S1) and Quality of The Included Reviews, Coded Using the ROBIS Tool for the Evaluation of the Risk of Bias (Table S2).

Table S1. Characteristics of included reviews

No.	Reference	Number of original studies concerning psychosocial determinants of alternative protein intake	Number of original studies	Region/ country where the original studies were conducted	Was any theory/framework used to guide/organise the findings of the systematic review? NO or YES (if yes, list the theory/ies)	Design of original studies: a) quantitative b) qualitative c) mixed methods	Objectives of the systematic review	Number of participants	Population	Type of review (systematic review, scoping review, narrative review etc.)	Time span of original studies	Measurement methods
1	Ardoin, R., & Prinyawiwatkul, W. (2021). Consumer perceptions of insect consumption: a review of western research since 2015. International Journal of Food Science & Technology. doi:10.1111/ijfs.15167	5	13	USA, Italy, Switzerland	NO	a - quantitative	This review discusses current trends in perceptual entomophagy research in Australia, Canada, Europe and the USA since 2015, along with an analysis of the guiding theoretical approaches to predicting insect consumption.	not provided	not provided	review	2015-2020	not provided
2	Baiano, A. (2020). 3D Printed Foods: A Comprehensive Review on Technologies, Nutritional Value, Safety, Consumer Attitude, Regulatory Framework, and Economic and Sustainability Issues. Food Reviews International, DOI: 10.1080/87559129.2020.1762091	8	261	Switzerland, Australia, Canada	NO	a & b - quantitatve and qualitative	This work is aimed to provide a comprehensive overview of 3D printed foods.	649	not provided	review	2010-2020	survey, news analysis, focus group discussion, online discussion group
3	Batat, W., & Peter, P. (2020). The healthy and sustainable bugs appetite: factors affecting entomophagy acceptance and adoption in Western food cultures. *Journal of Consumer Marketing* , 37(3), 291-303. https://doi.org/10.1108/JCM-10-2018-2906	not provided	not provided	not provided	NO	not provided	The purpose of this paper introduces entomophagy as an alternative food consumption (AFC) capable of contributing to food well-being (FWB) among Western consumers. Specifically, it provides a conceptual framework where key factors related to the acceptance and adoption of insects and insects based foods are identified.	not provided	not provided	review	not provided	not provided

4	Dagevos, H.. (2020). A literature review of consumer research on edible insects: recent evidence and new vistas from 2019 studies. Journal of Insects as Food and Feed. 7. 1-12. 10.3920/JIFF2020.0052.	33	33	"Western countries"	NO	not provided	This literature review presents established threads of research about: (1) Westerners' unfamiliarity with; and (2) fear of eating insects; or (3) consumer reactions to processed or unprocessed insect food products.	not provided	adults and young adults (Millenials and Generation Z), university students, vegan and vegatarians	review	2019	not provided
5	De Cianni, R., Pippinato, L., & Mancuso, T. (2023). A systematic review on drivers influencing consumption of edible mushrooms and innovative mushroom-containing products, *Appetite* , 182, 106454, https://doi.org/10.1016/j.appet.2023.106454.	27	31	Finland, Brazil, Portugal, Hungary, USA, India, Turkey, Malaysia, Nigeria, Brazil, Mexico, Sweden, Thailand	NO	a - quantitative	The main objectives are the identification and shaping of the key factors that determine consumption and purchasing behaviour toward edible mushrooms and mushroom products, providing an overview of key research issues and approaches and discussing the implications for industries and policymakers, as well as the identification of research gaps to be addressed in future studies.	not provided	not provided	systematic review	2000-present	not provided
6	Deroy, O., Reade, B., & Spence, C. (2015). The insectivore's dilemma, and how to take the West out of it. Food Quality and Preference, 44, 44–55. doi:10.1016/j.foodqual.2015.02	not provided	not provided	not provided	NO	not provided	This article's aim is to suggest an alternative sensorially-driven strategy, which stands a much greater chance of making people eat insects on a regular basis.	not provided	not provided	review	not provided	not provided
7	Eckl, M.R., Biesbroek, S., van't Veer, P., Geleijnse, J.M.(2021). Replacement of Meat with Non·Meat Protein Sources: A Review of the Drivers and Inhibitors in Developed Countries. *Nutrients* , 13, 3602. https://doi.org/10.3390/nu13103602	23	23	UK, Denmark, Finland, Germany, Iceland, Romania, Italy, Netherlands, Hungary, Canada, USA, New Zealand, France, Belgium	NO	a & b - quantitatve and qualitative	The aim of this review is to identify the drivers and inhibitors underlying consumer behavior of replacing meat with non-meat protein sources in omnivores and flexitarians in developed countries.	10933	adults, meat consumers or flexitarians	narrative review	2011-2021	discrete choice experiment, online survey, willingness to pay experiment, experiment, interviews, longitudinal experiment, semi-structured interviews
8	Florença, S.G., Guiné, R.P.F., Gonçalves, F.J.A., Barroca, M.J., Ferreira, M., Costa, C.A., Correia, P.M.R., Cardoso, A.P., Campos, S., Anjos, O., et al. (2022). The Motivations for Consumption of Edible Insects: A Systematic Review. *Foods,* 11, 3643. https://doi.org/10.3390/foods11223643	31	31	Belgium, Denmark, Finland, Germany, Hungary, Italy, Netherlands, Poland, Russia, Spain, Sweden, Switzerland, UK, Brazil, Canada, Dominican Republic, Mexico, Peru, USA, Kenya, Nigeria, South Africa, China, India, Japan, Thailand, Australia, New Zealand	NO	a & b - quantitatve and qualitative	This work aims to: (1) examine the determinants positively and negatively influencing the consumption of insects; (2) see if the degree of acceptability differs between eating whole insects and insects incorporated in products; and finally, (3) if the determinants that influence the consumption diverge between insect-eating countries (IEC) and Western countries (WC).	20392	children, adolescents and adults	systematic review	2014-2021	focus group, questionnaire, interview

9	Giordano, S., Clodoveo, M. L., De Gennaro, B., & Corbo, F. (2017). Factors determining Neophobia and Neophilia with regard to new technologies applied to the food sector: a Systematic Review, *International Journal of Gastronomy and Food Science* , 11, 1-19, https://doi.org/10.1016/j.ijgfs.2017.10.001	9	53	Germany, China, Belgium, USA, Netherlands, UK, Switzerland, Thailand	NO	a & b - quantitatve and qualitative	This systematic review analyses and synthetizes the main results of recent studies dealing with food neophobia and neophilia with regard to new technologies applied to the food sector, both in the context of developed countries and in developing ones. In particular, main factors leading to caution and aversion for food technologies were identified and discussed, as well as different approaches to measure consumers' resistance to the mentioned technologies and to predict consumers' behavior.	3482	consumers, habitual meat consumers, students, suppermarket shoppers, not vegan or vegetarian, insect eaters and non-eaters	systematic review	2006-2016	questionnaire survey, hedonic tests; Three Studies: Study 1 Retail setting; Study 2 Restaurant setting; Study 3 Support findings from 1 and 2. Direct test through images and descriptions; web-based survey through questionnaire, cross-national consumer survey through questionnaire, focus groups interview
10	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. doi:10.1016/j.tifs.2019.07.046	66 (articles concernig plant-based diets and not meat reduction)	110	USA, UK, Croatia, Sweden, China, Greece, Australia, Belgium, Netherlands, Germany, Portugal, Canada, India, Finland, Italy, Hungary, Austria, Spain, Malaysia, Norway	YES - The COM-B Theoretical Model	a & b & c- quantitatve and qualitative and mixed methods	The present review aims to address this limitation and has two specific objectives: (1) to map the variables (i.e., actual or potential barriers and enablers) known to be associated with meat curtailment, meat substitution and adherence to plant-based diets; (2) to integrate the current body of knowledge into a coherent overarching theoretical framework of behavior change (COM-B system).	241529	convenience sample, university students, meat eaters, meat reducers, vegetarians, university students, urban sample, general population, business students, adolescents, Mturk population, vegans, food shoppers, internet users, soldiers, ethnic minorities, students of environmental studies, medical students, food retail representatives, psychology students, flexitarians	systematic review	1989-2018	2x2 experiment, focus groups, interviews, cross-sectional survey, 2-way field experiment, 2-way RCT with follow-up, cross-sectional telephone survey, semi-structured focus groups, 2x2x2 between-subject experiment, online ethnographic approach with discussion, online open-ended survey, free association task, 3-way experiment, 6x2 experiment, semi-structured interviews, in-home product use test, free-sorting task with closed-ended questionnaire, cohort study, natural field experiment, implicit association test
11	Hartmann, C., Siegrist, M. (2017). Consumer perception and behaviour regarding sustainable protein consumption: A systematic review. Trends in Food Science & Technology, 61, 11-25, https://doi.org/10.1016/j.tifs.2016.12.006.	38	38	USA, UK, Netherlands, Portugal, Australia (Victoria), Switzerland, Belgium, Germany, Turkish/Kurdish & Chinese/ Hong Kongese migrants from Netherlands, France, China, Canada, Denmark, Italy	NO	a - quantitative	research questions: 1) Are consumers aware that meat consumption has a large environmental impact? 2) Are consumers willing to reduce meat consumption or substitute meat with an alternative? 3) Are consumers willing to accept meat substitutes and alternative proteins, such as insects or cultured meat?	38947	convenience sample, students, visitors to an Insectarium, students interested in insect-food, christian schools students, university students, second-generation migrants in Netherlands	systematic review	1997-2016	experimental between-subject design with control group, online experiment, online survey, face-to-face interview, postal survey, hedonic test, paper survey, experimental between-subject design with repeated measure, sorting task, implicit association task

12	He, J., Evans, N. M., Liu, H., & Shao, S. (2020). A review of research on plant-based meat alternatives: Driving forces, history, manufacturing, and consumer attitudes. Comprehensive Reviews in Food Science and Food Safety. doi:10.1111/1541-4337.12610	not provided	not provided	not provided	NO	a & b - quantitatve and qualitative	The aim of this review was to gather current knowledge on plant-based meat alternatives	not provided	not provided	review	not provided	not provided
13	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	not provided	not provided	"Western countries"	NO	a & b - quantitatve and qualitative	This literature review focuses on the following questions: • What are the justifications for insect-eating presented in current literature and how do they reflect consumers' concerns? • What factors are understood as influencing consumer acceptance of insects as food? • How can design interventions address these factors and support the adoption of edible insects?	not provided	not provided	review	2005-2018	not provided
14	Kröger, T., Dupont, J., Büsing, L. & Fiebelkorn, F. (2022) Acceptance of Insect-Based Food Products in Western Societies: A Systematic Review. Frontiers in Nutrition, 8:759885. doi: 10.3389/fnut.2021.759885	119	119	Czech Republic, USA, Italy, Belgium, Poland, Canada, Switzerland, Germany, Hungary, UK, Spain, Australia, Denmark, Netherlands, Finland, France, Sweden, New Zealand	NO	a - quantitative	This systematic review sought to identify, analyze, and synthesize the findings of empirical studies on consumer acceptance of insect-based food products in Western countries.	53493	adults, young adults, university students, undergraduate students, school children, both from urban and rural areas	systematic review	2013-2021	sensory analysis, questionnaire survey, digital questionnaire, 2x2 between-subject experimental design, surveys manipulating descriptive social norms, open-ended questions, pre- and post- tasting questionnaire, global survey, paper questionnaire, focus group interviews, self-administered questionnaire, exploratory survey, projective sensory experience, quasi-experiment, within-subjects design, face-to-face survey, computer administered questionnaire, Applied facial expression coding system (FACES), web-based questionnaire, nationwide telephone survey, descrete choice experiment

15	M.C. Onwezen, E.P. Bouwman, M.J. Reinders, H. Dagevos. (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.	91	91	The majority of the studies were conducted in the Netherlands (20 studies), Italy (17 studies), Germany (13 studies), the United States (9 studies), Australia (8 studies), Belgium (7 studies), the United Kingdom (5 studies), and Switzerland (6 studies). Other countries, such as the Czech Republic, are only represented once or twice.	NO	a & b - quantitatve and qualitative	Overview of drivers of acceptance of a wide range of alternative proteins.	51333	the particular age range, gender or socio-economic status was not specified	systematic review	2005-2020	questionnaire survey, online survey, focus groups interviews, online experiment, experiment, survey, choice experiment, quasi-experiment, semi-structured interviews, survey and sensory tests, telephone survey
16	Mancini, S., Moruzzo, R., Riccioli, F., & Paci, G. (2019). European consumers' readiness to adopt insects as food. A review. Food Research International. doi:10.1016/j.foodres.2019.01.	41	41	Czech Republic, Italy, Belgium, Poland, Netherlands, Hungary, Switzerland, Germany, China, Denmark, France, Australia, Sweden, Ireland, Thailand	NO	a & b - quantitatve and qualitative	This review article, analyzed different methodologies conducted on European consumers and categorised the studies in relation to the type of analysis chosen, data collection and results obtained.	12930	students with part-time occupation plus employees in several jobs, undergraduate students, students, university students and employees, consumers from outside the university, staff and student of AgroParisTech, participants at a "bug banquet", university students of Gastronomy and Food Science courses of the Department of Food Science, adults with various education level	review	2012-2019	survey, focus groups, tasting test, online survey, semi-structured interviews, implicit associations test, non-verbal evaluation of acceptance, choice experiment, postal survey, telephone survey
17	Mina, G., Peira, G., & Bonadonna, A. (2023). The Potential Future of Insects in the European Food System: A Systematic Review Based on the Consumer Point of View. *Foods* , 12, 646. https://doi.org/10.3390/foods12030646	62	98	Italy, Germany, Netherlands, Belgium, Poland, UK, Switzerland, Finland, France, Romania, Portugal, Sweden, Hungary, Ireland, Denmark, Spain, Norway, Czech Republic	NO	a & b - quantitatve and qualitative	Research Question 1 (RQ1): Among the variables analyzed in the literature, which appear to be barriers and which drivers for the consumption of insects in Europe? Research Question 2 (RQ2): Considering what emerged from the first research question, which are the most promising strategies to convince European consumers to eat insects?	not provided	general consumers, university students, minors, millenials, gen z, older people, consumers who have already eaten insects, participants in a health fair, university staff	systematic review	2015-2022	survey, focus groups, tasting, experiment, interview

18	Nguyen, J., Ferraro, C., Ferraro, C., Sands, S., & Luxton, S. (2022). Alternative protein consumption: A systematic review and future research directions. International Journal of Consumer Studies, 46, 1691– 1717. https://doi.org/10.1111/ijcs.12797	64	64	Netherlands, United States, Finland, Sweden, Germany, Czech Republic, Belgium, France, Switzerland, Australia, New Zealand, Denmark, United Kingdom, Canada, Italy, Brazil, Spain, Dominican Republic, Scotland, Poland, Portugal, South Korea, China	YES - The COM-B Theoretical Model	a & b - quantitatve and qualitative	To review existing literature and identify key factors influencing alternative proteins consumption; to extrapolate the relevance of these factors to the marketing domain.	48443	both men and women, age range - 15-100; children, students, adults and older adults	systematic review	2004-2021	online survey, online experiment, field experiment, survey, experimental lab, interviews, focus groups, workshops, online interviews
19	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, DOI: 10.1080/10408398.2022.2036096	76	76	UK, Portugal, The Netherlands, Italy, Belgium, Switzerland, Germany, China, Denmark, USA, France, Spain, Romania, New Zealand, Australia, Finland, Sweden, Czech Republic, Poland, Hungary	NO	a & b - quantitatve and qualitative	This paper focuses on in-depth understanding of consumer perception and acceptability of plant-, seaweed-, and insect-based meat products to get insights on their current situation and future implementation.	50,664	adult consumers	review	2012-2021	survey, quantitative and qualitative online survey, consumer tests, integrative bottom-up approach, experimental sessions, online conjoint survey, focus groups, concept maps, experiment, cross-national studies, interviews, online questionnaire, online interview, questionnaire, open and closed questionnaire, secondary data from Swiss food panel, sensorial tasting session, semi-structured interviews, analysis of non-hypothetical wilingness to pay, hedonic test, short questionnaire, explorative study, web-based survey, behavioral economics experiment, individual single tasting, consumer survey
20	Siddiqui, S. A., Zannou, O., Karim, I., Kasmiati, Awad, N.M.H., Gołaszewski, J., Heinz, V., Smetana, S. (2022).Avoiding Food Neophobia and Increasing Consumer Acceptance of New Food Trends—A Decade of Research. Sustainability, 14, 10391. https://doi.org/10.3390/su141610391	133	133	Europe, Asia, North America	NO	a & b - quantitatve and qualitative	This paper reviews articles to arrange appropriate strategies for reducing neophobia and increasing consumer acceptance of novel foods and new food technologies.	not provided	chldren, young adults & adults; urban and rural	review	2012-2021	survey, telephone survey, twitter analysis, interviews

21	Siddiqui, S.A., Alvi, T., Sameen, A., Khan, S., Blinov, A.V., Nagdalian, A.A., Mehdizadeh, M., Adli, D.N., & Onwezen, M. (2022). Consumer Acceptance of Alternative Proteins: A Systematic Review of Current Alternative Protein Sources and Interventions Adapted to Increase Their Acceptability. Sustainability, 14, 15370. https://doi.org/10.3390/su142215370	28	33	Finland, Belgium, Canada, Germany, China, USA, UK, Italy, Japan, Switzerland, India, Columbia, Denmark, Australia, Chile, Sweden, The Netherlands	NO	a & b - quantitatve and qualitative	This systemic review highlights different varieties of alternative proteins and interventions adopted to increase the acceptance of alternative protein sources.	11337	adults, children, adolescents	systematic review	2016-2022	online survey, online cross-sectional survey, supermarket audits, consumer interviews, online auction involving German consumers, face to face interviews, 3x1 randomized experimental design, review, face to face filling out of questionnaire in a paper-and-pencil format for study, online experiments, cross-cultural survey, mixed within/between-subjects experimental design, self-administered personal survey, online questionnaire, entomophagy attitude questionnaire, semi-structured interviews, face to face survey
22	Szenderák, J., Fróna, D., & Rákos, M. (2022) Consumer Acceptance of Plant-Based Meat Substitutes: A Narrative Review. Foods, 11, 1274. https://doi.org/10.3390/foods11091274	28	28	India, Europe, USA, China, Korea, Germany, Japan, Belgium, Canada, South Africa, Turkey	NO	a & b - quantitatve and qualitative	In this review, the factors affecting the consumer acceptance of plant-based meat substitutes were analyzed and systematically summarized.	37332	not provided	narrative review	2016-2022	discrete choice experiment, survey, ANOVA and linear regression, interviews, online survey, nutritional profiling, review, life cycle assessment, linear regression, online interviews, emotional and sensory profiles of products, t-test, content analysis
23	Toti, E., Massaro, L., Kais, A., Aiello, P., Palmery, M., & Peluso, I. (2020). Entomophagy: A Narrative Review on Nutritional Value, Safety, Cultural Acceptance and A Focus on the Role of Food Neophobia in Italy. European Journal of Investigation in Health, Psychology and Education, 10(2), 628–643. doi:10.3390/ejihpe10020046	19	19	Italy, Denmark	NO	a & b - quantitatve and qualitative	The purpose of this narrative paper is to provide an overview of the main topics related to entomophagy.	39179	international university students, italian university students, employees and consumers from outside the university, university students with part-time occupation, employees in several jobs, individuals recruited in a "bug banquet", university staff, just graduates	narrative review	not provided	questionnaire, online questionnaire, tasting test, computer questionnaire
24	Wang, M., Zhou, J., Tavares, J., Pinto, C. A., Saraiva, J. A., Prieto, M. A., Cao, H., Xiao, J., Simal-Gandara, J., & Barba F. J. (2022). Applications of algae to obtain healthier meat products: A critical review on nutrients, acceptability and quality, Critical Reviews in Food Science and Nutrition, DOI: 10.1080/10408398.2022.2054939	not provided	not provided	not provided	NO	not provided	This review summarizes the potential applications of algae derived bioactive compounds, as well as their application status to improve the quality of meat and meat products.	not provided	not provided	review	not provided	not provided

25	Wassmann, B., Siegrist, M., & Hartmann, C. (2021). Correlates of the willingness to consume insects: a meta-analysis. Journal of Insects as Food and Feed. 7. 1-14. 10.3920/JIFF2020.0130.	37	37	USA, Switzerland, Thailand, Netherlands, Germany, Finland, Hungary, China, Denmark, Italy, Belgium, UK, India	NO	a - quantitative	Our findings aim to consolidate the existing body of knowledge on the barriers to and potential avenues for the acceptance of edible insects and may also illuminate the next steps appropriate for entomophagy acceptance research.	18255	not provided	meta-analysis	2012-2020	experiment, paper pencil survey, computer-administered survey, online survey
26	Weinrich, R. (2019). Opportunities for the Adoption of Health-Based Sustainable Dietary Patterns: A Review on Consumer Research of Meat Substitutes. Sustainability, 11(15), 4028. doi:10.3390/su11154028	27	27	UK, Belgium, South Africa, Italy, The Netherlands, Malaysia, Taiwan, USA, Canada	YES - innovation-decision process	a & b - quantitatve and qualitative	The aim of this paper is to review consumer research dealing with consumers' adoption of meat substitutes.	16514	consumers, students, meat-eaters, users of meat substitutes, vegetarians, general population	review	1975-2017	questionnaire, descrete choice experiment, group iterview sessions, content analysis, taste testing sessions, qualitative interviews, choice experiment, focus group interviews
27	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	not provided	not provided	not provided	NO	not provided	The main objective of this review was to identify the key factors influencing consumer perception and acceptability of insect-based foods described in the literature published in the recent years.	not provided	not provided	review	2019-2020	not provided
28	Wendt, M.-C., & Weinrich, R. (2023). A systematic review of consumer studies applying the Food Technology Neophobia Scale: Lessons and applications. Food Quality and Preference, 106, 104811, https://doi.org/10.1016/j.foodqual.2023.104811.	49	49	Australia, Canada, Italy, South Korea, Belgium, Poland, Brazil, Finland, Chile, Uganda, Switzerland, Mexico, China, Germany, USA, Netherlands, Spain, Dominican Republic	NO	a - quantitative	1) Is the FTNS a suitable tool to measure consumer acceptance of novel food technologies? 2) What is the impact of FTN on willingness to try products created using novel technologies? 3) What research areas should be addressed in future studies?	24557	in most studies (except one) participants were from well-developed countries, majority of the studies (43) had non-representative sample	systematic review	2008-2022	online survey, paper and pencil questionnaire, interviewer-administered questionnaire

Table S2. The risk odd bias assessment in the included reviews using the ROBIS tool

		PHASE 2				PHASE 3
No.	Review	1. STUDY ELIGIBILITY CRITERIA	2. IDENTIFICATION AND SELECTION OF STUDIES	3. DATA COLLECTION AND STUDY APPRAISAL	4. SYNTHESIS AND FINDINGS	RISK OF BIAS IN THE REVIEW
1	Ardoin 2021	HIGH	HIGH	HIGH	HIGH	HIGH
2	Baiano 2022	HIGH	HIGH	HIGH	HIGH	HIGH
3	Batat 2020	HIGH	HIGH	HIGH	HIGH	HIGH
4	Dagevos 2021	LOW	LOW	HIGH	LOW	HIGH
5	De Cianni 2023	LOW	LOW	HIGH	LOW	LOW
6	Deroy 2015	HIGH	HIGH	HIGH	HIGH	HIGH
7	Eckl 2021	LOW	LOW	LOW	LOW	LOW
8	Florença 2022	LOW	LOW	LOW	LOW	LOW
9	Giordano 2018	LOW	LOW	LOW	LOW	LOW
10	Graça 2019	LOW	LOW	LOW	LOW	LOW
11	Hartmann 2017	LOW	LOW	LOW	LOW	LOW
12	He 2020	HIGH	HIGH	HIGH	HIGH	HIGH
13	Kauppi 2019	LOW	HIGH	HIGH	HIGH	HIGH
14	Kröger 2022	LOW	LOW	LOW	LOW	LOW
15	Mancini 2019	LOW	LOW	LOW	LOW	LOW
16	Mina 2023	LOW	LOW	LOW	LOW	LOW
17	Nguyen 2022	LOW	LOW	LOW	LOW	LOW
18	Onwezen 2021	LOW	LOW	LOW	LOW	LOW
19	Siddiqui 2022b	LOW	HIGH	HIGH	LOW	LOW
20	Siddiqui 2022c	LOW	HIGH	HIGH	LOW	HIGH
21	Siddiqui 2022d	LOW	HIGH	HIGH	LOW	HIGH
22	Szenderák 2022	LOW	LOW	LOW	LOW	LOW
23	Toti 2020	HIGH	HIGH	HIGH	HIGH	HIGH
24	Wang 2022	HIGH	HIGH	HIGH	HIGH	HIGH

25	Wassmann 2021	LOW	LOW	LOW	LOW	**LOW**
26	Weinrich 2019	LOW	LOW	LOW	LOW	**LOW**
27	Wendin 2021	HIGH	HIGH	HIGH	HIGH	**HIGH**
28	Wendt 2023	LOW	LOW	LOW	LOW	**LOW**