

# A systematic review on consumer acceptance of alternative proteins: Pulses, algae, insects, plant-based meat alternatives, and cultured meat

M.C. Onwezen<sup>\*</sup>, E.P. Bouwman, M.J. Reinders, H. Dagevos

Wageningen Economic Research, the Netherlands

## 1. A B S T R A C T

Consumers' dietary patterns have a significant impact on planetary and personal health. To address health and environmental challenges one of the many possible solutions is to substitute meat consumption with alternative protein sources.

This systematic review identifies 91 articles with a focus on the drivers of consumer acceptance of five alternative proteins: pulses, algae, insects, plant-based alternative proteins, and cultured meat. This review demonstrates that acceptance of the alternative proteins included here is relatively low (compared to that of meat); acceptance of insects is lowest, followed by acceptance of cultured meat. Pulses and plant-based alternative proteins have the highest acceptance level. In general, the following drivers of acceptance consistently show to be relevant for the acceptance of various alternative proteins: motives of taste and health, familiarity, attitudes, food neophobia, disgust, and social norms. However, there are also differences in relevance between individuals and between alternative proteins. For example, for insects and other novel alternative proteins the drivers of familiarity and affective processes of food neophobia and disgust seem more relevant. As part of gaining full insight in relevant drivers of acceptance, the review also shows an overview of the intervention studies that were included in the 91 articles of the review, providing implications on how consumer acceptance can be increased. The focal areas of the intervention studies included here do not fully correspond with the current knowledge of drivers. To date, intervention studies have mainly focussed on conscious deliberations, whereas familiarity and affective factors have also been shown to be key drivers. The comprehensive overview of the most relevant factors for consumer acceptance of various categories of alternative proteins thus shows large consistencies across bodies of research. Variations can be found in the nuances showing different priorities of drivers for different proteins and different segments, showing the relevance of being context and person specific for future research.

## 1. Introduction

A convincing body of evidence demonstrates that the overconsumption of meat (Ocké et al., 2009; Sans & Combris, 2015) contributes substantially to worrisome environmental impacts (Aiking, 2014; Aiking & de Boer, 2018) and to lifestyle diseases (Ekmekcioglu et al., 2018; Westhoek et al., 2014). To address today's and tomorrow's health and environmental challenges, a transition towards lower meat consumption levels and increased consumption of plant-based foods is key (Aiking & de Boer, 2018; de Boer & Aiking, 2019; Godfray et al., 2018; Graça, Godinho, & Truninger, 2019; Poore & Nemecek, 2018; Springmann et al., 2018; Van der Weele, Feindt, Van der Goot, Van Mierlo, & Van Boekel, 2019; Willett, Rockström, Loken, Nishtar, & Murray, 2019). Consumers can adopt a more sustainable, plant-rich diet in various ways (de Boer, Schöslér, & Aiking, 2014; Onwezen & Van der Weele, 2016): becoming a vegan or a vegetarian, eating smaller amounts of meat (e.g., curtailment, Verain, Dagevos, & Antonides, 2015), or eating meat less frequently (e.g., flexitarianism, Dagevos & Reinders, 2018; Dagevos & Voordouw, 2013). One of the options for a more

sustainable diet is to substitute meat with alternative proteins. Consumers can include various sources of proteins in their diets for example replacing meat with a meat substitute, or using alternative proteins like seaweed or beans in their dishes.

In comparison to meat, the market shares of alternative proteins remain low (Gravely & Fraser, 2018), even despite the fact that supermarkets and restaurants increasingly offer alternatives to traditional meat products or dishes, such as plant-based burgers or wraps with beans (Curtain & Grafenauer, 2019). Alternative proteins, such as pulses, algae, insects, plant-based meat alternatives, and cultured meat (e.g., Hartmann & Siegrist, 2017; Van der Weele et al., 2019), are generally considered to be healthier and more environmentally friendly than traditional animal-derived proteins (e.g., Aiking, 2011). That being said, the benefits of alternative protein production have not yet been fully scientifically documented, particularly with respect to the environment. For instance, uncertainty remains about whether cultured meat will be produced in a more environmentally sustainable manner than conventional meat (e.g., Alexander, Brown, Dias, Moran, & Rounsevell, 2019; Van der Weele et al., 2019).

<sup>\*</sup> Corresponding author.

E-mail address: [marleen.onwezen@wur.nl](mailto:marleen.onwezen@wur.nl) (M.C. Onwezen).

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However, consumers are often unaware of meat-related environmental and health issues; they are also often unwilling to change their meat-eating habits (e.g., Harguess, Crespo, & Hong, 2020; Hartmann & Siegrist, 2017; Onwezen & Van der Weele, 2016; Sanchez-Sabate & Sabaté, 2019). Given the importance of transitioning to more sustainable diets, we need to better understand why consumers might be willing to consume alternative proteins and how this knowledge can be used to develop interventions to increase consumer acceptance.

A large body of consumer acceptance research focusses on specific cases of alternative proteins, namely pulses (i.e., lentils and beans, Allegra, Muratore, & Zarba, 2015; de Boer et al., 2013; Lea et al., 2005; Melendrez-Ruiz et al., 2019), algae (i.e., aquatic organisms for consumption, Brayden et al., 2018; Birch, Skallerud, & Paul, 2019a; Moons et al., 2018), insects (e.g., Adámek et al., 2018; Ali, 2016; Baker et al., 2016; Balzan et al., 2016), plant-based meat alternatives (Gravelly & Fraser, 2018; Hoek et al., 2011; Schösler et al., 2014), and cultured meat (i.e., clean meat produced by in vitro procedure, Bekker et al., 2017; Circus & Robinson, 2019; Siegrist et al., 2018; Slade, 2018; Wilks et al., 2019). These studies include a wide range of possible factors that drive consumer acceptance of these products—for example, food choice motives (Onwezen et al., 2019; Vainio et al., 2016), attitudes towards alternative proteins (Lemken et al., 2017), food neophobia (Birch et al., 2019a; Moons et al., 2018), and familiarity with alternative proteins (Schlup & Brunner, 2018; Verbeke, 2015; Woolf et al., 2019). It seems that some sources of alternative proteins are more easily accepted by consumers than others (e.g., de Boer et al., 2013; Onwezen, van den Puttelaar, et al., 2019), and it is possible that different drivers are relevant to explaining consumer acceptance for these alternative proteins (e.g., Menozzi et al., 2017; Tan, Verbaan, & Stieger, 2017). However, because studies generally do not examine a wide range of factors and a variety of alternative proteins, it remains unclear which factors explain consumer acceptance and how this varies across different types of alternative proteins.

The present review of literature aims to contribute to this field of research by providing a comprehensive overview of the most relevant drivers of Western consumers' acceptance of, or willingness to buy or eat, a range of alternative proteins. As part of gaining full insight into the drivers of acceptance, we also include intervention studies that focus on increasing acceptance of alternative proteins via drivers of acceptance. We focus on the acceptance of five alternative proteins that reflect a broad range in terms of novelty, desirability, and plausibility (Van der Weele et al., 2019): pulses, algae, insects, plant-based meat alternatives, and cultured meat.

We contribute to the existing literature by focussing on specific drivers of acceptance. Multiple systematic reviews and meta-analyses have aimed to gain insight into effective ways to stimulate healthy and sustainable dietary patterns (e.g., Adriaanse, Vinkers, De Ridder, Hox, & De Wit, 2011; Bianchi, Garnett, Dorsel, Aveyard, & Jebb, 2018; Wilson, Buckley, Buckley, & Bogomolova, 2016). However, in these studies, there has been little focus on the underlying determinants that steer consumers to healthier and more sustainable food consumption, which would provide more insight into the effectiveness of interventions (O'Rourke & MacKinnon, 2018).

There are several reviews on related areas of consumer acceptance of alternative proteins, such as those regarding the consumer acceptance of innovative food (Siegrist, 2008); novel food technologies (Siegrist & Hartmann, 2020); food naturalness (Roman, Sánchez-Siles, & Siegrist, 2017); meat consumption (Sanchez-Sabate & Sabaté, 2019); and specific meat alternatives like cultured meat (Bryant & Barnett, 2018), insects (Dagevos, 2021, in press; Mancini, Moruzzo, Riccioli, & Paci, 2019), and plant-based meat substitutes (Weinrich, 2019). These reviews provide comprehensive and detailed overviews of relevant drivers of behaviour; however, they do not include multiple alternative proteins. We aim to contribute to this field of studies by providing an overview on consumer acceptance of various alternative proteins. Thereby allowing for the possibility to reflect on similarities and differences across various

categories of alternative proteins. To the best of our knowledge, the only systematic review on consumer acceptance of several alternative proteins available to date is one by Hartmann and Siegrist (2017). This study includes 19 articles focussed on meat substitutes and alternative proteins such as insects and cultured meat. Hartmann and Siegrist's review paper examines consumers' awareness of the environmental impact of meat production and their willingness to change their current meat consumption behaviour in general. We add to their review in multiple ways. First, many studies on novel proteins have been recently published, thus requiring a new overview of the literature. Second, the current study provides a more comprehensive and in-depth overview of relevant drivers of consumer acceptance, thereby resulting in a deeper understanding of the drivers that determine consumers' acceptance of different alternative proteins. Third, the present review encompasses a larger variety of alternative proteins than the review by Hartmann and Siegrist (2017), including cultured meat, seaweed and microalgae, insects, pulses, and plant-based alternative proteins. Finally, we add to the literature by reflecting on differences between categories of alternative proteins, thereby providing a first indication of whether different alternative proteins are accepted for different reasons.

Our main contribution to the literature is thus that we provide an up to date, in-depth overview of drivers of acceptance of a wide range of alternative proteins. This overview can help bridging knowledge across research domains and results in a research agenda towards understanding and steering consumer acceptance of alternative proteins.

## 2. Method

### 2.1. Article selection

In June 2020, a literature search was conducted in the electronic database Scopus, as this is the largest abstract and citation database of peer-reviewed literature. We used the following search query: ALL (consumption\*) AND TITLE-ABS-KEY (food\* AND consumer\* AND (accept\* OR preference\* OR willing\* OR buy\* OR purchas\* OR choice\* OR behavio\* OR adopt\* OR perception\*) AND (“cultured meat\*” OR “in vitro meat\*” OR “synthetic meat\*” OR seaweed\* OR alga\* OR insect\* OR lupin\* OR pulse\* OR legume\* OR \*bean\* OR “dry pea\*” OR chickpea\* OR “cow pea\*” OR “pigeon pea\*” OR lentil\* OR “meat alternative\*” OR “meat substitute\*” OR “plant-based meat\*” OR “meat analogue\*”). The search terms were tested and refined through multiple rounds until the resulting number of papers was manageable while simultaneously demonstrating face validity (i.e., whether important key papers were included in the search results). “Consumption”, “food”, and “consumer” were included to ensure a focus on consumers' food consumption. Various words for consumer acceptance were included. Finally, various words were included for the five selected alternative proteins. Regarding pulses, the definition of the United Nations Food and Agriculture Organization (FAO)<sup>1</sup> was utilised. The search terms were included in the keywords, title, or abstract of the article being searched. Non-English articles, conference papers, reviews, and irrelevant subject areas (i.e., biochemistry, genetics and molecular biology, immunology and microbiology, chemistry, chemical engineering, engineering, and neuroscience) were excluded, resulting in a total of 665 articles.

Fig. 1 displays a flowchart of the article selection process, while Table 1 contains the inclusion and exclusion criteria used. The 665 articles were screened according to their title and abstract by two

<sup>1</sup> FAO recognizes 11 types of pulses: dry beans, dry broad beans, dry peas, chickpeas, cow peas, pigeon peas, lentils, Bambara beans, vetches, lupins and pulses.

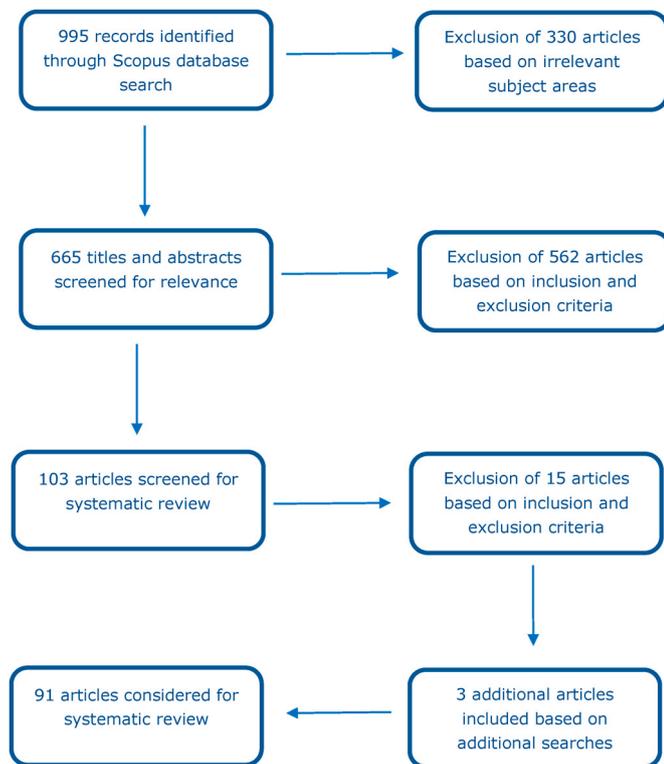


Fig. 1. Flowchart of systematic literature search.

**Table 1**  
Inclusion and exclusion criteria for article selection.

Inclusion criteria
Concerns consumer behaviour or acceptance of alternative protein sources
Contains empirical data (e.g., focus groups, surveys, experiments)
Focuses on understanding, explaining, or influencing consumer acceptance or purchase behaviour regarding alternative proteins
Concerns protein sources (product level) instead of proteins (nutrient level)
Full-text paper written in English and published in a peer-reviewed journal
Concerns studies conducted in Western countries
Exclusion criteria
Only concerns technical or ethical aspects of alternative protein sources
Reviews, opinion papers, conference papers and abstracts, concept articles
Is unrelated to consumer behaviour
Concerns trends in food or meat consumption patterns
Concerns animal welfare or hunting and eating wild animals
Concerns studies conducted in non-Western countries

independent raters. Interrater agreement resulted in a conformity of 79%; disagreement was resolved by a discussion resulting in full consensus.<sup>2</sup> Based on this screening, 103 articles were considered relevant. Most studies were excluded because they either did not contain consumer data or they did not focus primarily on consumers or alternative proteins, or Western countries.

In the next step, full-text articles were retrieved. All articles were read, and we further refined the set of included articles by excluding papers that did not fit the main purpose of our review. This additional screening resulted in a total of 88 papers included by June 2020. To assure that we do not miss any intervention studies an additional search

<sup>2</sup> As part of the peer review procedure the search string was adapted and the search was updated, resulting in 168 new articles. The inter-rater reliability is an average of the initial Cohen's kappa (0.72) and the Cohen's kappa of the additional search (0.86).

was performed including the term “intervention” in the search query. This resulted in one extra study that was included based on the additional search including the term “intervention”.<sup>3</sup> Two additional relevant articles were found independent of the title and abstract screening. In total, this resulted in 91 relevant articles that were included in the systematic review.

## 2.2. Data extraction

All relevant information from the articles was extracted. Again, disagreement was resolved by discussion and consensus. All articles were scanned for information on country, sample size, type of study (e.g., survey, experiment), type of alternative protein, independent variables, dependent variables, and main outcomes. The information is listed below in Table 2 (and in more detail in Appendix A). For a complete overview of the included studies, we refer to the supplementary materials.

## 3. Results

We first describe general findings regarding the studies (section 3.1; country, methods, etc.) and current acceptance levels of the alternative proteins, including variations in lifestyle and demographics (section 3.2), followed by specific findings on the drivers of consumer acceptance of the different alternative proteins (section 3.3). Finally, we discuss the interventions to increase consumer acceptance (section 3.4).

### 3.1. General findings

The literature research shows that the research field on alternative proteins is developing rapidly. For example, in 2014, there were only three studies published, whereas there were 16 studies in 2018 and 37 in 2019.

The results reveal an unequal distribution of articles across the different alternative proteins. There are 9 articles on pulses, 9 on algae, 58 on insects, 9 on plant-based meat alternatives, and 16 on cultured meat.<sup>4</sup> Thus, most studies focus on insects.

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.

The types of study designs show an overrepresentation of quantitative designs: 46 of the studies include a survey, 40 studies include an experiment, seven include focus groups, and five include interviews.<sup>5</sup>

### 3.2. Acceptance of the different types of alternative proteins

In the selected body of research, different outcome measures were used to refer to acceptance of alternative proteins—for example, willingness to pay, intention to try or purchase, and self-reported behaviour. Generally, the results indicate that alternative proteins have low acceptance levels (e.g., Graça et al., 2019; La Barbera, Verneau, & Coppola, 2019; Marinova & Bogueva, 2019; Neff et al., 2018).

Numerous studies compare the acceptance of alternative proteins to that of traditional meat, revealing that alternative proteins are evaluated significantly less positively (e.g., Onwezen, van den Puttelaar, et al.,

<sup>3</sup> The additional search resulted in 96 extra studies, from which 1 study showed to be relevant. The abstracts of these studies (and when necessary the full manuscript) were all checked by two independent raters and 1 study showed to be relevant beyond already included studies.

<sup>4</sup> Note that some studies include multiple protein sources.

<sup>5</sup> Note that some studies include multiple types of study design. Studies that include multiple experiments are included as 1 study.

Table 2

Overview of main findings for drivers and interventions of various meat alternatives.

<b>Pulses</b>	<p><b>Product-related attributes</b></p> <ul style="list-style-type: none"> <li>Motives or barriers to accept<sup>a*</sup>: Health (Lea, Worsley, &amp; Crawford, 2005; Vainio, Niva, Jallinoja, &amp; Latvala, 2016), taste (Lea et al., 2005; Vainio et al., 2016), environment (Lea et al., 2005; Vainio et al., 2016), weight control (Vainio et al., 2016), reflection oriented motives (de Boer, Schösler, &amp; Boersema, 2013), variety, versatility (Lea et al., 2005), perceived benefits (Lemken, Knigge, Meyerding, &amp; Spiller, 2017), flatulence (Lemken et al., 2017), preparation difficulty, and viewing pulses as food for vegetarians (Melendrez-Ruiz, Buatois, Chambaron, Monnery-Patris, &amp; Arvisenet, 2019), time needed to prepare, a lack of knowledge of how to prepare legumes or incorporate them in meals and legume distaste (Figueira, Curtain, Beck, &amp; Grafenauer, 2019; Lea et al., 2005).</li> </ul> <p><b>Psychological factors</b></p> <ul style="list-style-type: none"> <li>Attitudes<sup>c</sup> (Lemken et al., 2017; Lucas, Gouin, &amp; Lesueur, 2019).</li> </ul> <p><b>External attributes</b></p> <ul style="list-style-type: none"> <li>Social environment<sup>f</sup>: Family preferences (Figueira et al., 2019).</li> </ul> <p><b>Interventions</b></p> <ul style="list-style-type: none"> <li>Health and sustainability claims increase willingness-to-pay for legumes (Lemken et al., 2017).</li> <li>Lentil consumption increased based on environmental (78%), economic (75%) and nutritional (72%) information (Warne, Ahmed, Byker Shanks, &amp; Miller, 2019).</li> </ul>
<b>Algae</b>	<p><b>Product-related attributes</b></p> <ul style="list-style-type: none"> <li>Motives or barriers to accept<sup>a</sup>: Health (Birch et al., 2019; Grasso, Hung, Olthof, Verbeke, &amp; Brouwer, 2019; Moons, Barbarossa, &amp; De Pelsmacker, 2018; Weinrich &amp; Elshiewy, 2019), taste (health and taste; Moons et al., 2018; de Boer et al., 2013), reflection oriented motives (de Boer et al., 2013), organic, ethical and local (Weinrich &amp; Elshiewy, 2019).</li> <li>Familiarity<sup>b</sup> (previous consumption and level of meat consumption) associate with acceptance (Birch et al., 2019).</li> </ul> <p><b>Psychological factors</b></p> <ul style="list-style-type: none"> <li>Attitudes<sup>c</sup> (Lemken et al., 2017; Lucas et al., 2019).</li> <li>Food neophobia<sup>d</sup> is relevant in understanding willingness to consume seaweed (Birch et al., 2019; Moons et al., 2018).</li> </ul> <p><b>External attributes</b></p> <ul style="list-style-type: none"> <li>Trust<sup>e</sup>: Independent promoters increase trust in the product (Balzan, Fasolato, Maniero, &amp; Novelli, 2016).</li> </ul> <p><b>Interventions</b></p> <ul style="list-style-type: none"> <li>Health and environmental claims increase acceptance of seaweed (Brayden, Noblet, Evans, &amp; Rickard, 2018).</li> <li>The lesser the environmental impact of the meat substitute (compared to pork/beef), the more it is accepted (Weinrich &amp; Elshiewy, 2019).</li> <li>Acceptance of seaweed claim is influenced by the location at which consumers purchase seaweed (Lucas et al., 2019).</li> <li>Disguising ingredients increases familiarity (Balzan et al., 2016).</li> </ul>
<b>Insects</b>	<p><b>Product-related attributes</b></p> <ul style="list-style-type: none"> <li>Motives or barriers to accept<sup>a</sup>: health (Adámek, Adámková, Mlček, Borkovcová, &amp; Bednářová, 2018; Ali, 2016; Grasso et al., 2019; Kornher, Schellhorn, &amp; Vetter, 2019; Palmieri, Perito, Macri, &amp; Lupi, 2019; Powell, Jones, &amp; Considine, 2019; Sogari, Bogueva &amp; Marinova, 2019), taste (de Boer et al., 2013; Cicatiello, De Rosa, Franco, &amp; Lacetera, 2016; Grasso et al., 2019; Hartmann, Shi, Giusto, &amp; Siegrist, 2015; Menozzi, Sogari, Veneziani, Simoni, &amp; Mora, 2017; Orkusz, Wolańska, Harasym, Piwowar, &amp; Kapelko, 2020; Powell et al., 2019; Wilkinson et al., 2018; Sogari, Menozzi, &amp; Mora, 2018; Tan et al., 2017; Tucker, 2014), environment (Ali, 2006; Kornher et al., 2019; Orkusz et al., 2020; Palmieri</li> </ul>

Table 2 (continued)

	<p>et al., 2019; Rumpold &amp; Langen, 2019; Sogari, 2015; Sogari, Bogueva &amp; Marinova, 2019; Tucker, 2014; Verbeke et al., 2015), appearance (Orkusz et al., 2020; Wilkinson et al., 2018), safety (Orkusz et al., 2020; Wilkinson et al., 2018), convenience (Balzan et al., 2016; Lensvelt &amp; Steenbekkers, 2014; Schlup &amp; Brunner, 2018; Verbeke, 2015), price (Lensvelt &amp; Steenbekkers, 2014), naturalness (Lensvelt &amp; Steenbekkers, 2014; Powell et al., 2019), not immoral, but nutritious (Barton, Richardson, &amp; McSweeney, 2020), quality (Lensvelt &amp; Steenbekkers, 2014; Orkusz et al., 2020; Wilkinson et al., 2018), selectiveness/fussiness in food choice as barriers (Grasso et al., 2019), risk/danger regarding insects (Gallen, Pantin-Sohier, &amp; Peyrat-Guillard, 2019), lack of availability and incompatibility with local food culture (Menozzi et al., 2017), unnaturalness (Tucker, 2014; Verbeke et al., 2015).</p> <ul style="list-style-type: none"> <li>Familiarity<sup>b</sup> (i.e., need for familiarity: Schlup &amp; Brunner, 2018; Verbeke, 2015; Woolf, Zhu, Emory, Zhao, &amp; Liu, 2019) and past experience with eating insects increases consumption and tastiness of insects (Caparros Megido et al., 2016; Cicatiello et al., 2016; Hartmann et al., 2015; Lammers, Ullmann, &amp; Fiebelkorn, 2019; Palmieri et al., 2019; Schlup &amp; Brunner, 2018; Sogari, Menozzi, &amp; Mora, 2019; Tan et al., 2015, 2016a, 2016b; Verbeke, 2015; Woolf et al., 2019).</li> </ul> <p><b>Psychological factors</b></p> <ul style="list-style-type: none"> <li>Attitudes<sup>c</sup>: and negative beliefs (Lombardi, Vecchio, Borrello, Caracciolo, &amp; Cembalo, 2019). Also within the theory of planned behaviour (Menozzi et al., 2017; Piha, Pohjanheimo, Lähteenmäki-Uutela, Křecková, &amp; Otterbring, 2018) attitudes<sup>c</sup>, subjective norms and perceived behavioural control have a significant impact on acceptance (Menozzi et al., 2017).</li> <li>Food neophobia, disgust and affect<sup>d</sup>: food neophobia (Barton et al., 2020; Gere, Székely, Kovács, Kókai, &amp; Sipos, 2017; Hartmann et al., 2015; Kornher et al., 2019; La Barbera, Verneau, Amato, &amp; Grunert, 2018; La Barbera, 2019; Lammers et al., 2019; Laureati, Proserpio, Jucker, &amp; Savoldelli, 2016; Lombardi et al., 2019; Orkusz et al., 2020; Orsi, Voege, &amp; Stranieri, 2019; Palmieri et al., 2019; Piha et al., 2018; Schäufole, Albores, &amp; Hamm, 2019; Schlup &amp; Brunner, 2018; Sogari, Menozzi, &amp; Mora, 2019; Tan et al., 2016; Verbeke, 2015; Wilkinson et al., 2018) and disgust (Barton et al., 2020; Cicatiello et al., 2016; La Barbera et al., 2018; Gallen et al., 2019; Kornher et al., 2019; Myers &amp; Pettigrew, 2018; Orsi et al., 2019; Poortvliet, Van der Pas, Mulder, &amp; Fogliano, 2019; Powell et al., 2019; Sogari et al., 2016, 2018, 2019a, 2019b), and affective attitudes towards eating insects (Fisher &amp; Steenbekkers, 2018) and affective variables like emotions ambivalence and disgust (Onwezen, van den Puttelaar, Verain, &amp; Veldkamp, 2019) affected willingness to eat specific insects.</li> <li>Curiosity (Sogari et al., 2016), sensation seeking (Lammers et al., 2019).</li> </ul> <p><b>External attributes</b></p> <ul style="list-style-type: none"> <li>Trust<sup>e</sup>: Public health institutions suggested to play a role in promoting consumption of insects (Balzan et al., 2016).</li> <li>Social environment<sup>f</sup>: eating insects perceived to be not supported by family and/or friends (Sogari, 2015; Sogari et al., 2016). High social acceptance (Hartmann et al., 2015) and the more participants thought other participants ate mealworm-containing products (Jensen &amp; Lieberoth, 2019), or perceived eating insects as a socially acceptable activity (Schäufole et al., 2019), the more likely they were to try insect foods themselves. Perceptions of a conspiracy theory (regarding a social movement toward growing insect consumption) (Sogari, Bogueva &amp; Marinova, 2019).</li> <li>Cultural appropriateness<sup>g</sup>: Insects were perceived as inappropriate in culture (Gallen et al., 2019; Myers &amp; Pettigrew, 2018; Tan et al., 2016; 2017). Insects that</li> </ul>
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Table 2 (continued)

	<p>were marketed more in one's own culture were preferred more (Fisher &amp; Steenbekkers, 2018; Hartmann et al., 2015).</p> <p><b>Interventions</b></p> <p><i>Product attributes</i></p> <ul style="list-style-type: none"> <li>• Price interventions showed that high prices were associated with increases in expected quality (Berger, Bärtsch, Schmidt, Christandl, &amp; Wyss, 2018).</li> <li>• Health and environmental claims increase acceptance of insects (Cavallo &amp; Materia, 2018; de-Magistris, Pascucci, &amp; Mitsopoulos, 2015).</li> <li>• Information on benefits nutrition, societal benefits (Verneau et al., 2016) general-(compared to specific information) increased acceptance (Lombardi et al., 2019).</li> <li>• Familiarity with products increases willingness to try (Schäufele et al., 2019). Familiarity with products can be increased by producing products such that they fit with known products (Orkusz et al., 2020), prior information (Barsics et al., 2017) or tasting (Barton et al., 2020; Hartmann &amp; Siegrist, 2016; Lensvelt &amp; Steenbekkers, 2014; Pambo et al., 2017; Sogari et al., 2018).</li> <li>• Willingness to eat insects decreases when insects are visible in the products (even when barely visible; Ali, 2006; Baker, Shin, &amp; Kim, 2016; Balzan et al., 2016; Cavallo &amp; Materia, 2018; de-Magistris et al., 2015; Jensen &amp; Lieberoth, 2019; Schlup &amp; Brunner, 2018), hidden ingredients of insects are revealed (Iannuzzi, Sisto, &amp; Nigro, 2019), for unprocessed compared to processed insects (Gallen et al., 2019; Hartmann et al., 2015; Lammers et al., 2019; Orsi et al., 2019), for insects as food compared to insects as feed (La Barbera, 2019; Laureati et al., 2016; Onwezen, van den Puttelaar, et al., 2019), for common versus uncommon products (Poortvliet et al., 2019), or when descriptions in a menu setting were very explicit (instead of vague) (Baker et al., 2016).</li> </ul> <p><i>Social environment</i></p> <ul style="list-style-type: none"> <li>• Participants exposed to positive peer ratings of a nutrition bar expected it to be of higher quality than did participants exposed to negative peer ratings (Berger, Christandl, Bitterlin, &amp; Wyss, 2019).</li> </ul> <p><b>Product-related attributes</b></p> <ul style="list-style-type: none"> <li>• Motives or barriers to accept<sup>a</sup>: moral and ethical motives (Circus &amp; Robinson, 2019), perceived appeal (Bryant et al., 2019), perceptions of environmental impact, and health-consciousness (Siegrist &amp; Hartmann, 2019), internalized motivation, enjoyment of eating and cooking (Schösler, de Boer, &amp; Boersema, 2014), type of mince, fat content, country of origin, price (Apostolidis &amp; McLeay, 2016), concerned about the additives, artificiality, and insufficient essential vitamins and micronutrients, and taste of meat (Weinrich, 2018).</li> <li>• Familiarity<sup>b</sup>, familiarity (Hoek et al., 2011) and previous experience (Hoek et al., 2013).</li> </ul> <p><b>Psychological factors</b></p> <ul style="list-style-type: none"> <li>• Attitudes<sup>c</sup> and beliefs towards meat substitutes and food neophobia (Hoek et al., 2011a).</li> <li>• Food neophobia, disgust and affect<sup>d</sup>: food neophobia (Bryant et al., 2019; Hoek et al., 2011), disgust (Bryant et al., 2019; Siegrist &amp; Hartmann, 2019).</li> </ul> <p><b>External attributes</b></p> <p><b>Interventions</b></p> <ul style="list-style-type: none"> <li>• Plant-based meat alternatives have less shelf space compared to traditional meat, less promotions. Consumers found it slightly more satisfying as well as easier to shop for animal-based compared to plant-based protein sources (Gravely &amp; Fraser, 2018).</li> </ul> <p><b>Product-related attributes</b></p> <ul style="list-style-type: none"> <li>• Motives or barriers to accept<sup>a</sup>: Health (Adámek et al., 2018; Ali, 2006; Grasso et al., 2019; Verbeke et al., 2015), taste (Tucker, 2014), environment (Ali, 2006; Tucker, 2014; green eating behaviour Grasso et al., 2019; Verbeke et al., 2015), perceived appeal and goodness of clean meat (Birch et al., 2019), food security and safety (Verbeke et al., 2015), and</li> </ul>
Plant-based meat alternatives	
Cultured meat	

Table 2 (continued)

	<p>selectiveness/fussiness in food choice as barriers (Grasso et al., 2019).</p> <ul style="list-style-type: none"> <li>• Familiarity<sup>b</sup>: Of participants familiar with cultured meat, 64% were willing to try it, whereas 40% of participants unfamiliar with cultured meat would be willing to try it (Mancini &amp; Antonioli, 2019).</li> </ul> <p><b>Psychological factors</b></p> <ul style="list-style-type: none"> <li>• Attitudes<sup>c</sup> (Lemken et al., 2017; Lucas et al., 2019) towards the environment and agriculture (Slade, 2018).</li> <li>• Food neophobia, disgust, and affect<sup>d</sup>: Food neophobia (Birch et al., 2019; Wilks, Phillips, Fielding, &amp; Hornsey, 2019), disgust (Birch et al., 2019; Verbeke et al., 2015) and disgust sensitivity (Wilks et al., 2019).</li> </ul> <p><b>External attributes</b></p> <ul style="list-style-type: none"> <li>• Trust<sup>e</sup>: Concerned about risk governance, control, and need for regulation and proper labelling (Verbeke et al., 2015), and associations with political conservatism and distrust in science (Wilks et al., 2019).</li> </ul> <p><b>Interventions</b></p> <ul style="list-style-type: none"> <li>• Naturalness of food additives (perceived naturalness, Siegrist &amp; Sütterlin, 2017), "same meat" framing (positive attitudes, Bryant &amp; Dillard, 2019), describing cultured meat in a nontechnical way that focuses on the final product increases acceptance of cultured meat (Siegrist, Sütterlin, &amp; Hartmann, 2018) increase acceptance of cultured meat.</li> <li>• 'high-tech' framing led to the least positive attitudes (Bryant &amp; Dillard, 2019), 'clean meat is natural'-message (Bryant et al., 2019), production of cultured meat and its benefits (Siegrist et al., 2018) E-numbers or possible negative health effects (perceived naturalness; Siegrist &amp; Sütterlin, 2017), information about cultured meat (tasty and nutritious as a conventional burger, Mancini &amp; Antonioli, 2019) result in lower levels or negative effects on the acceptance of cultured meat.</li> <li>• Information affects explicit (and not implicit) attitude, especially for unfamiliar respondents (Bekker, Fischer, Tobi, &amp; van Trijp, 2017).</li> </ul>

Note. \* a,b,c,d,e,f,g These superscript letters are used to link drivers with the manuscript. In this way we do not refer to all references all the time, but simply refer to the superscript letters that correspond with the driver and the related references.

2019; Slade, 2018). For example, when participants were informed that all burgers tasted the same, 65% would purchase the beef burger, 21% would purchase the plant-based burger, 11% preferred the cultured meat burger, and 4% would purchase nothing (Slade, 2018).

A small number of studies include multiple alternative proteins (e.g., Bryant et al., 2019; Circus & Robinson, 2019; de Boer et al., 2013; Gómez-Luciano, Vriesekoop, & Urbano, 2019; Grasso et al., 2019; Iannuzzi, 2019; Onwezen, van den Puttelaar, et al., 2019; Slade, 2018, Tucker, 2014). Direct comparisons indicate that insects are the least accepted alternative protein, cultured meat the second-least, and that plant-based meat substitutes are among the most accepted alternative proteins (Circus & Robinson, 2019; Grasso et al., 2019; Iannuzzi, 2019), demonstrating that consumers are less willing to accept animal-based novel proteins than plant-based novel proteins (de Boer et al., 2013; Slade, 2018). For example, participants were much less willing to taste insect snacks compared to other snacks made from lentils, seaweed, and hybrid meat (i.e., meat products in which meat has been partially replaced by more sustainable protein sources) (de Boer et al., 2013); similarly, plant-based burgers were preferred over cultured meat burgers (21% versus 11%; Slade, 2018).

Lifestyle and demographics are described below as these provide often-used descriptions of populations and segmentation criteria (Onwezen, 2018; Verain et al., 2012).

*Lifestyle.* The studies we examined consistently noted the relevance of dietary patterns (i.e., current meat and meat alternative consumption): Consumers with high levels of meat consumption are more

receptive to cultured meat (e.g., [Circus & Robinson, 2019](#)) and products that look similar to meat ([Hoek et al., 2011](#)), whereas they are less open to plant-based proteins (lentils, [de Boer et al., 2013](#); meat substitutes, [Siegrist & Hartmann, 2019](#); algae, [Weinrich & Elshiewy, 2019](#); plant-based meat substitutes, [Circus & Robinson, 2019](#)). Cultured meat was, for example, favoured by individuals with high meat attachment; edible insects were not favoured by the low and the high meat-attachment groups; and plant-based substitutes were favoured mostly by the low meat-attachment groups who primarily followed vegan and vegetarian diets ([Circus & Robinson, 2019](#)).

Additionally, more general dietary lifestyle patterns influence acceptance of alternative proteins; for instance, following a green, vegetarian diet or a healthy lifestyle is an important aspect in acceptance of snacks made from lentils, seaweed ([de Boer et al., 2013](#)), and insects (green eating behaviour; [Grasso et al., 2019](#)).

**Demographics.** The results on demographic variables (age, gender, education, etc.) reveal variation in relevance in their association with acceptance of alternative proteins. In some studies, demographics contribute to the understanding of consumer acceptance of alternative proteins (e.g., gender [Gómez-Luciano et al., 2019](#); [Orkusz et al., 2020](#)); in other studies, demographics are insignificant (e.g., gender [Barton et al., 2020](#); [Birch et al., 2019a](#); [de Boer et al., 2013](#)). The explained variance of demographic variables is generally low, as they only explain some aspects of the acceptance of alternative proteins (e.g., [Grasso et al., 2019](#)).

That being said, a common thread can be found throughout the results of the studies we reviewed. Individuals who are young and highly educated ([Birch, Skallerud, & Paul, 2019b](#); [de Boer et al., 2013](#); [Gómez-Luciano et al., 2019](#); [Grasso et al., 2019](#); [Grasso et al., 2019, 2019](#); [Siegrist & Hartmann, 2019](#); [Wilks et al., 2019](#)), are not politically conservative ([Wilks et al., 2019](#)), live in urban areas ([de Boer et al., 2013](#)), or are vegetarian or vegan (insects; [Rumpold & Langen, 2019](#)) are more willing to accept alternative proteins.

The influence of gender seems to vary across alternative proteins. Insects are more accepted by males ([Cicatiello et al., 2016](#); [Grasso et al., 2019](#); [Lammers et al., 2019](#); [Laureati et al., 2016](#); [Orkusz et al., 2020](#); [Schäufele et al., 2019](#); [Sogari, Menozzi, & Mora, 2019](#); [Woolf et al., 2019](#)), whereas plant-based alternative proteins are more accepted by females (plant-based alternatives; [Gómez-Luciano et al., 2019](#); [Melendrez-Ruiz et al., 2019](#)).

### 3.3. Drivers of acceptance

Based on a framework of acceptance of novel foods ([Siegrist, 2008](#)), we define three types of drivers and interventions. The three lines of drivers are (1) product-related factors, (2) psychological factors, and (3) external attributes (social environment, trust, and culture). The authors (experts in the field of consumer acceptance) categorised drivers of this literature overview within the abovementioned three lines. For each line of research, we first describe the general findings, followed by a reflection on the differences in drivers of acceptance of the categories of alternative proteins. To reflect on differences across alternative proteins, we use studies that include multiple alternative proteins and we counted the number of studies showing significant associations.

#### 3.3.1. Product-related factors

The category of drivers refers to product properties and product-related motivations and associations, including being familiar with products. Based on the literature, two relevant lines of product-related factors are discussed: food motivations<sup>a,6</sup> and familiarity<sup>b</sup>

**Food motivations.**<sup>a</sup> The results show a range of product-related

drivers that are significant in consumer acceptance of all included alternative proteins:<sup>a</sup> healthiness (see references below), taste (see references below), convenience (e.g., [Balzan et al., 2016](#); [Figueira et al., 2019](#); [Lea et al., 2005](#); [Lensvelt & Steenbekkers, 2014](#)), environmental benefits ([Ali, 2016](#); [Kornher et al., 2019](#); [Lea et al., 2005](#); [Vainio et al., 2016](#); [Weinrich & Elshiewy, 2019](#)), and appearance ([Bryant et al., 2019](#); [Orkusz et al., 2020](#); [Wilkinson et al., 2018](#)). There may be variations between individuals (e.g., vegetarian, foodie, or food enjoyer, [Moons et al., 2018](#)) and between the experiences of users ([House, 2016](#)). A study by [House \(2016\)](#), for example, revealed that motivations for eating insects for the first time substantially differ from factors influencing repeated consumption of insect-based food (e.g., price, taste, availability), indicating the importance of differentiating between a first trial and repeated behaviour.

Healthiness and taste were revealed to be highly relevant for the acceptance of all alternative proteins, particularly in the cases of pulses (taste: [de Boer et al., 2013](#); health and taste: [Lea et al., 2005](#)), algae (taste: [de Boer et al., 2013](#); healthiness and taste: [Moons et al., 2018](#)), insects (taste: [de Boer et al., 2013](#); [Cicatiello et al., 2016](#); [Grasso et al., 2019](#); [Hartmann et al., 2015](#); [Menozzi et al., 2017](#); [Orkusz et al., 2020](#); [Powell et al., 2019](#); [Sogari et al., 2018](#); [Tan, Tibboel, & Stieger, 2017](#); [Tucker, 2014](#); [Wilkinson et al., 2018](#), and healthiness: [Adámek et al., 2018](#); [Ali, 2006](#); [Kornher et al., 2019](#); [Palmieri et al., 2019](#); [Powell et al., 2019](#); [Sogari, Bogueva, & Marinova, 2019](#)), and plant-based meat alternatives (taste: [Weinrich, 2018](#)). It is worth noting that taste was not only mentioned as a motivation but also as a relevant barrier—for example, in the case of pulses ([Figueira et al., 2019](#); [Melendrez-Ruiz et al., 2019](#)).

If we focus on healthiness ([Adámek et al., 2018](#); [Ali, 2006](#)) and environmental benefits ([Ali, 2006](#); [Tucker, 2014](#); [Verbeke et al., 2015](#)), the findings reveal that consumers do not always know whether alternative proteins have specific benefits. For example, consumers do not seem to be aware of the potential health benefits and environmental benefits, such as the environmental and nutritional advantages of eating insects ([Myers & Pettigrew, 2018](#)); many participants also underestimated the ecological impact of animal production ([Vanhonacker, Van Loo, Gellynck, & Verbeke, 2013](#)). However, when consumers are aware of such potential benefits, these motivations are shown to play an important role in consumer acceptance. For example, the belief that eating insects has health benefits ([Menozzi et al., 2017](#); [Schlup & Brunner, 2018](#)) and environmental benefits ([Menozzi et al., 2017](#); [Sogari, 2016](#); [Vanhonacker et al., 2013](#); [Verbeke, 2015](#)) significantly affects consumers' intention to consume insects. More than 80% of participants were willing to eat food enriched with edible insects because they believed it to be healthy ([Adámek et al., 2018](#)). Note that environmental benefits also reveal mixed findings, and the environmental benefits are also not always included in research designs (e.g., review on insects, [Dagevos, 2021](#)).

**Familiarity.**<sup>b</sup> Individuals have a tendency to behave in similar ways as they are used to behave and to choose options that are already known (e.g., [Pelchat & Pliner, 1995](#); [Tuorila, Andersson, Martikainen, & Salovaara, 1998](#)). In the context of alternative proteins, familiarity ([Schlup & Brunner, 2018](#)) is relevant in the acceptance of pulses (e.g., [Florkowski & Park, 2001](#)), algae ([Birch et al., 2019a](#)), insects ([Schlup & Brunner, 2018](#); [Tan, van den Berg, & Stieger, 2016](#); [Verbeke, 2015](#); [Woolf et al., 2019](#)), and cultured meat ([Hoek et al., 2011](#)). Related concepts, such as previous experience with alternative proteins (i.e., past behaviour; [Florkowski & Park, 2001](#)) and knowledge of and experience with plant-based meat alternatives ([Hoek et al., 2013](#)), are also demonstrated to be linked with acceptance. Moreover, past consumption of insects not only increases consumption but also positively impacts wider associations, such as perceptions of tastiness of insects ([Tan et al., 2015, 2016a, 2016b](#); [Cicatiello et al., 2016](#); [Hartmann et al., 2015](#); [Megido et al., 2016](#); [Schlup & Brunner, 2018](#); [Verbeke, 2015](#)). The research on insect acceptance clarifies the underlying processes of the relevance of familiarity by illustrating, for example, that past experiences with insects

<sup>6</sup> The superscript letters refer to [Table 2](#). We use these superscript letters when we refer to all references related to a specific driver with the same superscript letter in [Table 2](#).

result in a formulation of intentions based on memories; comparatively, individuals who do not have these past experiences often have existing negative associations (Tan et al., 2016a, 2017a).

*Differences between alternative proteins in product-related factors.* Table 2 shows a large range of different motivations<sup>a</sup> to consume various alternative proteins (e.g., healthiness, taste, price, convenience, etc). A direct comparison of the relevance of these motivations for the different alternative proteins is not possible, as each study utilises different questionnaires and methods. However, the results do provide some indications of noteworthy differences among the alternative proteins. For example, health motivations seem to play a more prominent role in the acceptance of plant-based proteins (Circus & Robinson, 2019; de Boer et al., 2013), whereas environmental motivations seem to be more relevant in the acceptance of animal-based proteins such as cultured meat (Circus & Robinson, 2019).

We discovered a greater number of studies demonstrating the relevance of some form of familiarity as a driver of the acceptance of insects (59%) compared to that of cultured meat (33%), plant-based meat alternatives (27%), algae (20%), and pulses (0%). Although this might occur due various reasons, for example because of a bias in research designs (i.e., familiarity more often included for novel products), or because barriers on familiarity are more easily accessible for consumers than motivations of familiarity, the findings do show indications that underscore the relevance of familiarity for insects. Individuals seem to have negative associations with and fear of trying insects; insects are still far from being accepted by consumers as a conventional part of their diets compared to plant-based proteins (de Boer et al., 2013). Moreover, familiarity seems to play a more prominent role when products are novel for a consumer, e.g., familiarity was less important for heavy users of various meat substitutes in explaining their acceptance compared to non-users and light or medium users. Non-users had a higher tendency to avoid new food (Hoek et al., 2011).

### 3.3.2. Psychological factors

Individuals may exhibit distinct factors that explain variations in acceptance of alternative proteins. The personal characteristics that demonstrate consistent results are attitudes,<sup>c</sup> and food neophobia and disgust.<sup>d</sup>

*Attitudes.*<sup>c</sup> Attitudes are consistently shown to be relevant in explaining intentions to consume alternative proteins; this seems to apply to all alternative proteins (Onwezen, van den Puttelaar, et al., 2019; pulses (Lemken et al., 2017), algae (Lucas et al., 2019), insects (Fisher & Steenbekkers, 2018; Lombardi et al., 2019; Menozzi et al., 2017; Piha et al., 2018), plant-based meat alternatives (Hoek et al., 2011), and cultured meat (Slade, 2018)). For example, Lombardi et al. (2019) found that negative beliefs and attitudes toward insects negatively affect the willingness to pay for insect-based products. Moreover, attitudes seem to differ between groups of individuals—for example, between non-users, light and medium users, and heavy users of meat substitutes. Non-users have a very positive attitude toward meat, while heavy users have more positive attitudes toward meat substitutes (Hoek et al., 2011).

*Food neophobia, disgust, and related feelings.*<sup>d</sup> Food neophobia—the aversion to trying novel foods (Pliner & Hobden, 1992)—is a key barrier for the consumption of insects (Barton et al., 2020; Gere et al., 2017; Hartmann et al., 2015; Kornher et al., 2019; La Barbera, 2019; La Barbera et al., 2018; Lammers et al., 2019; Laureati et al., 2016; Lombardi et al., 2019; Orkus et al., 2020; Orsi et al., 2019; Palmieri et al., 2019; Piha et al., 2018; Schäufele et al., 2019; Schlup & Brunner, 2018; Sogari, Bogueva, & Marinova, 2019; Tan, Fischer, et al., 2016; Verbeke, 2015;

Wilkinson et al., 2018), seaweed (Birch et al., 2019b; Moons et al., 2018), cultured meat (Wilks et al., 2019), and plant-based meat alternatives (Bryant et al., 2019; Hoek et al., 2011). Similar relevant concepts are disgust for (that is, sensitivity to) insects (Barton et al., 2020; Cicatiello et al., 2016; La Barbera et al., 2018; Gallen et al., 2019; Kornher et al., 2019; Myers & Pettigrew, 2018; Orsi et al., 2019; Poortvliet et al., 2019; Powell et al., 2019; Sogari et al., 2016, 2018, 2019a, 2019b), plant-based meat alternatives (Bryant et al., 2019; Siegrist & Hartmann, 2019), seaweed (Birch et al., 2019b), and cultured meat (Verbeke et al., 2015; Wilks et al., 2019); affective attitudes (i.e., feelings) toward insects (Fischer & Steenbekkers, 2018); and fear of cultured meat (Cicatiello et al., 2016).

Novel meat alternatives may attract neophilic consumers who seek new food alternatives (e.g., out of curiosity; Sogari, 2016) and are not scared to try novel foods (i.e., drivers of food neophobia, fear, and disgust). Note that these are distinct mechanisms; for example, food neophobia and disgust have separate effects on intention to eat insects, with disgust having more explanatory power (La Barbera et al., 2018). Moons et al. (2018) indicate that sensitivity to food neophobia could differ between specific target groups (i.e., foodies) that are more or less engaged with food and food choices, suggesting that these processes may be even more relevant for specific target groups.

*Differences across alternative proteins in psychological factors.* The acceptance of all alternative proteins is affected by attitudes. The findings of Onwezen, van den Puttelaar, Verain, and Veldkamp (2019) demonstrate a first indication that attitudes are more relevant to meat-related products such as traditional burgers and cultured meat.

The acceptance of all alternative proteins is affected by food neophobia; however, insects reveal a broader group of affect-related feelings that explain acceptance of specific products (i.e., mostly insect-based products). General disgust, affective attitudes toward eating insects (Fisher & Steenbekkers, 2018), fear (Cicatiello et al., 2016), and possible negative evaluations by family or friends (Sogari, 2016) all negatively affect willingness to eat specific insects. In accordance with these findings, Onwezen and colleagues (2019) show that affective drivers are more relevant for innovative alternative proteins of insects and seaweed (compared to less innovative alternative proteins of pulses and fish), indicating that acceptance of innovative alternative proteins is based more on feelings than is acceptance of less innovative alternative proteins.

### 3.3.3. External attributes

As the term “alternative proteins” often refers to new food products that are perceived as innovative by consumers (e.g., insects; Onwezen, van den Puttelaar, et al., 2019), consumers use external factors to form an opinion on these products (Siegrist, 2008). The results of our review and of previous studies (Siegrist, 2008) reveal three types of external attributes: trust,<sup>e</sup> social environment,<sup>f</sup> and (cultural) appropriateness.<sup>g</sup>

*Trust.*<sup>e</sup> Generally, a low number of studies include trust in their research (three studies out of 90 included studies). The findings on trust reveal a positive association between trust and acceptance of alternative proteins (Lensvelt & Steenbekkers, 2014; Wilks et al., 2019). For example, a general distrust in science correlates with less acceptance of cultured meat (Wilks et al., 2019). Independent promoters, conversely, appear to play a role in increasing trust in the product (algae; Balzan et al., 2016); similarly, information provided by public health institutions increase trust in insects as an alternative protein (Balzan et al., 2016). There is also variation between countries (for instance, the Netherlands demonstrates more trust than Australia) in trusting information about insect food from different organisations (Lensvelt &

Steenbekkers, 2014).

**Social environment.**<sup>8</sup> Social norms provide information on appropriate behaviour via the perception of behaviour and opinions of others. Social norms are generally shown relevant drivers of behaviour (Onwezen, Antonides, & Bartels, 2013; White, Smith, Terry, Greenslade, & McKimmie, 2009). Multiple studies consistently refer to the influence of the social environment on acceptance of alternative proteins (social norms: Jensen & Lieberoth, 2019; Lensvelt & Steenbekkers, 2014; Onwezen, van den Puttelaar, et al., 2019 and social acceptance: Hartmann et al., 2015; Lemken et al., 2017; Sogari, 2015; 2016; Schäufole et al., 2019; Slade, 2018; Vainio et al., 2016; Warne et al., 2019; Wilks et al., 2019). The negative opinions of family and friends, for example, are referred to as a relevant barrier for trying pulses (Figueira et al., 2019) or edible insects in the future (Sogari et al., 2016). Moreover, in comparison to a range of acceptance variables such as disgust, emotions, attitudes, and perceived behavioural control, social norms appeared to be the most relevant factor in explaining consumer acceptance of a range of alternative proteins: fish, pulses, insects, seaweed, and cultured meat (Onwezen, van den Puttelaar, et al., 2019).

Some studies also reveal the potential of social norms to steer behaviour: The more participants perceived eating insects as a socially acceptable activity, the more they were willing to try insect products (Schäufole et al., 2019). For example, the more participants thought other participants ate products containing mealworm, the more likely they were to eat these foods themselves (Jensen & Lieberoth, 2019). The impact of social norms seems especially relevant for those who do not regularly consume those particular products (e.g., individuals without an established diet containing beans and soy products, Vainio et al., 2016).

**Cultural appropriateness.** Only studies on insects reveal the relevance of cultural traditions (i.e., alternative proteins not accepted because perceived as inappropriate in one's own culture; Gallen et al., 2019; Myers & Pettigrew, 2018) or food appropriateness (Tan, Tibboel, & Stieger, 2017). A study by Hartmann et al. (2015) reveals that Chinese participants rated all insect-based products more favourably than Germans regarding taste, nutritional value, familiarity, and social acceptance and were more willing to eat insect-based products (with no differences for processed versus unprocessed insects), indicating that insects that were already part of a person's culture were preferred (Hartmann et al., 2015).

**Differences between alternative proteins in external attributes.** Social norms are a highly relevant factor for all alternative proteins (in comparison to the included range of explanatory factors such as attitudes, perceived behavioural control, and emotions), as well as for various forms of novel insects that differ in how innovative they are perceived to be (Onwezen, van den Puttelaar, et al., 2019). Social acceptance was important for the acceptance of insects in China and Germany (Hartmann et al., 2015), indicating that social environment is also relevant for acceptance when a particular food is already part of tradition.

### 3.4. Interventions

Compared to studies that focus on understanding the drivers of behaviour, far fewer articles have tested the effectiveness of these drivers by means of behavioural interventions (27% of all studies have a link with interventions). We use a broad definition of interventions including all experimental designs that include one or multiple activities to manipulate the choice environment and therefore test how an intervention affects consumer acceptance (e.g., attitudes, intentions or behaviour). Below we discuss the findings of these intervention studies pertaining to the behavioural drivers that were distinguished above.

#### 3.4.1. Product-related attributes

The majority of the included intervention studies focussed on testing the effectiveness of product-related attributes (13 out of 27 intervention studies included some form of claim information). Claims of health and environmental benefits are shown to support the acceptance of pulses (Lemken et al., 2017; environmental benefits: Warne et al., 2019), seaweed (Brayden et al., 2018; environmental benefits: Weinrich & Elshiewy, 2019), cultured meat (health benefits: Siegrist & Sütterlin, 2017), insects (Cavallo & Materia, 2018; de-Magistris et al., 2015), and lentil consumption (environmental information in combination with economic and nutritional information: Warne et al., 2019). A combination of both environmental and health claims has been proven to have superior results in increasing acceptance over separate claims (Lemken et al., 2017). Note that physical environment may play a role. For example, a study by Lucas et al. (2019) indicated that participants' choice of seaweed claims is strongly influenced by the location at which they purchase seaweed.

In addition to claims, framing information in a specific manner is also beneficial in promoting acceptance of alternative proteins. For example, highlighting societal benefits (more than highlighting individual benefits) increased acceptance of insects (Verneau et al., 2016); describing cultured meat in a nontechnical manner that focusses on the final product increases acceptance of cultured meat (Siegrist et al., 2018); and more specific information increased participants' willingness to pay for insects (Lombardi et al., 2019).

However, not all information was shown to be effective; for example, positioning the product with different types of information (i.e., product-related information, physiological information, social norm information, or no information) did not affect acceptance of insects (Lensvelt & Steenbekkers, 2014) or cultured meat (Mancini & Antonioni, 2019). Similarly, the 'clean meat is natural' message failed to make participants consider clean meat more natural (compared to a control condition) or willing to pay more (Bryant et al., 2019).

Finally, some studies even showed drawback effects as a result of information provision. For example, 'high-tech' framing led to the least positive attitudes (Bryant & Dillard, 2019), and communicating e-numbers or possible negative health effects decreased the perceived naturalness of cultured meat (Siegrist & Sütterlin, 2017).

Price interventions prove to be effective in increasing consumer acceptance of alternative proteins. High prices were associated with increases in expected quality, which positively influenced participants' preference for mealworm burgers and mealworm truffles (Berger et al., 2018).

**Familiarity.** In line with the findings on familiarity, intervention studies reveal that familiarity can be used to increase consumer acceptance (i.e., tasting increased familiarity with and acceptance of insects; Barton et al., 2020; Hartmann & Siegrist, 2016; Lensvelt & Steenbekkers, 2014; Sogari et al., 2018). For example, participants who ate tortilla chips containing cricket flour were more willing to eat unprocessed insects than people who had eaten traditional tortilla chips (containing corn flour; Hartmann & Siegrist, 2016). Consumers can also be made more familiar with and more willing to accept alternative proteins by providing them with prior information on consumption of insects (Barsics et al., 2017). Laureati et al. (2016) demonstrated that attending university courses or working in an environment in which the topics of insects and sustainability are investigated and debated positively affects consumers' willingness to incorporate insects into their diets. A similar effect is found when providing prior information via an information session.

Generally, individuals prefer products in which novel ingredients are disguised; disguising ingredients increases familiarity with algae

(Balzan et al., 2016), and willingness to eat insects decreases when insects are visible in the products (even when barely visible; Ali, 2016; Baker et al., 2016; Cavallo & Matera, 2018; de-Magistris et al., 2015; Schlup & Brunner, 2018). Similarly, acceptance was lower for unprocessed insects compared to processed insects (Hartmann et al., 2015), for insects as food compared to insects as animal feed (Laureati et al., 2016), and when descriptions of insects in a menu setting were very explicit instead of vague (Baker et al., 2016).

#### 3.4.2. External attributes

Social norms can be utilised to increase acceptance levels such that participants exposed to positive peer ratings of a nutrition bar expected it to be of higher quality than did participants exposed to negative peer ratings (Berger et al., 2019).

Providing information via different organisations affects the levels of trust on insects and can also be helpful to further increase the effectiveness of health and environmental claims. For example, public health institutions can play an active role in promoting consumer acceptance of insects (Balzan et al., 2016).

## 4. General discussion

Insights into consumer acceptance of alternative proteins and its drivers are needed to steer consumers towards lower meat consumption and higher consumption of alternative proteins (Dagevos & Reinders, 2018; Harguess et al., 2020; Hartmann & Siegrist, 2017; Sanchez-Sabate & Sabaté, 2019). The present systematic review provides an overview of relevant drivers of willingness to eat and try five different alternative proteins, including the effectiveness of interventions to increase consumer acceptance of these alternative proteins. The systematic review adds to the literature by a focus on drivers to understand and find ways to steer consumer acceptance, and by including a wide range of alternative proteins thereby allowing for a comprehensive overview and comparisons across categories of alternative proteins. Based on our search criteria, 91 articles were identified and included in this systematic review.

### 4.1. Acceptance of alternative proteins is relatively low, especially for insects followed by cultured meat

In accordance with previous findings (e.g., Dagevos & Voordouw, 2013; de Boer et al., 2013; Graça et al., 2019; Malek, Umberger, & Goddard, 2019), our first main finding was that acceptance levels of alternative proteins are relatively low in comparison to the consumption of meat (e.g., Onwezen, van den Puttelaar, et al., 2019; Slade, 2018). Furthermore, we observed variations in acceptance levels between the different alternative proteins. Plant-based meat alternatives and pulses are most accepted, insects are least accepted, and cultured meat second-least (Circus & Robinson, 2019; de Boer et al., 2013; Ianuzzi, 2019; Onwezen, van den Puttelaar, et al., 2019). Interestingly, pulses and plant-based meat alternatives are also estimated to have higher sustainability potential at this moment compared to other alternative proteins (Van der Weele et al., 2019), which implies that it is most promising—in terms of environmental impact and societal acceptance—to focus on increasing consumption of pulses and plant-based meat alternatives.

Acceptance levels vary across segmentation criteria of demographics and lifestyle. Demographic variables were generally found to be less relevant compared to social and psychological factors in understanding consumer acceptance of alternative proteins. This finding is in accordance with previous research (Beane & Ennis, 1987; Hartmann & Siegrist, 2017; Wansink, Sonka, & Park, 2004). Lifestyle showed to be of significance, consumers with high levels of meat consumption are more receptive to cultured meat (e.g., Circus & Robinson, 2019) and meat alternatives that look similar to meat (Hoek et al., 2011), whereas they are less open to plant-based meat alternatives (pulses, de Boer et al.,

2013; meat substitutes, Siegrist & Hartmann, 2019; algae, Weinrich & Elshiewy, 2019; plant-based meat substitutes, Circus & Robinson, 2019).

### 4.2. Relevant drivers to increase consumer acceptance

This review provides a comprehensive overview of which drivers are consistently shown to have an association with various alternative proteins. In short, these drivers include the food choice motives<sup>a</sup> of taste, healthiness (Lea et al., 2005; Moons et al., 2018), familiarity,<sup>b</sup> attitudes,<sup>c</sup> food neophobia and disgust,<sup>d</sup> and social norms<sup>f</sup> (more details below). The relevance of this wide range of drivers implies that for acceptance of alternative proteins it is relevant to use integrated approaches including drivers from different levels (e.g., personal, physical environment and social environment, Story et al., 2008).

While alternative proteins are often referred to as a specific category of food choices (e.g., Hartmann & Siegrist, 2017), we want to note that the relevance of the abovementioned drivers is consistent with the body of research on drivers of food choices in general (e.g., similar effects were found for healthy food choices, organic food choices, fruit and vegetable choices, and choices for novel foods).<sup>7</sup> Indicating that the acceptance of alternative proteins is not that different compared to food choices in related domains and that much more cross-learning across domains is possible. Moreover, the findings indicate that consumer acceptance of alternative proteins shows many congruencies across alternative proteins. Highlighting the relevance of future research in the context of alternative proteins to learn from related bodies of research within related areas of alternative proteins, for example there is a large body of research on acceptance of insects which can be used by related domains such as acceptance of seaweed.

That being said, our review clearly illustrates differences in alternative proteins and groups of consumers. Both directions provide a more nuanced picture regarding acceptance of alternative proteins, showing that acceptance of alternative proteins varies across products and categories and across consumers. Moreover, the relevant drivers of acceptance also show variations across consumer groups and across alternative proteins. We elaborate on these findings in more detail below.

### 4.3. Differences between groups of consumers

Regarding the drivers of acceptance, the results show that past consumption influences a person's motivations for eating insects (e.g., price, taste, availability; House, 2016). Variations in use of alternative proteins resulted in a different impact of familiarity, attitudes (Hoek et al., 2011), food neophobia (Moons et al., 2018), and social norms (Vainio et al., 2016) on acceptance. Past consumption of alternative proteins is thus a relevant factor to include in understanding and targeting consumers (i.e., segmentation criteria, Onwezen, 2018) in the context of alternative proteins. Moreover, the findings on psychological factors also indicate the relevance of personal variations in understanding consumer acceptance. It is for example more relevant to target on consumer groups that are more receptive to various alternative proteins, e.g., scoring low on food neophobia, disgust and having positive attitudes and associations with alternative proteins.

<sup>7</sup> Taste and health for example are often mentioned as the most relevant food choices (Onwezen et al., 2001, 2019b; Steptoe et al., 1995). Attitudes and social norms are part of the theory of planned behaviour which shows to have predictive value for a broad range of food products (organic food, Arvola et al., 2008; fruit, Bogers, Brug, van Assema, & Dagnelie, 2004; sustainable food, Vermeir & Verbeke, 2008). Food neophobia, disgust and trust seem to be especially related to novel food technologies (Genetic modification, Siegrist, 2008; novel foods, Tuorila & Hartmann, 2020).

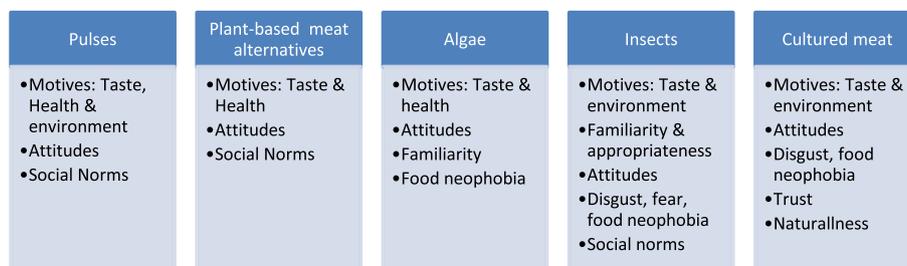


Fig. 2. Framework with a simplified overview of the most relevant drivers of consumer acceptance for the various alternative proteins.

#### 4.4. Differences between alternative proteins

Although future research including designs with direct comparisons across various drivers and various alternative proteins is necessary, the results provide implications for variations in drivers of acceptance across various alternative proteins. Fig. 2 shows a highly simplified overview of the main drivers for each alternative protein. We highlight three relevant lines of differences between alternative proteins.

First, health motivations seem to be more relevant to acceptance of plant-based proteins, and environmental motivations seem more closely linked to the consumption of animal-based proteins (comparison across various alternative proteins: Circus & Robinson, 2019; de Boer et al., 2013). Second, insect-based studies reveal a broader range of affect-related drivers<sup>d-insects</sup> compared to other alternative proteins. Consumers may rely more on affective processes for novel alternatives compared to conventional alternatives (Onwezen, van den Puttelaar, et al., 2019). Third, the role of familiarity seems especially relevant to insect-based alternative proteins (e.g., Schlup & Brunner, 2018; Verbeke, 2015; Woolf et al., 2019).

Taken together these findings indicate that consumer acceptance of various alternative proteins also shows variations in relevance of drivers. It is therefore recommended for future research to be specific about which proteins are researched, as research even shows variations for different products within categories. Moreover, interventions developed to increase consumer acceptance should be targeted at specific alternative proteins, as these show to be associated with specific product attributes and barriers, and personal motivations and environmental drivers.

#### 4.5. Interventions

As noted in the results, the majority of studies on interventions included manipulations of claim information. There are indications that information on health and environmental benefits (Brayden et al., 2018; Lemken et al., 2017; Warne et al., 2019; Weinrich & Elshiewy, 2019) positively influences consumer acceptance. Informational claims can be framed to make them more effective in increasing consumer acceptance, such as highlighting societal benefits (more than highlighting individual benefits; Verneau et al., 2016), nontechnical (versus technical) descriptions of production (Siegrist et al., 2018), and including specific (instead of general) information (Lombardi et al., 2019). The results also reveal that not all information was shown to be effective; some information even resulted in negative effects (Bryant & Dillard, 2019).

In accordance with the central role of familiarity in the acceptance of alternative proteins, the results on interventions indicate various effective routes to increase familiarity and thus promote consumer acceptance of alternative proteins: Introducing alternative proteins in existing and recognizable dishes and products and decreasing the visibility of the alternative proteins (especially regarding insects) can increase the

acceptance of alternative proteins (Barton et al., 2020; Hartmann & Siegrist, 2016; Lensvelt & Steenbekkers, 2014; Pambo et al., 2017; Sogari et al., 2018). For example developing processed products that fit with known products and recipes (e.g., wraps in which seaweed or insects are processed).

The body of research on designing interventions had a focus on familiarity and information. Only a small amount of intervention studies included other aspects like for example social norm or affective interventions. This demonstrates that the body of research on interventions is not fully in line with the body of literature on the drivers of acceptance of sustainable protein and on consumer acceptance in general. The results on the affective and social aspects of drivers were promising (see our discussion above), and also other bodies of literature emphasise the importance of including aspects beyond information alone—aspects such as nudging—in interventions in order to potentially change behaviour (e.g., Marchiori, Adriaanse & De Ridder, 2017).

#### 4.6. Future research lines

The manuscripts provides a comprehensive overview of the literature. This overview also results in research gaps and lines for future research. This section focusses on what we believe are the most prominent research gaps that set the agenda for future research.

Some sustainable protein sources have been studied more than others (e.g., insects versus algae, see Table 2). More research on a wide range of specific alternative proteins is necessary to gain better insight into the acceptance of consumers regarding a wide range of alternative protein products. Additionally, there are only a few studies that include multiple novel protein sources (e.g., Circus & Robinson, 2019; de Boer et al., 2013; Ianuzzi, 2019; Onwezen, van den Puttelaar, et al., 2019). The comparisons between various products of a specific alternative protein, or across categories of alternative proteins in a comparable way (e.g., a burger from various alternative proteins), are especially crucial to gaining a better understanding of why some specific products are accepted and others are not. Moreover, there is a need for future research to find ways to increase comparisons across studies, for example the use of standardised measures, and an overarching theoretical framework. We state it is relevant to develop standardised measurements and include a wide range of variables including multiple levels (e.g., personal, social environment and physical environment, Story, 2008). In this way knowledge in relative importance across drivers can be increased.

The studies included emphasised cognitive deliberation far more than affective and unconscious factors (e.g., for pulses, there were nine individual studies on food choice motives and none on affective variables; for algae, there were 16 and two respectively). At the same time, the research suggests that affective factors are especially relevant for novel products, which are perceived as more innovative by consumers (Onwezen, van den Puttelaar, et al., 2019). Thus, a recommendation for

future research is to attend more to affective factors.

Although the amount of studies on social norms was relatively low, the results show the relevance of this driver in consumer acceptance of all alternative proteins. Consumers use all kinds of information to form opinions on alternative proteins, including social context. Studies on food choices in general (Higgs, 2015) and specifically regarding food innovations have already noted the significance of the social environment (Ronteltap, Van Trijp, Renes, & Frewer, 2007). The current review adds to this knowledge by illustrating that social information is also a highly relevant driver of acceptance for all alternative proteins (e.g., Onwezen, van den Puttelaar, et al., 2019). Future research is needed to further explore the potential of social norms in consumer acceptance of alternative proteins.

Although we focussed on Western countries, a few studies included a comparison between Western and non-Western countries (Bryant et al., 2019; Hartmann et al., 2015; Tan et al., 2015). These comparisons are especially interesting in the context of insects and seaweed, because these products already form a part of the traditional diet in a number of non-Western countries. The comparison can provide valuable insight into how insects and seaweed could become part of traditional diets elsewhere. Future studies should include more representative samples in more countries to identify and explain differences between various countries and cultures.

The amount of intervention studies was relatively small compared to the total amount of studies on consumer acceptance. Moreover, most interventions studies were not performed in real life settings whereas, testing consumer responses in real-life settings is also very important (Taufik, Verain, Bouwman, & Reinders, 2019). Finally, we noticed that the interventions included often-used informational claims, which is a common approach to influencing consumer food choices (Guthrie, Mancino, & Lin, 2015). However, there are many other factors aside from information that influence behaviour; therefore, information does not always determine behavioural change (Guthrie et al., 2015; Michie, Van Stralen, & West, 2011; Rothschild, 1999). We recommend future studies to include other interventions to increase consumer acceptance of alternative proteins for example affective factors and social norms, and also test interventions in real-life for real behavioural choices.

#### 4.7. Limitations

A common limitation of a systematic review is that publication bias has likely inflated the reported results. Publication bias causes effective studies to be published more often than ineffective studies (Rothstein, Sutton, & Borenstein, 2005, pp. 1–7). Moreover, although we used a broad search string, some studies may be missing in our overview. Including other search engines and a reference check might complement the overview in future literature reviews.

The data did not allow us to conduct a meta-analysis due to the inconsistent way in which outcome measures were reported as well as the diversity in populations, settings, and reported results (e.g., lack of effect sizes and correlation coefficients). As a result, we cannot assess the

## Appendix B. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.appet.2020.105058>.

## Appendix A. Table including all articles from the systematic literature review

relative effectiveness in targeting each of the different determinants in the acceptance of sustainable protein sources. Future research may benefit from the use of consistent outcome measures and the reporting of effect sizes to allow a better quantitative comparison between studies (also see Bryant & Barnett, 2018).

We used an existing framework on acceptance of novel food (Siegrist, 2008) to discuss our results. Possibly the framework which is developed for novel foods is less suitable for conventional alternative proteins. Although we worked from the raw table (see Appendix A and the supplementary materials) and fitted the results within the framework it is possible that a different framework would result in different findings. For example the results on trust are only found because the framework explicitly mentioned the relevance of trust. It therefore becomes clear that this factor is under researched in the literature on alternative proteins.

The focus of the review is on acceptance of alternative proteins, as actual behaviour is often not applicable in the case of novel proteins and is not possible in the case of future proteins. However, it should be considered that an increase in intentions or acceptance does not necessarily equate to an increase in behaviour as well (Sheeran & Webb, 2016).

## 5. Conclusion

The findings of the current review provide a comprehensive overview of the consumer acceptance of multiple alternative proteins. Although consumer acceptance varies greatly across alternative proteins, such that plant-based proteins are far more accepted than others like insects, the results also reveal consistencies in the drivers of consumer acceptance. The relevant drivers for consumer acceptance of all alternative proteins were food choice motives (especially healthiness and taste), familiarity, attitudes, food neophobia, disgust, and social norms. Besides these consistencies the review also shows the relevance of being specific and taking variations between individuals and alternative proteins into account. Future research is necessary with a focus on comparisons. Comparisons across multiple drivers, comparisons across multiple alternative proteins, comparisons across countries, and comparisons across consumer segments. Moreover, intervention studies have a focus on information and familiarity whereas other drivers like social norms and affect also show to be relevant. Thus, aside from focussing on providing information on benefits and motives, there is an urgent need to find ways to make consumers more familiar with various alternative proteins and to include affective messaging and social norm incentives in real-life contexts.

## Acknowledgements

We would like to thank Raimo Rood for his contributions to the data collection. The review is conducted in a research project on alternative proteins funded by the Dutch Ministry of Agriculture, Nature and Food Quality.

Authors (year)	Country	Sample Size	Type of study	Protein source category	Independent/exploratory variables	Dependent/predicted variables	Outcomes	Most important factor(s) influencing consumer acceptance/responses
1. Allegra et al. (2015)	Italy	197	Questionnaire survey	Legumes	Participant age, social group (traditionalist, modernist), legume consumption (memory vs. impulse), type of legume (traditionally eaten locally vs. generic grain legume)	Valuation and consumption of traditional and generic legumes.	Assessments of the perceived quality, typicality and value for money of legumes do not differ by age, whereas ease of use and availability do differ by age (younger adults are less knowledgeable about characteristics of specific legumes and how to prepare them). Overall, legumes traditionally eaten locally (in Sicily) are valued more highly than generic grain legumes (?). For the age group over 45 years, consumption of legumes is motivated by memory, and for younger age groups it is based on impulse (?). Chickpeas, kidney beans and green peas were the types of legume consumed most by participants. These legumes were most frequently used for Mexican meals, followed by Indian and Middle Eastern meals. For participants who did not consume legumes, family preferences, time needed to prepare legumes, a lack of knowledge of how to prepare legumes or incorporate them in meals and legume taste were barriers for legume consumption.	Age and specific motivation for legume consumption (memory vs. impulse)
2. Figueira et al. (2019)	Australia	505 (308 answered all questions)	Online survey	Legumes	Gender, age group, employment status, diet (e.g., gluten-free), highest level of education, ethnicity/cultural background, main household purchaser and preparer of ingredients/meals, broad food preferences, nutritional knowledge, attitudes toward legumes, culinary use of legumes, legume consumption patterns	-	-	-
3. Lea et al. (2005)	Australia	50	Focus group interviews	Legumes/pulses, nuts (among other plant foods)	Health-related and environmental benefits; versatility, taste, quality and variety of plant foods, knowledge and skills concerning plant foods (and their preparation), preparation time for plant foods, awareness and views of plant food promotions	Consumption of plant-based foods	Health-related benefits of plant foods were considered most important, followed by taste, variety, versatility and environmental benefits. Lack of preparation knowledge and skills as well as preparation time were barriers to consumption. Participants were highly aware of plant food promotions, but noted that these should focus more on practical convenience.	Health-related benefits of plant foods, preparation time of plant foods, knowledge and skills concerning (preparation of) plant foods

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Authors (year)	Country	Sample Size	Type of study	Protein source category	Independent/exploratory variables	Dependent/predicted variables	Outcomes	Most important factor(s) influencing consumer acceptance/responses
4. Lemken et al. (2017)	Germany	1020	Online experiment	Legumes/pulses	Price sensitivity, health concern in diets, visual attraction of products, perceived social barriers to legume consumption, health and environmental claims associated with product	Willingness-to-pay for legume products	Health and environmental claims increase willingness-to-pay for legumes, with a mix of both being superior to separate claims. The effect of food attitudes in general on WTP varies between chickpea and green-pea pasta. Legumes' association with flatulence reduces the willingness-to-pay for these products.	Mix of health and environmental claims associated with product
5. Melendrez-Ruiz et al. (2019)	France	120	Experiment	Pulses	Gender, age, education level, household composition, scenario employed during dish-composition task (e.g., 'restaurant' - or 'vegetarian guest' -scenario), participant' views/attitudes regarding pulses	Participants' choice of food images with which to compose a dish for a specific scenario, participants' evaluation of food images	Participants selected images of Pulse-group products (for use in their dish composition) significantly more often in the Self-service, Restaurant and Vegetarian scenarios, compared to the Everyday (control) scenario. Participants under 40 years old used images of red beans, chickpeas and red lentils more often than did older participants. Participants over 40, on the other hand, chose images of eggs and gnocchi more often than younger participants. Men preferred red meat most, men over 40 most often selected sausage, and women over 40 tended to select white beans and broccoli more frequently. Possible barriers to pulse consumption (as mentioned by participants) were dislike of pulses, preparation difficulty, and viewing pulses as food for vegetarians.	Scenario employed during dish-composition task

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Authors (year)	Country	Sample Size	Type of study	Protein source category	Independent/exploratory variables	Dependent/predicted variables	Outcomes	Most important factor(s) influencing consumer acceptance/responses
6. Vainio et al. (2016)	Finland	1048	Survey	Beans and soy	Age, gender, education level, (Finnish) region of residence, household size, adherence to a specific diet, eating motives (e.g., social motives)	Changes in food consumption patterns	Motives relating to environmental concerns, health and weight control were relatively strong, while motives related to convenience and price were relatively weak, among participants who followed an established diet including beans and soy products (compared to those consuming only beef). Those undergoing a diet change more strongly endorsed motives related to environmental concerns, health, sociability, social image and product price (compared to those with an established diet containing beans and soy products).	Adherence to a specific diet, motives relating to environmental concerns, health and weight control
7. Warne et al. (2019)	United States & Canada	138 (only surveyed consumers)	Survey/experiment	Pulses (lentils)	Participants' age, own/household lentil consumption frequency, changes in lentil consumption over past 5 years, provision to participants of a brochure containing information on the environmental, economic and nutritional aspects of lentil (vs animal protein) production	Knowledge of lentils, sources of lentil knowledge, general food security status, reasons for eating lentils, attributes important when buying lentils, perception of what constitutes high-quality lentils, social value and quality attributes of lentils in relation to purchase decision, perception of sensory qualities of lentils, perception of health benefits of lentil consumption, lentil purchase location, perception of lentil availability on the market, willingness to change lentil consumption frequency based on information in lentil brochure	Participants indicated they would increase their lentil consumption based on the environmental (78%), economic (75%) and nutritional (72%) information in the brochure contrasting lentils and animal-based protein sources. Lentil consumers differed significantly from non-consumers in their willingness to change their lentil consumption frequency based on the nutritional information in the brochure. Non-consumers (vs. consumers) more frequently reported being unsure whether or not to change their lentil consumption frequency based on the nutritional information, whereas consumers more often reported they would not change their lentil consumption frequency based on this information.	Participants' age, lentil consumption frequency, provision to participants of a brochure containing information on the environmental, economic and nutritional aspects of lentil (vs animal protein) production

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Authors (year)	Country	Sample Size	Type of study	Protein source category	Independent/exploratory variables	Dependent/predicted variables	Outcomes	Most important factor(s) influencing consumer acceptance/responses
Algae 8. Birch et al. (2019b)	Australia	521	Online survey	Algae (seaweed)	Gender, education level, annual household income, age, food neophobia, health-consciousness, responsibility with food and food safety concern, symbolic value (concerning food consumption), snacking behaviour, past seaweed consumption	Likelihood of eating seaweed in the next 12 months	Participants who had eaten or tasted seaweed in the past were more likely (compared to those who hadn't) to eat seaweed in the next 12 months. Participants who preferred red meat, pork or chicken over fish/seaweed were significantly less likely to have ever eaten seaweed, consumed seaweed in the past 12 months, or to eat seaweed in the next 12 months. Gender and age had no significant effect on likelihood to consume seaweed in the next 12 months. Respondents with a university degree are 4 times more likely than those with lower education to eat seaweed in the next 12 months, and those who are familiar (vs. unfamiliar) with seaweed products are 7.6 times more likely to do so. Food neophobia was the most significant predictor of likelihood to eat seaweed in the next 12 months, with higher food neophobia scores leading to a lower likelihood to consume seaweed. Attaching more importance to the symbolic value of food consumption, higher health-consciousness, and more snacking behaviour each led to a higher likelihood of eating seaweed in the next 12 months. Responsibility with food and food safety concern did not significantly affect this likelihood.	Food neophobia

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Authors (year)	Country	Sample Size	Type of study	Protein source category	Independent/exploratory variables	Dependent/predicted variables	Outcomes	Most important factor(s) influencing consumer acceptance/responses
9. Birch et al. (2019a)	Australia	521	Online survey	Algae (seaweed)	Gender, education level, annual household income, age, food neophobia, health consciousness, responsibility with food and food safety concern, symbolic value (concerning food consumption), snacking behaviour, past seaweed consumption, perceived health and nutritional benefits of seaweed, perceived seaweed taste, perception of seaweed's naturalness, safety and freshness, knowledge of and familiarity with seaweed, and perception of seaweed expensiveness	Likelihood of eating seaweed in the next 12 months	Important drivers for consuming seaweed in the future are health and nutritional benefits of seaweed, seaweed taste, and seaweed being natural, safe and fresh. Important barriers are lack of knowledge about and familiarity with seaweed and the perception that seaweed is expensive. Participants who are younger, female, more health-conscious, and have higher household incomes and education levels, who are less neophobic with food, who snack more, and who attach more importance to the symbolic value of food are more likely to consume seaweed.	Food neophobia
10. Brayden et al. (2018)	United States	2155	Survey	Seaweed	Source, certification, origin and price of seafood products. Participants' age, gender and education level.	Preferences and willingness-to-pay for seafood products (such as seaweed)	Participants prefer wild-harvested seafood products (fish and seaweed), and are additionally willing to pay more for products that have a certification label (organic or sustainably harvested) or originate from their home state.	Source, certification, origin and price of seafood products
11. Lucas et al. (2019)	France	Online pre-survey: 123 Survey: 495	(Online) survey	Seaweed	Gender, age, occupation, household situation, income, financial satisfaction, meat and fish consumption, frequency and type of seafood consumed, cooking habits, curiosity, seaweed consumption (consumer vs. non-consumer), perceived taste of seaweed, type of seaweed products consumed, cooking methods for seaweed, buying habits regarding seaweed, reasons for not consuming seaweed, willingness to try/buy seaweed, location of seaweed consumption/purchase, knowledge of seaweed, seaweed attributes that encourage/would encourage consumption for participants	Participants' seaweed label preference	Attitudes toward seaweed strongly influence seaweed consumption. Participants' choice of seaweed label/claim is strongly influenced by the location at which they purchase seaweed.	Location of seaweed consumption/purchase

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Authors (year)	Country	Sample Size	Type of study	Protein source category	Independent/exploratory variables	Dependent/predicted variables	Outcomes	Most important factor(s) influencing consumer acceptance/responses
12. Moons et al. (2018)	Belgium	1325	Survey	Algae	Health consciousness, food involvement, neophobia, willingness to compromise on taste, environmental concern, gender, age, education level, consumer segment (sporting, vegetarian, foodie, or enjoyer)	Adoption intention of spirulina-enhanced food	Health consciousness and willingness to compromise on taste drive adoption intention of spirulina-enhanced food for sporting individuals, vegetarians and foodies. Neophobia negatively affects this intention for foodies, but does not affect sporting individuals and vegetarians. Food involvement and environmental concern do not affect adoption intention.	Health consciousness, willingness to compromise on taste
13. Weinrich and Elshiewy (2019)	Germany, The Netherlands, & France	940 (315 in Germany, 308 in NL, 315 in France)	Experiment	Meat substitutes based on micro-algae	Gender, age, household size, education level, (grocery) shopping responsibility within household (e.g. "mostly me"), diet (e.g. vegetarian), meat consumption habit/frequency, whether or not the meat substitute was organic/local, degree to which meat substitute was less environmentally impactful compared to pork/beef (e.g., 30% less), product price, attitudes toward meat and meat substitutes	Participants' choice of meat substitute, willingness-to-pay (WTP) for meat substitutes, preferences for specific proportion of micro-algae within meat substitute (10%, 30% or 50%), preferences for specific second ingredient in meat substitute (soy, quinoa, peas, lupines, milk, or egg)	The most preferred second ingredient (i.e., in addition to micro-algae) for meat substitutes was egg followed by peas and milk. Furthermore, many participants preferred meat substitutes that are organic (64%) and local (79%). Results additionally show that the lesser the environmental impact of the meat substitute (compared to pork/beef), the more they prefer it. Acceptance of meat substitutes was driven by the perception that meat consumption is unhealthy and meat production viewing a meat-free diet as sufficient (for a balanced diet). In Germany and the Netherlands (but not France), a stronger meat-eating habit was associated with a weaker preference for meat substitutes based on micro-algae. The perception that meat is expensive did not increase preference for the meat substitutes. The findings for WTP followed a pattern similar to those for preferences, although (in France) unfamiliarity with meat substitutes was additionally found to lower WTP and perceiving meat as	Meat consumption habit/frequency, whether or not the meat substitute was organic/local, degree to which meat substitute was less environmentally impactful compared to pork/beef, attitudes toward meat and meat substitutes

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Authors (year)	Country	Sample Size	Type of study	Protein source category	Independent/exploratory variables	Dependent/predicted variables	Outcomes	Most important factor(s) influencing consumer acceptance/responses
<b>Insects</b> 14. Adámek et al. (2018)	Czech Republic	96	Survey	Insects	Gender, age, interest in insect consumption, Beliefs about insects as food (e.g., in terms of healthiness), energy or protein bar manufacturer (Czech vs. American), bar flavour	Evaluation of taste and smell of energy and protein enriched with cricket flour, preference for American vs. Czech manufacturer of bars, willingness to consume insects in the future	expensive increased WTP for the meat substitutes. More than 80 percent of participants was willing to eat food enriched with edible insects because they think it is healthy. Participants preferred a Czech (as opposed to American) bar manufacturer. Participants most strongly preferred energy or protein bars with orange and pineapple flavour from the Czech manufacturer (there were no differences in evaluations of bar flavours from the American manufacturer). Although 84 percent of participants claimed they were willing to eat new and different products, only 54 percent was willing to consider eating insects (even when informed about the benefits of doing so). Fifty-eight percent of participants would eat insects if they tasted good, whereas 38 to 41 percent would consider eating insects for their health benefits and sustainability. When viewing pictures of dishes containing barely visible insects, 41 percent indicated they would eat these dishes and 32 percent said they <i>might</i> do so. When viewing pictures of dishes containing visible insects, 57 percent indicated they would not eat the pictured dishes.	Beliefs about insects as food (e.g., in terms of healthiness)
15. Ali (2016)	United States	116	Online survey	Insects	Age, gender, food preferences, food neophobia in relation to entomophagy (eating insects), visibility of insect within pictured food product, provision of information about benefits of eating insects.	Willingness to eat insects	Visibility of insects within pictured food products	
16. Baker et al. (2016)	United States	Study 1: 221 Study 2: 200 Study 3: 201	Experiments	Insects	<b>All 3 studies:</b> Product image (picture); insects easily identifiable vs. hard to identify), product description (explicit vs. vague), consumption setting (retail shop in study 1, restaurant in study 2, both part of setting manipulation in study 3).	Risk perception and purchase intention regarding insect-based food products	In retail settings, product image (images in which insects were easily identifiable versus hard to identify as part of food products) is most important for reducing perception of risk, whereas in the restaurant setting the menu	Product image and description, consumption setting

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Authors (year)	Country	Sample Size	Type of study	Protein source category	Independent/exploratory variables	Dependent/predicted variables	Outcomes	Most important factor(s) influencing consumer acceptance/responses
17. Balzan et al. (2016)	Italy	32	Focus group interviews	Insects	Basic demographics (age, employment status, education level), participants' knowledge of insect consumption, and their views on food safety, eco-sustainability and sale of edible insects, experience with preparing insects as food, preparation form of edible insects	Willingness to eat insect-based food	description was most important in this regard. Additionally, participants preferred vague product descriptions over explicit ones, with the former minimising risk perception and increasing purchase intention of edible insect products. Participants' willingness to eat insect-based food depends on the form in which it is presented to them. Lack of practice in preparation of insect-based food was a major barrier to its consumption. Participants suggested that public health institutions could play a role in promoting consumption of insects.	Preparation form of insect-based food, experience with preparing insect-based food
18. La Barbera et al. (2019)	Not specified (most likely a west-European country, perhaps Italy)	280	Online survey	Insects	Individual sensitivity to disgust, food neophobia, gender, age, number of members in one's household, education level, occupation status	Six dependent variables: Intention to try raw insects (1), or to introduce them into own daily diet (2), intention to try food containing processed insects (3), or to introduce it into own daily diet (4), intention to try food derived from animals fed with insects (5), or to introduce it into own daily diet (6)	In general, participants' intention to eat insects and to introduce them into their daily diet is low. Intention to try and to include in one's daily diet were both generally higher for food containing processed insects compared to raw insects as food. However, intention to try or to include in one's daily diet food derived from animals fed with insects received the highest scores (compared to the other measures of intention). Food neophobia is more correlated with intention to try insects than with intention to introduce them into one's daily diet. On average, participants had low food neophobia scores. However, participants' questionnaire responses indicated that they considered the eating of insects disgusting and that they found it unnatural for humans to eat insects. Participants did not consider	Food neophobia is a better predictor (compared to disgust sensitivity) of intention to try processed insects and both to try and introduce into daily diet animals fed with insects. However, disgust sensitivity appears to be a better predictor of intention to introduce raw insects into own daily diet.
19. Barton et al. (2020)	(Atlantic) Canada	Survey: 107 Hedonic test/experiment: 102	Survey/experiment	Insects	Participants' age, gender, and income, food neophobia, beliefs about and attitudes toward insect consumption <b>Hedonic test/experiment:</b> Presence (vs. absence) of chocolate in protein powder drink, presence (vs. absence) of cricket powder in protein powder drink, participants'	Beliefs about and attitudes toward insect consumption, hedonic evaluation of protein powder drinks using specific answering options (e.g., 'watery', 'beany' or 'nutty')	Participants' tasting of protein powders (some containing cricket powder)	

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					tasting of protein powders (some containing cricket powder)		killing insects immoral and viewed insects as nutritious. Participants had no intention to purchase or use cricket powder in their everyday lives. Gender had no significant effect on any of the results. Of the 107 participants who completed the survey, 102 were willing to return the next day to try the protein powders (including the ones containing cricket powder). After consuming the protein powders, participants' beliefs about and attitudes toward insect consumption improved significantly. The inclusion of 30% cricket powder in the protein powder did not significantly affect participants' liking scores or their choice of attributes (e.g., 'nutty') to describe the protein powders.	
20. Barsics et al. (2017)	Belgium	135	Experiment	Insects	Socio-demographic information (age, gender and ethnic origin), participants' previous awareness of and experience with insect consumption, presence (versus absence) of label indicating insect ingredient in bread, information session attendance (attended vs. not attended)	Sensory evaluations of bread	Appearance, flavour and overall liking ratings were significantly better for bread labelled as insect-free (versus bread labelled as containing insects) by participants who attended the presentation beforehand (versus those who did not).	Presence (versus absence) of label indicating insect ingredient in bread, information session attendance,
21. Berger et al. (2018)	Germany	Study 1: 80 Study 2: 160	Experiments	Insects	Price of mealworm burger/truffle, expected quality of mealworm burger/truffle, willingness-to-pay for the mealworm burger/truffle, preference for mealworm burgers/truffles		High prices positively influence participants' preference for mealworm burgers and even mealworm truffles (in which unprocessed insects were visible). When prices are artificially lowered (to simulate government subsidies), this effect is weakened.	Price of mealworm burger/truffle, expected quality of mealworm burger/truffle
22. Berger et al. (2019)	Study 1: Switzerland Study 2: Germany	Study 1: 120 Study 2: 90	Studies 1 & 2: Experiment	Studies 1 & 2: Insects	Study 1: Participants' exposure to positive, negative, or neutral peer ratings of a nutrition bar (secretly containing	Study 1: Participants' expectations of the nutrition bar's quality, willingness to taste the nutrition bar, and overall	Study 1: Participants exposed to positive peer ratings of the nutrition bar expected it to be of higher quality than did	Study 1: Participants' exposure to positive, negative, or neutral peer ratings of a nutrition bar (secretly containing

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					mealworm) <b>Study 2:</b> Participants' exposure to a high, middle, or low rating of a burger (which participants knew contained mealworms) by an expert (a 'renowned restaurant guide'), participants' general and insect-based disgust sensitivity	ratings of the nutrition bar (after eating it). <b>Study 2:</b> Participants' expectations of the burger's quality, willingness to try the burger, 'consumer acceptance' (a composite index consisting of participants' ratings of the burger's taste and the price they would be willing to pay for the burger)	participants exposed to negative peer ratings. Participants' expectations also significantly differed between the negative and neutral peer rating conditions. No significant difference was found between the neutral and positive peer rating conditions. Although peer ratings did not directly influence the overall ratings of the nutrition bar, they did affect participants' pre-tasting expectations, which in turn influenced the overall ratings. <b>Study 2:</b> Participants exposed to high-score expert reviews had higher expectations of the burger's quality than did participants exposed to the middle-score reviews, who in turn had higher expectations than did participants exposed to the low-score expert reviews. Consumer acceptance was higher for participants exposed to high-score reviews compared to those exposed to middle- and low-score reviews (there was no significant difference between the latter two groups). Disgust sensitivity (general or insect-based) did not moderate the effect of expert influence on expectation of burger quality. 'Consumer acceptance' was more affected by expert ratings for participants low (compared to high) in insect-based disgust sensitivity. Additionally, the effect of expert ratings on consumer acceptance is mediated by expectations of burger quality.	mealworm) <b>Study 2:</b> Participants' exposure to a high, middle, or low rating of a mealworm burger by an expert, insect-based disgust sensitivity

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23. Caparros Megido et al. (2016)	Belgium	79	Experiment	Insects	Preparation of burger (containing lentils, beef, and/or mealworms), participants' gender, participants' knowledge of or previous experience with insect consumption, participants' perception of insect consumption	Sensory evaluations and preferences regarding different burgers	Female participants preferred the appearance of beef burgers, whereas male participants preferred the appearance of beef and insect burgers. Taste evaluation of insect-based burgers was in-between the evaluations for beef and lentil-based burgers. Among the insect-based burgers, the one containing mealworm and beef was preferred. Participants with previous insect consumption experience gave higher ratings to all preparations. On average, participants are willing to buy edible insect products, with invisibility of insect shape and cacao flavour (the latter only for participants with higher neophobia) likely fostering this willingness. A certificate of sustainability only seems to increase acceptance of edible insect products among people with higher education.	Gender, previous experience with insect consumption
24. Cavallo and Matera (2018)	Italy	135	Online experiment	Insects	Participants' gender, age, household size, education level and neophobia, visibility of insect shape (flour vs. whole insect), product packaging (opaque vs. transparent), cacao flavour (present vs. absent), protein content (high vs. low), sustainability certification (present vs. absent)	Willingness to buy and acceptance of edible insects	Participants' education level and neophobia, cacao flavour, sustainability certification, education level	Visibility of insect shape, cacao flavour, neophobia, sustainability certification, education level
25. Cicatiello et al. (2016)	Italy	201	Survey	Insects	Participants' education level, gender and age, animal protein most often consumed, direct experience with eating insect-based food, importance of food cues in food choice, meals per week consumed outside home, frequencies of buying organic products and eating in ethnic restaurants, appreciation of unusual food products, barriers to insect consumption (e.g., insect appearance), familiarity with foreign food	Willingness to try eating insects	Thirty-one percent of respondents were willing to try eating insects, and 5 percent had already tried. Familiarity with foreign food, higher education and male gender positively influenced attitudes toward eating insects. The main barriers to trying insects as food were fear of insects and the idea that insects might have a disgusting taste. However, these barriers were mainly mentioned by participants who lacked direct experience with eating insects.	Familiarity with foreign food, education level, gender, experience with eating insect food
26. de-Magistris et al. (2015)	The Netherlands	155	Choice experiment	Insects	Participant gender, age, education level, income, previous experience with insect-based products, Product price, product logo,	Willingness-to-pay and preference for insect-based food products	Participants' willingness-to-pay and preference were highest for insect-based products with a nutritional health claim and logo. Participants are unwilling to	Product nutritional claim and logo, visibility of insect in food product.

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27. Fisher & Steenbekkers (2018)	The Netherlands	140	Quasi-experimental study	Insects	nutritional claims, visibility of insect in food product. Participants' prior experience with eating insects, food neophobia, overall, cognitive and affective attitudes toward eating insects, disgust towards eating insects, acceptance of insects as food in general, degree to which insect products are marketed in one's own culture	Willingness to eat insects and preference for specific insect types	pay for products in which insects are visible. Insects that were marketed more in one's own culture were preferred more, and those marketed less in one's own culture were preferred less. General disgust and affective attitudes towards eating insects negatively affected willingness to eat specific insects. However, neophobia was not found to influence willingness to eat insects.	Degree to which insect products are marketed in one's own culture, disgust and affective attitudes towards eating insects
28. Gallen et al. (2019)	France	37	Experiment	Insects	Degree to which insect product had been processed, type of insect flavouring	Participants' categorisation of insect products, intention to consume insect product	Participants' classifications of insects generally fell into the category of 'non-edible in my culture'. Participants also felt disgust and risk/danger regarding insects, and they were uncertain about how to eat insects. Flavoured and processed insects were rejected less, possibly because they felt more familiar/less like insects to participants. Intention to consume was higher for some processed insect products, compared to whole and unflavoured insects.	Degree to which insect product had been processed, type of insect flavouring
29. Gere et al. (2017)	Hungary	400	Online survey	Insects	Gender, age, education level, food neophobia, food technology neophobia, attitude towards health characteristics of food, convenience orientation for food choice, attention to environmental impact of food choice, belief that meat is nutritious and healthy, intention to reduce fresh meat, desire for new food alternatives, consumption, awareness of insects, whey, algae and soy as alternative protein sources.	Consumption of insects	Less than 11 percent of respondents were unaware of insects, soy, algae and whey as alternative protein sources, whereas almost 60 percent were aware of insects as food. Insect-based food may attract consumers who seek new food alternatives and intend to reduce their meat intake. However, food neophobia is a barrier for the consumption of insects.	Desire for new food alternatives, intention to reduce meat intake, food neophobia
30. Hartmann et al. (2015)	Germany and China	502 (Germany), 443 (China)	Survey	Insects	Food neophobia, preparation of insect (processed or unprocessed), attitudes toward insect-based food items, previous experience	Evaluations of insect-based products, willingness to eat insect-based products	Chinese participants rated all insect-based products more favourably (compared to Germans) regarding taste, nutritional value, familiarity	Ethnicity, preparation of edible insect (processed or unprocessed), food neophobia, perceived social acceptance, taste

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31. Hartmann and Siegrist (2016)	Switzerland	104	Experiment	Insects	with eating insects, perceived social acceptance of eating insects, taste expectations, ethnicity	Willingness to eat insect-based products	and social acceptance, and were more willing to eat insect-based products (with no differences for processed vs. unprocessed insects). Germans were more willing to eat processed (versus unprocessed) insect food. In both countries, low food neophobia, high social acceptance, positive taste expectations, and previous insect consumption predicted willingness to consume insects. Participants who ate chips containing cricket flour were more willing to eat unprocessed insects than people who had eaten traditional chips (containing corn flour).	expectations, previous insect consumption
32. House (2016)	The Netherlands	33	Semi-structured interviews	Insects	Initial motivations for consuming insect-based food (e.g., good for health or environment), price, taste and availability of insect-based food, degree of fit between insect food and current eating patterns, household composition and family circumstances, ethical considerations for eating insects	(Repeat) consumption of insect-based food	Initial motivations for eating insects substantially differ from factors influencing repeat consumption of insect-based food (e.g., price, taste, availability and fit), and the latter factors are in line with factors influencing routine consumption of more conventional food products.	Price, taste and availability of insect-based food, degree of fit between insect food and current eating patterns
33. Jensen and Lieberoth (2019)	Denmark	189	Online survey and sensory test	Insects	Age, gender, pathogen disgust (disgust sensitivity), perceived infectability, perceived social norm regarding insect consumption, food neophobia, previous insect consumption, visibility of insect (presence vs. absence of pictures accompanying the food product)	Willingness to eat insects or other food, actual insect/food tasting, perception of food combination appropriateness, insect eating disgust	Spring rolls with visible (vs. invisible) mealworms were considered significantly less appropriate, more distasteful, and less edible, with the same pattern occurring for traditional Danish buttermilk soup. The more participants thought other participants ate the mealworm-containing products, the more likely they were to eat these foods themselves. Pathogen disgust and perceived infectability failed to consistently predict insect eating disgust, willingness to eat insects, or actual insect tasting.	Perceived social norm regarding insect consumption

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34. Kornher et al. (2019)	Germany	311	Experiment	Insects	Disgust towards insect-eating, level of general aversion towards insects, past insect consumption, preferences for learning about food products and recipes, food neophobia, attitudes toward organic production methods, attention paid to CO2 emissions of food production, preference for convenience food, importance attached to nutritional information about food, importance attached to food taste, importance attached to health statements on food products, gender, age, education level, frequency of weekly meat consumption, presence vs. absence of positive statement about insect product shown to participants, product information given to participants (production method, visual impression, health claim, carbon burger patty, and purchase price),	Willingness-to-pay for insect burger, willingness to eat insects (in the future)	Participants more willing to eat insects were more concerned with the environmental and health-effects of consumption behaviour and tended to consume meat less often than those unwilling to eat insects. On the other hand, greater disgust towards insect-eating, greater general aversion towards insects and higher food neophobia scores were associated with unwillingness to eat insects.	Food neophobia, attention paid to CO2 emissions of food production importance attached to health statements on food products frequency of weekly meat consumption
35. La Barbera et al. (2018)	Italy	118	Experiment	Insects	Food neophobia, disgust experienced toward insects in food, implicit attitudes toward insect-eating	Intention to eat insect-based food, implicit attitudes toward eating insects	Food neophobia and disgust independently influence intention to eat insects, with disgust having more explanatory power. Implicit attitude affects disgust and indirectly affects eating intention (mediated by disgust). Respondents were not ready to adopt insects as food, but a positive trend for use of insects as feed was observed. Readiness to adopt insects as food and feed was mainly affected by age, gender, cultural background and food neophobia. Sustainability of behaviour did not affect acceptance of insects.	Disgust experienced towards insect-eating
36. Laureati et al. (2016)	Italy	341 (all participated in survey, 68 participated in experiment)	Survey, experiment	Insects	Survey: Food neophobia, sustainable behaviour, age, gender, income, place of residence/cultural background, awareness of topic (eating insects) Experiment: Expected liking of insect-based foods	Willingness to adopt insects as feed and food, visual acceptability of insects	Respondents were not ready to adopt insects as food, but a positive trend for use of insects as feed was observed. Readiness to adopt insects as food and feed was mainly affected by age, gender, cultural background and food neophobia. Sustainability of behaviour did not affect acceptance of insects.	Age, gender, cultural background, food neophobia
37. Lammers et al. (2019)	Germany	516	Online survey	Insects	Gender, age, education level, meat consumption	Willingness to consume insect burger/buffalo worms	Willingness to consume was significantly higher for the	(continued on next page)

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38. Lensvelt and Steenbekkers (2014)	The Netherlands and Australia	Survey: 209 Experiment: 133	Online survey, experiment	Insects	frequency, willingness to reduce meat consumption, diet (e.g., vegan), familiarity with insects as food, previous insect consumption, food neophobia, food technology neophobia, sensation seeking, sustainability consciousness, food disgust, willingness to consume an insect burger and buffalo worms, processing of insect in food (processed vs. unprocessed)	(composed of willingness to try, willingness to buy, and 'willingness to substitute')	insect burger compared to the buffalo worms. Furthermore, men were more willing to consume buffalo worms than were women. Previous insect consumption and higher sensation seeking predicted higher willingness to consume the insect burger, whereas higher food neophobia, higher food technology neophobia and higher food disgust predicted a lower willingness to consume the insect burger. For the buffalo worms, previous insect consumption and higher sensation seeking predicted higher willingness to consume the product. Higher food neophobia, higher food technology neophobia and higher food disgust predicted lower willingness to consume buffalo worms.	Food neophobia, food disgust, previous insect consumption
39. Lombardi et al. (2019)	Italy	200	Experiment	Insects	Food neophobia, beliefs and attitudes about insects, concern for healthiness in food choices, general information about the food	Willingness-to-pay for food products	Participants who valued pasta equally regardless of whether or not it contained insects had a significantly higher willingness-to-pay for higher willingness-to-pay for	Food neophobia, beliefs and attitudes about insects, specific information about insects provided to participants

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40. Menozzi et al. (2017)	Italy	231	Survey	Insects	<p>products provided to participants, specific information about insects provided to participants (benefits for individual vs. benefits for the community), participants' views on relation between humans and the environment, food product (carrier) used to contain insects, presence vs. absence of insects in carrier</p>	<p>Actual consumption of insects</p>	<p>cookies and chocolate bars without insects (vs. containing insects). Participants' willingness-to-pay increased from the general-information- to the specific-information-round, regardless of the type of specific information provided. Information about the benefits of insect-eating for the individual (vs. community) had a slightly stronger positive effect on willingness-to-pay for all three products. Negative beliefs and attitudes concerning insects and high levels of food neophobia negatively influenced willingness-to-pay for insect-based products. Concern for healthiness in food choices and views on the relation between humans and the environment generally failed to influence willingness-to-pay.</p> <p>Attitudes and perceived behavioural control are significant predictors of intention to eat insects, and intention and perceived behavioural control significantly predict actual consumption of insects. The belief that eating insects positively affects personal health and the environment significantly affects attitudes and intention. Barriers to intention and actual consumption are disgust, lack of availability and incompatibility with local food culture.</p> <p>Among Australian seniors, there was low awareness of the environmental and nutritional advantages of entomophagy. Most seniors viewed entomophagy as disgusting and incompatible</p>	<p>Attitudes and perceived behavioural control, intention to eat insects, belief that eating insects benefits health and environment, disgust towards (eating) insects, lack of availability of insect products with local food culture</p>
41. Myers and Pettigrew (2018)	Australia	77	Interviews	Insects	<p>Perceived cultural norms regarding entomophagy, reason for eating insects (necessity vs. enjoyment), knowledge of entomophagy (e.g., nutritional and</p>	<p>Views of entomophagy</p>	<p>Knowledge/awareness of environmental and nutritional advantages of entomophagy, perceived cultural norms regarding entomophagy</p>	<p>Knowledge/awareness of environmental and nutritional advantages of entomophagy, perceived cultural norms regarding entomophagy</p>

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42. Orkusz et al. (2020)	Poland	Survey: 464 Sensory test: 402	Survey, sensory test	Insects	environmental benefits/ concerns) Gender, place of residence, household income, travel destination, protein sources in one's diet, food neophobia, familiarity with insects as food, attitudes towards the benefits of eating insects, previous insect consumption, disgust toward insect consumption, potential reasons for eating insects, information given to participants on the type of insect added to bread for tasting session	Willingness to try edible insects or eat animals fed with insects, preferred insect preparation (e.g., whole insects with spices),	with their cultural values and beliefs, although a small group considered it novel and potentially enjoyable. Participants preferred whole insects with spice or covered in chocolate to insect that were simple fried. Furthermore, more men than women were willing to try insects prepared in a way that made them invisible (with flour added). Higher income was also associated with higher willingness to eat insects in an undetectable form. For over 30% of participants (more frequently men than women), scarcity of agricultural land and reduce wastage of food were reasons to include insects in the/their western diets. Taste, quality, appearance and nutritional safety of insects also considerably influenced acceptance of insects as food, whereas environmental benefits of edible insects had the least influence on acceptance. Participants with low (vs. medium or high) food neophobia were much more willing to include edible insects in their own diets. Willingness to try did not differ between the insect-pasta, -burger and -granola, while the protein bar containing cricket powder was most popular. Willingness to try was lower for whole insects compared to processed-insect products, and participants were more disgusted by visible/whole insects than by invisible/processed insect products. Overall, visibility of insects in the food product, disgust towards insects and food	Food neophobia
43. Orsi et al. (2019)	Germany	393	Online survey	Insects	Gender, age, diet (vegan or vegetarian), education level, food neophobia, environmental awareness, health consciousness, familiarity with insect consumption, experience with insects as food, type of food containing insects (protein bar with cricket powder, insect pasta, insect granola, or insect burger), experienced disgust and risk perception regarding whole or processed insects, visibility of insects in food	Willingness to try insect-containing food product	Food neophobia were much more willing to include edible insects in their own diets. Willingness to try did not differ between the insect-pasta, -burger and -granola, while the protein bar containing cricket powder was most popular. Willingness to try was lower for whole insects compared to processed-insect products, and participants were more disgusted by visible/whole insects than by invisible/processed insect products. Overall, visibility of insects in the food product, disgust towards insects and food	Food neophobia, disgust towards insects, visibility of insects in food product

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44. Palmieri et al. (2019)	Italy	456	Online survey	Insects	product (visible vs. invisible/whole vs. processed) Gender, age, education level, food preferences/diet (e.g., omnivore), weekly meat consumption frequency, concern for health-related and environmental effects of food, attitude toward (food-related) information from expert sources, food neophobia/neophilia, food technophobia (i.e., attitude toward new food technologies), knowledge of (the existence of) edible insects, previous insect-based food consumption, motives for eating insects (e.g., nutritional and environmental benefits), perception of health-related risks of insect consumption	Willingness to eat insect-based food	neophobia are barriers to insect consumption. Participants who are concerned with sustainability and health (compared to those who are not) tend to be more willing to consume insects. Less neophobia/more openness towards novel foods also increases the likelihood of a participant being willing to eat insect-based food. Previous insect consumption also increases the probability of being willing to consume insects. Participants who attach weight to taste in their food choices (compared to those who do not) are more likely to adopt insects into their diets. Those who do not consider insect consumption dangerous for their health tend to be willing to try insect-based food, whereas those who think insect-eating can cause allergies or infections tend to be less willing to consume insect-based food. Higher food technophobia is, on average, associated with reduced willingness to eat insects.	Concern for health-related and environmental effects of food, food neophobia/neophilia, food technophobia, previous insect-based food consumption, motives for eating insects, perception of health-related risks of insect consumption
45. Piha et al. (2018)	Finland, Sweden, Germany, and the Czech Republic	887	Online survey	Insects	Age, gender, food neophobia, subjective knowledge of product, objective knowledge of product, product-related experiences	General attitudes toward product, willingness to buy product	The effects of subjective and objective knowledge and food neophobia on willingness to buy are primarily mediated by general attitudes toward insect food. In Northern Europe, objective and subjective knowledge, product-related experience and food neophobia equally predict willingness to buy, whereas in Central Europe the latter two are the superior predictors. Attitudes to insect food are generally more positive in Northern compared to Central Europe.	Subjective and objective knowledge of product, product-related experience, food neophobia, general attitudes toward product

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46. Poortvliet et al. (2019)	The Netherlands	130	Experiment	Insects	Type of meat that participants were shown pictures and descriptions of (bovine vs. insect), product type (common vs. uncommon), visibility of product ingredients in picture, familiarity of product to participants, food choice motives (e.g., disgust or sensory appeal)	Willingness to try the food product	Participants were more willing to try skewers (uncommon products) than burger patties (common products), with the former being considered to have more sensory appeal than the latter (this difference was larger for bovine meat than for insect meat). Participants additionally had higher risk perceptions in the bovine (compared to insect) conditions. Health- and disgust-related food choice motives mediated the indirect effect of meat type on willingness to try the food product. Sensory appeal and risk perception (as food choice motives) did not mediate this indirect effect.	Product type, food choice motives
47. Powell et al. (2019)	United Kingdom	510	Experiment	Insects	Trait disgust propensity, disgust sensitivity, emotional disgust regulation attitudes, pro-environmental attitudes, social desirability in participants' responses, risk-taking, political orientation, gender, age, ethnicity, education level, primary employment status, amount of money typically spent weekly on food, drink, and medicinal products in grocery stores, diet ('omnivore' vs. 'other diet'), primary grocery shop, product category presented to participants (e.g., insect-based foods, atypically-shaped fruit), description of food product, participants' evaluation of product attributes (e.g., taste or naturalness)	Participants' willingness-to-pay (WTP) for presented products, participants' evaluation of product attributes	When controlling for covariates (e.g., pro-environmental attitudes), trait disgust propensity had a significant negative effect on willingness-to-pay for the presented product. This effect was mediated by evaluations of perceived taste, health risk, naturalness and visual appeal of the product (explaining approximately half of the total effect). Suppression and trait reappraisal had no significant moderating effect on the results.	Trait disgust propensity, participants' evaluation of product attributes
48. Rumpold and Langen (2019)	Germany	149	Survey, sensory test	Insects	Open-mindedness towards novelty, previous insect consumption, insect form (dried whole, ground as an ingredient for a bar), self-reported ability to imagine oneself eating insects,	Decision to taste edible insect product (before or after provision of information about the product)	Of the 39 participants with previous insect-eating experience, the majority decided to taste the offered insect product, whereas 12.8% refused to taste regardless of the additional	Provision to participants of a random piece of information about edible insects

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Authors (year)	Country	Sample Size	Type of study	Protein source category	Independent/exploratory variables	Dependent/predicted variables	Outcomes	Most important factor(s) influencing consumer acceptance/responses
49. Schäufele et al. (2019)	Germany	342	Experiment	Insects	(disagreement with) view of insects as food of the future, (disagreement with) view of insects as a sustainable alternative to meat, willingness to buy whole/processed insects in a supermarket, age, gender, education level, cultural background, diet (e.g., vegetarian), provision to participants of a random piece of information about edible insects (e.g., risks, trendiness; only provided when participants refused the first offer to taste an edible insect product)	Willingness to try (insect) product	Information provided. Nine of the 42 participants who initially refused to taste the product were persuaded to do so by the additional information. Although of all 149 participants, 117 (78.5%) claimed they could imagine themselves eating insects, 14 of these 117 (12% of this subgroup) were nevertheless unwilling to actually taste an edible insect in this study. In addition, more than half of the vegan and vegetarian participants decided to taste the insect product.	Perceived social acceptability of eating insects
50. Schlup and Brunner (2018)	Switzerland	379	Survey	Insects	(consumer vs. non-consumer), insect visibility (whole insects, crushed insects, or supposed insects processed as meatballs), insect species within meal (mealworm vs. grasshopper), familiarity with eating insects (consisted of previous knowledge of and experience with edible insects), food neophobia, perceived social acceptability of eating insects, diet (e.g., vegetarian), perception of insects as a product for people with low financial resources, awareness of the environmental and health-related benefits of eating insects	Willingness to consume insects	The more participants perceived eating insects as a socially acceptable activity, the more they were willing to try the insect product. Food neophobia, on the other hand, had a significant and negative effect on the willingness to try the product. In addition, women were less willing to try the product than men. Lastly, higher visibility of insects predicted lower willingness to try the insect product.	Convenience orientation, discernibility of insects in food, expected food healthiness, need for familiarity, food neophobia, food technology neophobia, perceived health benefits of meat, gender and prior consumption of insects

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Authors (year)	Country	Sample Size	Type of study	Protein source category	Independent/exploratory variables	Dependent/predicted variables	Outcomes	Most important factor(s) influencing consumer acceptance/responses
51. Sogari (2015)	Italy	46	Experiment	Insects	perceived naturalness, weight control, need for familiarity, age, education level, gender, income, participants' origin (rural vs. urban), responsibility (yes/no), status as single (yes/no) Insects previously consumed, previous insect preference, sensory characteristics experienced while eating insects, perceived social impact of eating insects, curiosity about eating insects, perceived taste and appeal of eating insects, perceived nutritional benefits of eating insects, perceived environmental benefits of eating insects	Willingness and intention to eat insects	Curiosity and perceived environmental benefits are the most important factors motivating future consumption of insects. The majority of participants stated that eating insects would not be endorsed or supported by family and/or friends.	Curiosity about eating insects, perceived environmental benefits of eating insects
52. Sogari et al. (2016)	Italy	109	Focus group	Insects	Gender, expectations and knowledge regarding environmental, nutritional, sensory and social aspects of entomophagy (eating insects), self-elaborated reasons for tasting/not tasting a cookie with insect flour (curiosity about texture/taste, appeal, concerns about health and hygiene, etc.)	Stated willingness to taste an edible insect, actual choice of tasting vs. not tasting an insect-based cookie	Nearly all participants tasted the cookie with insect flour and where willing to try other edible insects in the future. An important reason for doing so is curiosity, whereas experienced disgust as well as negative opinions of family and friends are barriers to trying edible insects in the future.	Curiosity about eating insects, disgust towards insects, opinions of family and friends
53. Sogari et al. (2018)	Italy	88	Experiment	Insects	Age, gender, participants' Italian region of origin, tasting of insect products (jelly based on cricket flour or jelly with whole, visible cricket)	Sensory evaluation of tasted insect product, reasons for not tasting the insect product (s), likelihood of recommending the insect products to friends/family	Before tasting, participants gave the appearance of the insect-based jelly a mildly positive score, and this score significantly increased after tasting the product. The score participants gave for expected sensory-liking of the insect jelly also increased significantly after tasting. For males, there was a small but significant increase in taste scores after the actual tasting, whereas for females there was a small but significant decrease from pre- to post-tasting scores. Although the taste of jelly with whole cricket received higher scores than that of jelly made with cricket flour, the latter was preferred over	Gender, tasting of insect products (jelly based on cricket flour or jelly with whole, visible cricket)

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Authors (year)	Country	Sample Size	Type of study	Protein source category	Independent/exploratory variables	Dependent/predicted variables	Outcomes	Most important factor(s) influencing consumer acceptance/responses
54. Sogari, Bogueva & Marinova (2019)	Australia	First online survey: 227 Second online survey: 328 <b>Variables and findings were discussed for both surveys together</b>	Online surveys	Insects	Self-reported potential reasons for including edible insects and insect-based products into one's diet, opinions on edible insects as an alternative food source, meat consumption frequency, gender	Not applicable.	<p>the former in terms of appearance. Participants who rejected only the jelly with whole cricket mentioned disgust and "concern for texture property" as the most important reasons for not tasting the product. Participants stated they were highly likely to recommend the insect products to friends, and slightly less likely to recommend them to family members.</p> <p>Reasons stated by participants for not eating edible insect products were disgust, neophobia, concerns about perceptions of masculinity (in the case of men), and perceptions of a conspiracy theory (regarding a social movement toward growing insect consumption). Some participants (n = 33) perceived health benefits (e.g., nutritional value) from edible insect consumption, whereas others (n = 10) believed insect consumption had a potentially negative effect on health (e.g., spreading diseases). Participants also acknowledged the environmental benefits of insect consumption (vs. conventional meat consumption). Furthermore, most participants believed that, in order to be effective, edible insect marketing should make the insect bodies less visible/invisible, so that taste and eating experience become the dominant features of insect-based foods. Vegetarian participants pointed out the lesser environmental impact of insect (vs. traditional) meat production as the main</p>	Self-reported potential reasons for including edible insects and insect-based products into one's diet, opinions on edible insects as an alternative food source, meat consumption frequency, gender

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Authors (year)	Country	Sample Size	Type of study	Protein source category	Independent/exploratory variables	Dependent/predicted variables	Outcomes	Most important factor(s) influencing consumer acceptance/responses
55. Sogari, Menozzi, and Mora (2019)	Italy	88	Experiment	Insects	Age, gender, participants' Italian region of origin, food neophobia, previous insect consumption, willingness to try insects, initial exposure to insect products (before tasting)	Evaluation of edible insect product's appearance and taste (before and after tasting), willingness to try insect products (jelly sweet with whole cricket and/or jelly sweet with processed cricket), decision to taste/not taste insect products	<p>justification for consuming insect-based food alternatives.</p> <p>Male participants were more willing to try the edible insect products than were female participants.</p> <p>Furthermore, food neophobia was negatively related to the willingness to try and the decision to actually taste the insect-containing products.</p> <p>The initial exposure to the insect products positively influenced participants' expectations of appearance and taste. Lastly, willingness (intention) to try strongly predicted actual tasting.</p> <p>Cultural exposure created specific views of which insect species and preparation methods were more appropriate.</p> <p>Participants who had previously eaten insects based their evaluations on their memories of previous consumption, whereas other participants evaluated based on visual properties and item associations.</p>	Gender, food neophobia, initial exposure to edible insect products, willingness to try the edible insects
56. Tan et al. (2015)	Thailand and the Netherlands	54	Focus groups	Insects	Participant food preferences, experiences with and knowledge of insects as food, interest in and concerns regarding insects as food, perceived appropriateness of insect preparation, insect visibility in food, cultural exposure to insects as food	Decision to taste insects, choice of insect product to taste, evaluations of insects as food	<p>Cultural exposure to insects as food, experiences with insects as food</p>	Cultural exposure to insects as food, experiences with insects as food
57. Tan, Fischer, van Trijp, & Steiger (2016)	The Netherlands	103	Experiment	Insects	Burger ingredient familiarity, sensory-liking of burger, perceived food appropriateness, food neophobia, gender, preparation form of product (burger vs. ingredient), eating situation (meal, special occasion, snack)	Willingness to eat unusual foods such as insects in the future	<p>Sensory-liking and perceived food appropriateness were lower for novel than for beef burgers before tasting. After tasting, sensory-liking levels became similar for novel and beef burgers (although food appropriateness remained lower for novel burgers). Future willingness to eat was and remained (after tasting) lower for the novel compared to the beef burger, and it was mainly predicted by food appropriateness (and not sensory liking or individual traits).</p>	Perceived food appropriateness
58. Tan, Tibboel, & Steiger (2017)	The Netherlands	100	Experiment	Insects	Expected sensory profiles (e.g., meaty, fatty, juicy) of ingredients and burgers, prior experience with tasting	Willingness to eat ingredients and burgers (again)	<p>Beliefs about taste were based on species-related associations and were generally more negative for</p>	Perceived food appropriateness

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Authors (year)	Country	Sample Size	Type of study	Protein source category	Independent/exploratory variables	Dependent/predicted variables	Outcomes	Most important factor(s) influencing consumer acceptance/responses
59. Tan, van den Berg, & Steger (2016)	The Netherlands	976	Experiment	Insects	Age, gender, education level, food neophobia, product preparation, product familiarity, taste familiarity of food carrier (i.e., food containing the insect ingredient)	Acceptance of insects as food	<p>food that had not been tasted before. While these beliefs had some effect on post-consumption beliefs, the latter were mainly determined by the food's actual properties. However, the low willingness to eat novel foods (or foods with novel ingredients) was related to perceived food appropriateness more than to the food's actual taste. Food taste nevertheless exerts an influence on perceived food appropriateness.</p> <p>Acceptance depended to a large extent on perceived appropriateness of mealworms as food and of the specific product combination. Even when visually identical, mealworm products were always considered inferior to carrier products.</p> <p>Participants' individual traits (e.g., food neophobia) and familiarity with mealworms affect willingness to try more than other acceptance measures, although they played a relatively minor role.</p>	Perceived appropriateness of mealworms as food, specific product combination
60. Tan, Verbaan, & Steger (2017)	The Netherlands	214	Experiment	Insects	Age, gender, food neophobia, prior product presentation order (experimental), product familiarity, perceived preparation appropriateness, perceived appropriateness as food, expected and experienced sensory-liking, expected and experienced sensory profile	Sensory-liking of and willingness to buy insect-based food products	<p>Mealworm products were expected to and experienced as tasting very different from mealworm-free products, and participants would generally like mealworm products to taste similar to mealworm-free products. Even with high interest and good products, willing participants hesitate to regularly consume insect-based products due to practical and socio-cultural factors (such as appropriateness of food preparation).</p> <p>Many participants underestimated the</p>	Perceived appropriateness of food preparation
61. Vanhonaeker et al. (2013)	Belgium	221	Survey	Insects, soy	Gender, age, education level, financial situation of	Attitudes toward, willingness to consume and willingness	<p>Awareness of and concern about environmental impact</p>	(continued on next page)

Authors (year)	Country	Sample Size	Type of study	Protein source category	Independent/exploratory variables	Dependent/predicted variables	Outcomes	Most important factor(s) influencing consumer acceptance/responses	
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62. Van Thielen, Vermuyten, Storms, Rumpold, and Van Campenhout (2019)	Belgium	388	Telephone survey	Insects	household, living environment (urban vs. rural), degree of responsibility for food purchases within household, awareness of and concern about environmental impact of animal production and meat consumption, participants' environmentally-friendly behaviours, meat consumption frequency, enjoyment of meat consumption	to pay for different food choices with lower ecological impact (e.g., plant-based foods)	ecological impact of animal production. Segments of participants can be distinguished based on awareness of and concern about the environmental impact of animal production and meat consumption. These segments show that awareness of and concern about the environmental impact of animal production and meat consumption sometimes increase willingness to reduce the ecological impact of one's diet. Enjoyment of meat and meat consumption frequency are barriers to such reduction. Well-known alternatives to traditional meat consumption such as consumption of organic meat and reduction of traditional meat consumption are accepted, although willingness to pay for alternative products is lower than willingness to consume. Participants do not appear to be open to alternatives that partly or entirely leave out meat in a meal.	Of all participants, 79% were aware of the possibility of buying insect-based foods. Furthermore, 11.2% had previously eaten food containing processed insects, 31.8% had no experience but were willing to try, and 57% had no experience with or interest in trying such products. Potential insect consumers stated they would accept invisible processed mealworms in energy bars, energy shakes, soup, burgers, sandwich spreads, and (fried and unfried) snacks. Additionally, participants	of animal production and meat consumption, enjoyment and frequency of meat consumption

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Authors (year)	Country	Sample Size	Type of study	Protein source category	Independent/exploratory variables	Dependent/predicted variables	Outcomes	Most important factor(s) influencing consumer acceptance/responses
63. Verbeke (2015)	Belgium	368	Online survey	Insects	Gender, age, education level, familiarity with insects as food, food neophobia, food technology neophobia, attitude towards health characteristics of food, convenience orientation regarding food choice, attention to environmental impact of food, importance of taste in evaluation of meat quality, belief that meat is nutritious and healthy, intention to reduce fresh meat consumption	Readiness to adopt insects as meat substitutes	thought that the presence of insects in products should be clearly stated on the product packaging. Lastly, participants indicated they would prefer to buy insect-containing products in the supermarket (in terms of purchase location preference). The predicted likelihood of males and females adopting insects as meat substitutes are 12.8 and 6.3 percent, respectively. People who claim to be familiar with the idea of eating insects are 2.6 times more likely to adopt insects as food, whereas those intending to reduce fresh meat intake are up to 4.5 times more likely to do so. Food neophobia is the largest contributing factor to participants' unwillingness to adopt insects as food. Stronger convenience orientation and more interest in the environmental impact of food choice increase likelihood of adopting insects by 75 and 71 percent, respectively. However, a strong belief that meat is nutritious/healthy and higher valuation of meat taste lower these odds to 64 and 61 percent, respectively.	Food neophobia, intention to reduce fresh meat consumption, interest in environmental impact of food choices
64. Verneau et al. (2016)	Denmark and Italy	282	Experiment	Insects	Participants' positive and negative implicit associations with insects, familiarity with insects as food, intention to incorporate insects into diet, suggest it to friends, and to buy food with insect rather than traditional proteins, experimental manipulation (provision of information about individual vs. societal benefits of eating insects), previous knowledge of insect-eating, gender, nation (of residence)	Actual consumption of insects	Messages concerning individual and societal benefits of eating insects affected intention and behaviour, with the societal message appearing more robust over time. These communication effects were still significant after accounting for the influences of gender, nation of residence and previous knowledge of insect-eating. Implicit negative attitudes towards insect-eating strongly influenced	Provision of information about individual vs. societal benefits of eating insects, implicit negative attitudes towards insect-eating

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Authors (year)	Country	Sample Size	Type of study	Protein source category	Independent/exploratory variables	Dependent/predicted variables	Outcomes	Most important factor(s) influencing consumer acceptance/responses
65. Wilkinson et al. (2018)	Australia	820	Online survey	Insects	Gender, age, education level, household income, ethnicity, food neophobia, protein sources consumed, awareness of entomophagy, previous insect consumption, attributes of edible insects (e.g., taste, appearance, quality, and safety)	Attitudes towards insects as food, willingness to try eating insects	behaviour yet did not impede the effectiveness of information about individual or societal benefits. Of the 820 participants, 68 percent had heard of entomophagy (insect-eating) and 21 percent had previously eaten insects. Taste, appearance, safety and quality of edible insects were most likely to influence participants' willingness to try eating insects. Neophobic participants accepted entomophagy far less than neophilic participants, and those who had previously eaten insects were most accepting of this food. Insects were considered more appealing when incorporated into familiar products or cooked meals. Male participants were more willing than females to regularly consume ICF. Participants were additionally more willing to consume ICF if they were familiar with the concept of entomophagy, were aware of the benefits of entomophagy, or if they had consumed insects prior to this study. Of the participants who had never eaten ICF before, 67% considered entomophagy disgusting, as did 35% of participants who had eaten ICF before. Previous exposure to ICF appeared to be the most important factor influencing perceptions of entomophagy among participants.	Taste, appearance, safety and quality of edible insects, previous insect consumption
66. Woolf et al. (2019)	United States	397	Online survey	Insects	Gender, age, ethnicity, education level, annual income, occupation, place of residence, familiarity with and knowledge of entomophagy, previous insect consumption, source/location of previous insect consumption (e.g., travel abroad or local restaurant), insect-containing foods (ICF) consumption frequency, motives for ICF consumption, overall experience rating for ICF consumption, type(s) of ICF consumed, overall rating of the ICF participants would be willing to consume	Willingness to try ICF/eat them regularly	Participants were more willing to consume ICF if they were familiar with the concept of entomophagy, were aware of the benefits of entomophagy, or if they had consumed insects prior to this study. Of the participants who had never eaten ICF before, 67% considered entomophagy disgusting, as did 35% of participants who had eaten ICF before. Previous exposure to ICF appeared to be the most important factor influencing perceptions of entomophagy among participants.	Previous ICF consumption
<b>Cultured meat</b> 67. Bekker et al. (2017)	The Netherlands	Study 1: 190 Study 2: 194 Study 3: 192	Experiments	Cultured meat	<b>All studies:</b> Familiarity with cultured meat <b>Studies 1 and 2:</b> Provision of positive versus negative	Explicit and implicit attitudes toward cultured meat	<b>Study 1</b> showed that positive or negative information about cultured meat changed the explicit attitude in the direction of	Provision of positive versus negative information about cultured meat

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Authors (year)	Country	Sample Size	Type of study	Protein source category	Independent/exploratory variables	Dependent/predicted variables	Outcomes	Most important factor(s) influencing consumer acceptance/responses
68. Bryant et al. (2019) Strategies ...	United States	1185	Experiment	Cultured meat	information about cultured meat <b>Study 2:</b> Provision of positive information about solar panels <b>Study 3:</b> Induction of positive or negative mood state  Gender, diet (e.g., vegetarian), familiarity with clean (cultured) meat, exposure to a promotional message/argument concerning clean meat (experimentally manipulated)	Behavioural intentions, attitudes, beliefs, affective reactions, and willingness to pay (WTP) regarding clean meat	the information. This effect was smaller for participants who were more familiar with cultured meat. <b>Study 2</b> showed that the explicit attitude towards cultured meat also changed in the direction of positive information about solar panels. <b>Study 3</b> showed that the explicit attitude change in the previous two studies was not due to content-free affect. In all three studies, implicit attitudes were unaffected by information or mood state. The 'clean meat is natural'-message failed to make participants consider clean meat more natural (compared to the control condition). The 'conventional meat is unnatural'-message made participants consider conventional made less natural (compared to the control condition). It also led to significantly higher WTP for clean fish sticks, and marginally higher WTP for clean chicken nuggets. The effect of this message on WTP for clean beef burgers was non-significant but followed the same direction. The 'challenging the appeal to nature'-argument (which debunked the perception that naturalness is important) failed to make participant attach less weight to naturalness. The framing of cultured meat had a significant effect on attitudes toward cultured meat, the belief that cultured meat is healthy, the belief that cultured meat is safe, and the belief that cultured meat is good for the environment. The "same meat" framing led to the	Promotional messages/arguments concerning clean meat (specifically the 'conventional meat is unnatural'-message)
69. Bryant and Dillard (2019)	United States	480	Experiment	Cultured meat	Gender, age, region of residence, diet (e.g., omnivore), participants' familiarity with cultured meat, cultured meat framing ('Societal benefits', 'High-tech' or 'Same meat')	Participants' perceptions of and attitudes toward cultured meat, willingness to try cultured meat, willingness to buy cultured meat regularly, willingness to eat cultured meat as a replacement for conventionally produced meat, willingness to eat	Experimental framing of cultured meat.	

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Authors (year)	Country	Sample Size	Type of study	Protein source category	Independent/exploratory variables	Dependent/predicted variables	Outcomes	Most important factor(s) influencing consumer acceptance/responses
70. Mancini and Antoniole (2019)	Italy	525	Online survey	Cultured meat	Gender, age, education level, place of residence, meat consumption habits, reasons for not eating meat, reasons for reducing meat consumption, prior familiarity with cultured meat, information provided to participants concerning cultured meat	cultured meat compared to plant-based meat substitutes.	most positive attitudes toward cultured meat, whereas the 'high-tech' framing led to the least positive attitudes. Participants exposed to the 'high-tech' framing of cultured meat (compared to those in the other conditions) were significantly less willing to try cultured meat, buy cultured meat regularly, eat cultured meat as replacement for conventional meat, or eat cultured meat as compared to plant-based meat alternatives.	Prior familiarity with cultured meat, information provided to participants concerning cultured meat
71. Siegrist and Sütterlin (2017)	Switzerland	Studies 1a, 1b, and 2: 244 Study 3: 253	Experiments	Cultured meat	Study 1a: Information about e-numbers (provided vs. not provided) Study 1b: Information about health effects (presence vs. absence of possible negative health effects of food additives), information about origin of food additive (synthetic vs. nature-identical vs. natural) Study 2: information about traditional vs. in-vitro meat Study 3: information about traditional versus in-vitro meat, perceived naturalness of traditional or in-vitro meat (mediator)	Studies 1a and 1b: Perceived naturalness of a food additive Study 1b: perceived acceptability of food additive Study 2: perceived acceptability of risk of colon cancer associated with product Study 3: Perceived naturalness of traditional or in-vitro meat (mediator), perceived acceptability of risk of colon cancer associated with product	Study 1a: Displaying E-numbers reduced perceived naturalness of food additives. Study 1b: Food additives were considered most natural when obtained from a plant source and when no negative information about health effects was provided. Information about possible negative health effects reduced the perceived naturalness, although no such effect was observed for synthetic food additives. Study 2: Perceived risk of colon cancer was considered much more acceptable for traditional compared to in-vitro meat.	Information about e-numbers, information about health effects, perceived naturalness of traditional or in-vitro meat

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Authors (year)	Country	Sample Size	Type of study	Protein source category	Independent/exploratory variables	Dependent/predicted variables	Outcomes	Most important factor(s) influencing consumer acceptance/responses
72. Siegrist et al. (2018)	Switzerland	Study 1: 204 Study 2: 298	Experiments	Cultured meat	<p><b>Study 1:</b> Experimental condition (information about traditional vs. in-vitro meat), perceived naturalness of traditional ground beef (mediator)</p> <p><b>Study 2:</b> Experimental condition (technical description of cultured meat production vs. nontechnical description of cultured meat production vs. general description of conventional meat production), perceived naturalness of cultured or conventional beef (mediator)</p>	<p><b>Study 1:</b> Perceived naturalness of traditional ground beef (mediator) and willingness to consume traditional ground beef</p> <p><b>Study 2:</b> Perceived naturalness of cultured or conventional beef, disgust toward cultured or conventional beef, willingness to eat/regularly buy cultured or conventional beef</p>	<p><b>Study 3:</b> Perceived naturalness of traditional or in-vitro meat mediates the perceived risk of colon cancer on the acceptability of this risk, with in-vitro meat being perceived as less natural and the health risk associated with it thus considered less acceptable.</p> <p><b>Study 1:</b> Findings suggest that acceptance of cultured meat is low because it is considered unnatural. Informing participants of the production of cultured meat and its benefits increases acceptance of conventional meat.</p> <p><b>Study 2:</b> Describing cultured meat in a nontechnical way that focuses on the final product instead of the production method increases acceptance of cultured meat.</p>	Perceived naturalness of cultured or conventional meat
73. Verbeke et al. (2015)	Belgium, Portugal, and the United Kingdom	179	Focus groups (on- and offline)	Cultured meat	<p>Perceived personal benefits and risks of cultured meat consumption, perceived societal benefits and concern about societal consequences, initial reactions towards cultured meat (e.g., disgust or judging by its unnaturalness), uncertainty about scientific knowledge regarding cultured meat, perceived controllability and regulations regarding cultured meat, acceptance of scientific progress</p>	Not applicable	<p>When learning about cultured meat, participants initially felt disgust and considered it unnatural. Despite seeing few personal benefits regarding cultured meat, participants acknowledged benefits of cultured meat for the environment and global food security. Personal and societal risks were framed in terms of safety- and health-related uncertainties as well as possible negative consequences such as loss of farming and eating traditions and rural livelihoods. Participants were additionally sceptic about the inevitability of scientific progress and concerned about risk governance, control, and need for regulation and proper labelling.</p>	-

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Authors (year)	Country	Sample Size	Type of study	Protein source category	Independent/exploratory variables	Dependent/predicted variables	Outcomes	Most important factor(s) influencing consumer acceptance/responses
74. Wilks et al. (2019)	United States	1193	Online survey	Cultured meat	Age, gender, household income, education level, meat consumption ('yes' or 'no'), political conservatism, degree of bias toward naturalness, speciesism, social dominance orientation, degree of distrust in science, conspiratorial ideation, degree of food neophobia, disgust sensitivity	Participants' willingness to eat cultured meat, likelihood of perceiving benefits of cultured (compared to farmed) meat, participants' (lack of) absolute opposition to cultured meat	Participants who were younger, male, less politically conservative, and who had lower levels of food neophobia were more willing to eat cultured meat. Furthermore, participants who were younger and male were more likely to perceive benefits of cultured (vs. farmed) meat. On the other hand, political conservatism, distrust in science and food neophobia were all negatively related to perceptions of cultured (compared to farmed) meat. Finally, participants who were older, female, and those higher in conspiratorial ideation, food neophobia and (food- and hygiene-related) disgust sensitivity were more likely to agree with the statements (regarding cultured meat) "This should be prohibited no matter how great the benefits and minor the risks are from allowing it" and "It is equally wrong to allow some of this to happen as it is to allow twice as much to happen. The amount doesn't matter".	Age, gender, political conservatism, degree of distrust in science, degree of conspiratorial ideation, degree of food neophobia, disgust sensitivity
<b>(Partially) plant-based meat alternatives</b>								
75. Elzerman, Hoek, Van Boekel, and Lumng (2011)	The Netherlands	93	Experiment	Meat substitutes	Meal context in which meat substitute is served to participant, flavour of meat substitute, texture of meat substitute, form in which meat substitute was served (minced or in pieces), participants' tasting of the meal	Overall liking of individual meat substitute, overall liking of meat substitute within meal, product liking, perceived appropriateness of meat substitute within meal, intention to use a dish with meat substitutes	Meal context influenced the perceived appropriateness and liking of meat substitutes. Furthermore, appropriateness seemed to be influenced more by the appearance of the meat substitute-meal combination than by the meat substitute's texture and flavour. Lastly, pre-tasting appropriateness ratings of meat substitutes within a meal influenced the acceptance of the meal.	Perceived appropriateness of meat substitute-meal combination
76. Hoek et al. (2011)	The Netherlands and United Kingdom	553	Survey	Meat substitutes; vegetable based food products that contain proteins	Food choice motives, attitudes, beliefs, food neophobia	Acceptance of meat substitutes	Consumer acceptance was largely determined by the attitudes and beliefs towards meat substitutes and food	In order to make meat substitutes more attractive to meat consumers, we would not recommend to focus on

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77. Hoek et al. (2013)	The Netherlands	89	Experiment	Meat substitutes made from pulses (mainly soy), cereal protein, or fungi.	Age, gender, food neophobia, variety seeking, prior frequency of meat substitute consumption, prior frequency of chicken consumption, repeated exposure to meat (substitute) product, type of product eaten (chicken vs. meat substitute), type of meal used to accompany meat (substitute) product	Desire to eat product, liking of product, boredom with product, eaten amount (of product)	neophobia. Key barriers for non-users and light/medium-users were the unfamiliarity with meat substitutes and the lower sensory attractiveness compared to meat. In addition, non-users had a higher tendency to avoid new foods. Hence, the less consumers were using meat substitutes, the more they wanted these products to be similar to meat. Although non-users and light/medium-users did recognize the ethical and weight-control aspects of meat substitutes, this was obviously less relevant to them. Actually, only heavy-users had high motivations to choose ethical foods, which explains their choice for meat substitutes. After the repeated exposure period, liking scores for chicken, tofu and Quorn were not significantly different, and liking for all three products decreased significantly over time. On average, participants ate 2/3 of the product, and this did not significantly decrease over time for any of the 3 product groups. Over time, most tofu-eating participants exhibited a mere-exposure pattern of increased liking, whereas chicken-eating participants showed a pattern of increased boredom with the product. The Quorn group was in-between, with a slight majority exhibiting a pattern of boredom with the product over time.	communication of ethical arguments, but to significantly improve the sensory quality and resemblance to meat.
43								Type of product eaten (chicken vs. meat substitute), prior frequency of meat substitute consumption, prior frequency of chicken consumption

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Authors (Year)	Country	Sample Size	Type of study	Protein source category	Independent/exploratory variables	Dependent/predicted variables	Outcomes	Most important factor(s) influencing consumer acceptance/responses
78. Gravelly and Fraser (2018)	Canada	Seven supermarkets, 24 consumers, 5 key informants	Survey	Alternative, plant-based protein sources	Supermarkets' shelf space allotments for plant-based protein products (meters of shelf space), supermarkets' promotion of plant-based protein products (presence vs. absence of special sales or descriptive signs), plant-based product shelf location in supermarket, consumers' perceptions of protein source availability in supermarkets, familiarity of consumers with supermarket, consumers' shopping strategies concerning protein products	Ease with which consumers were able to find a protein source in a supermarket, consumers' choice of protein sources	<p>accompany the meat (substitute) product. Food neophobia and variety seeking did not affect product boredom or mere exposure patterns. Previous substitutes was associated with higher liking scores for this product, whereas using more types of meals to accompany the product was associated with lower liking scores.</p> <p>Supermarkets allocated significantly more shelf space to animal-based compared to plant-based protein products. Consumers found it slightly more satisfying as well as easier to shop for animal-based protein sources. There were also more promotions for animal-based compared to plant-based protein sources.</p> <p>Plant-based protein sources were most commonly present in the grocery aisles of supermarkets.</p> <p>Shelf location of plant-based protein sources possibly limited the extent to which consumers discovered these products. Additionally, conventional retailers tended to devote more retail space, sales and promotional signage to plant-based protein sources (especially for plant-based meat and dairy substitutes) than did discount retailers.</p>	Supermarkets' shelf space allotments for plant-based protein products (meters of shelf space), supermarkets' promotion of plant-based protein products (presence vs. absence of special sales or descriptive signs), plant-based product shelf location in supermarket, consumers' shopping strategies concerning protein products
79. Schösler et al. (2014)	The Netherlands	1083	Online survey	Meat substitutes/ plant-based protein products	Gender, age, Body Mass Index (BMI), household size, education level, community size, types of food-related motivation (e.g., participants' response to the statement "I feel happy when I have time and attention to cook")	Number of meat-eating days per week, reason for eating low/high amount of meat, degree to which one's household buys organic/free-range meat, degree to which one's household buys meat substitutes, preferences for animal- vs. plant-based foods	<p>Difference in type of food-related motivation predicted differences in meat consumption amount and frequency, frequency of buying organic/free-range meat, frequency of buying meat substitutes, reasons for not (frequently) eating meat,</p>	Internalised food-related motivation, intrinsic enjoyment of eating and cooking

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Authors (year)	Country	Sample Size	Type of study	Protein source category	Independent/exploratory variables	Dependent/predicted variables	Outcomes	Most important factor(s) influencing consumer acceptance/responses
80. Siegrist and Hartmann (2019)	Switzerland	5586	Online survey	Meat substitutes (including a wider range of meat substitutes than only plant-based)	Ratings of the environmental impact of different foods, health consciousness, food disgust sensitivity, gender, age, household income, education level	Consumption frequency for (organic) meat and meat substitutes, frequency of purchasing organic meat	and preference for plant-based vs. animal-based protein foods. Internalised motivation was the most influential factor in this regard, followed by intrinsic enjoyment of eating and cooking. Participants who were more likely to consume meat substitutes were female (vs. male), younger and more highly educated, and had a lower meat consumption frequency, viewed meat as having a big environmental impact, were very health-conscious, and were low in food disgust sensitivity. Consumption of organic meat was positively influenced by high health consciousness, being female, being older, having a higher income and education level, and viewing conventionally produced meat as having a big environmental impact. Disgust sensitivity negatively influenced organic meat consumption frequency. Lastly, although meat and meat substitute consumption correlated negatively, this correlation was weak.	Ratings of the environmental impact of different foods, health consciousness, food disgust sensitivity, gender, age, household income, education level
81. Weinrich (2018)	Germany, France & The Netherlands	43 (13 in Germany, 16 in France, 14 in NL)	Focus groups	Meat substitutes (including a wider range of meat substitutes than only plant-based)	Age, gender, education level, net household income, previous meat substitute consumption (as well as the types of meat substitute), other types of meat substitutes; participants could think of potential reasons for (not) substituting meat (with a substitute), potential reasons for drivers or barriers for (not) substituting meat, attributes of currently-available meat substitutes liked/not liked, acceptable/unacceptable price level for a meat substitute, participants' ranking of top 3 reasons for	Not applicable.	Participants were concerned about the additives in and artificiality of meat substitutes and about the possibility that the essential vitamins and micronutrients gained from meat substitutes might be insufficient. Additionally, the taste of meat was mentioned as a reason for not substituting it with meat substitutes. The fact that participants' eating habits appeared to be fixed and that they focused in convenience (in consumption) were also possibly barriers to	Not applicable.

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Authors (year)	Country	Sample Size	Type of study	Protein source category	Independent/exploratory variables	Dependent/predicted variables	Outcomes	Most important factor(s) influencing consumer acceptance/responses
82. Apostolidis & McLeay (2016)	UK	247	Choice experiment	Meat substitute products (including a wider range of meat substitutes than only plant-based)	and against substituting meat with meat substitutes Demographics, Attributes choice experiment: Fat content, Carbon footprint, Type of mince, Method of production, Price, Origin	Product choice	consuming meat substitutes instead of meat. The type of mince, fat content, country of origin and price are major factors that influence choice. Carbon footprint, method of production and brand play a secondary role in determining consumers' choices of meat/meat substitutes. Latent class analysis is used to identify six consumer segments; price conscious, healthy eaters, taste driven, green, organic and vegetarian consumers which have different socio-demographic characteristics and meat consumption patterns.	The type of mince, fat content, country of origin and price are major factors that influence choice
<b>Multiple meat alternatives</b>								
83. Bryant et al. (2019) A survey ...	United States, India and China	3030 (US: 987, India: 1024, China: 1019)	Online survey	Cultured meat and plant-based meat	Participants' diet (e.g., vegan), frequency of meat consumption, food neophobia, political views, income, familiarity with clean (cultured) meat, meat attachment, attitudes toward clean meat (e.g., in terms of healthiness, ethics and appeal).	Intention to purchase clean meat, intention to purchase plant-based meat	In the US, pescatarians, vegetarians and vegans had a significantly lower intention to purchase clean meat compared to omnivores. Purchase intention was also higher for politically left-leaning participants and for those more familiar with clean meat. Lower food neophobia predicted higher purchase intent for both clean and plant-based meat. Higher disgust predicted lower purchase intention, whereas perceived appeal and goodness of clean meat predicted higher purchase intention. For plant-based meat in the US, more politically liberal participants and those more familiar with the product had a higher intention of buying it. Participants more attached to (conventional) meat were less inclined to buy plant-based meat. Lastly, perceived appeal of, excitement about, and low disgust toward plant-based	Participants' diet (e.g., vegan), frequency of meat consumption, food neophobia, political views, income, familiarity with clean (cultured) meat, meat attachment, attitudes toward clean meat (e.g., in terms of healthiness, ethics and appeal).

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Authors (year)	Country	Sample Size	Type of study	Protein source category	Independent/exploratory variables	Dependent/predicted variables	Outcomes	Most important factor(s) influencing consumer acceptance/responses
84. de Boer et al. (2013)	The Netherlands	1083	Survey	Legumes, seaweed, hybrid meat	Meat and fish consumption habits, taste-oriented food choice motives, reflection-oriented food choice motives, gender, age, education level, community size	Choice of snacks	meat predicted higher purchase intent. Taste-oriented food choice motives were associated with increased likelihood of choosing snacks from lentils, insects and seaweed, compared to choosing hybrid meat (part meat, part meat substitute). Reflection-oriented food choice motives were associated with increased likelihood of choosing snacks from lentils and seaweed, compared to choosing hybrid meat. Participants with high meat consumption were less likely to choose snacks from lentils and seaweed, whereas fish consumers were more likely to choose seaweed snacks. Higher education level and more urban living environment were associated with choosing lentil and seaweed snacks. Participants were much less willing to taste insect snacks compared to the other snacks.	Taste-oriented food choice motives, reflection-oriented food choice motives, meat and fish consumption habits
85. Circus and Robinson (2019)	United Kingdom	139	interviews and an online survey	Cultured meat, insects, plant-based meat substitutes	Based on the interviews specific personal drivers, personal barriers, global drivers and global barriers for cultured meat, insects and plant-based substitutes were developed	willingness to consume the three alternative proteins	Findings indicated that plant-based substitutes were favoured for personal consumption for moral and ethical reasons and edible insects were least favoured due to aversion. Meat attachment was significantly associated with personal willingness to consume alternative proteins in each of the three cases. Results challenged previous research that had proposed that when considering the effectiveness of certain alternatives in addressing global environmental issues, people may advocate them but not want to consume them personally. Results imply that the congruity of	This study has demonstrated an association between one's attachment to conventional meat and perception of alternative proteins and has highlighted the complexity of interactions between personal preference and more global perspectives.

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Authors (year)	Country	Sample Size	Type of study	Protein source category	Independent/exploratory variables	Dependent/predicted variables	Outcomes	Most important factor(s) influencing consumer acceptance/responses
86. Gómez-Luciano et al. (2019)	Spain and the Dominican Republic	401 (201 from the Dominican Republic, 200 from Spain)	Online and face-to-face survey	Cultured meat, insects	Gender, year of birth/age, education level, location of residence (rural vs. urban), presence (vs. absence) of food allergies, beliefs regarding the health and nutritional benefits of meat, views on the sensory experience of meat, attitudes concerning the healthiness, environmental effects and convenience of foods, frequency of meat consumption, self-estimated future meat consumption, attitudes toward and beliefs about meat	Willingness to try alternative protein sources, believes about how realistic plant-based diets are in the short-term (2030) and long-term (2050)	these perceptions is more complex. Of the Spanish participants, 15.5% believed meat was necessary for obtaining beneficial nutrients, whereas 43.5% thought that alternative protein sources could easily match the nutritional benefits of meat. Spanish women were significantly more willing to try plant-based diets than Spanish men, with the latter being generally unwilling to try plant-based proteins. Spanish women also considered plant-based diets realistic in the short-term and were willing to try mycoproteins. Spanish men were, however, likely to consider trying cultured meat. Spanish participants with a university-level education were more willing than those with other education levels to try plant-based alternative proteins. Spanish participants aged 16–27 were more likely to consider a diet of plant-based alternative proteins realistic in the long-term, and they were also more likely to consider mycoproteins an unrealistic alternative. Lastly, they were more likely to be unwilling to try cultured meat.	Gender, education level, age
87. Grasso et al. (2019)	United Kingdom, The Netherlands, Poland, Spain, and Finland	1825	Online survey	Insects, cultured meat, algae	Frequency of consumption for various protein sources (e.g., legumes, cheese), dietary regime (e.g., vegetarian), selectiveness in accepting foods ('food fussiness'), food choice motives (e.g., convenience), environmentally conscious/'green' eating behaviour, gender, age group, country of residence (of the 5 countries in this study), education level, perceived financial	Acceptance of/willingness to consume various protein sources (e.g., plant- and insect-based proteins)	Plant-based proteins were the most accepted alternative protein source, whereas insect- and in vitro meat-based proteins were the least accepted alternative protein sources. Green eating behaviour and higher education are positively related to the acceptance of alternative, sustainable protein sources. Selectiveness/fussiness in food choice, on the other	Food fussiness, food choice motives, green eating behaviour

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Authors (year)	Country	Sample Size	Type of study	Protein source category	Independent/exploratory variables	Dependent/predicted variables	Outcomes	Most important factor(s) influencing consumer acceptance/responses
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88. Iannuzzi et al. (2019)	Italy	587 (first and second sections of survey), 175 (third section of survey) It is unclear whether these numbers overlap or not	Online survey	Insects, algae	situation, living condition (e.g., 'lives alone'), responsibility for food purchases (e.g., 'Does most of food shopping'), health status	Participants' choice of pizza profile (pizza with specific combination of ingredients)	hand, is negatively related to acceptance of alternative protein sources. Female (compared to male) older adults were less likely to accept insect-based proteins, single-cell based proteins (e.g., algae) and in vitro meat-based protein sources. Country of residence also influenced acceptance of alternative protein sources. The sensory motive for choosing/eating food (i.e., attaching importance to sensory attributes of food) negatively influenced older adults' acceptance of single-cell- and insect-based protein sources. Valuing health while making food choices was positively related to acceptance of plant-based protein sources. Furthermore, older adults who attached weight to product prices while selecting food were more likely to accept in vitro meat-based protein sources. Sustainability and convenience food choice motives did not significantly affect acceptance of alternative protein sources. Making participants aware of the hidden ingredients of a pizza (cricket flour and/or spirulina algae) changed their choice of pizza. After the revelation of hidden ingredients, the pizza with cricket flour was chosen least, and the pizza with traditional ingredients, plus spirulina algae, was chosen most.	Participants' awareness of hidden/novel pizza ingredients
89. Onwezen, van den Puttelaar, Verain, and Veldkamp (2019)	The Netherlands	Study 1: 2461 Study 2: 2771 Study 3: 1001	Study 1: Experiment Study 2: Experiment Study 3: Experiment	Insects, seaweed, cultured meat, pulses	Study 1: Specific product participants were asked questions about (fish, seaweed, pulses, insects, or cultured meat), food choice motives, positive	Study 1: Perceived innovativeness of product, intention to eat product, intention to buy product Study 2:	Study 1: Insects and seaweed (compared to pulses and fish) were considered the most innovative product categories, whereas cultured	Study 1: Positive and negative emotional responses to product Study 2: Positive and negative

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Authors (year)	Country	Sample Size	Type of study	Protein source category	Independent/exploratory variables	Dependent/predicted variables	Outcomes	Most important factor(s) influencing consumer acceptance/responses
					and negative emotional responses to product, disgust towards product, attitude, injunctive norm, intention and perceived behavioural control regarding the buying of the product, ambivalence towards buying the product	Perceived innovativeness of product, intention to eat product, intention to buy product	meat was considered less innovative than insects. Seaweed and insects were considered equally innovative.	emotional responses to product
					<b>Study 2:</b> Specific product participants were asked questions about (fresh insects, dried insects, fried insects, processed insects, fresh insects as feed, or processed insects as feed, or meat burgers), food choice motives, positive and negative emotional responses to product, disgust towards product, attitude, injunctive norm, intention and perceived behavioural control regarding the buying of the product, ambivalence towards buying the product, concern for animal welfare	<b>Study 3:</b> Intention to eat (insect) product	Positive emotions, followed by disgust, are the most important predictors of product acceptance at the category level. Additionally, ambivalence had significant added value on the product-specific level. Affective factors have a significant added value for predicting acceptance of insects and seaweed, but not for pulses and fish. The influence of ambivalence and disgust towards insects on the acceptance of this product category seems to at least partially be accounted for by perceived innovativeness of insects.	emotional responses to product, personal norms regarding one's health/the environment, type of message given to participants (cognitive vs. affective)
					<b>Study 3:</b> Specific product participants were asked questions about (insect-based burger, burger made from chicken that was fed insects or chicken burger), type of message given to participants (cognitive vs. affective), type of message content (health, environment, or both), food choice motives, positive and negative emotional responses to product, disgust towards product, attitude, injunctive norm, intention and perceived behavioural control regarding the buying of the product, ambivalence towards buying the product, personal norms regarding one's health/the environment		The affective variables had added predictive value (for product acceptance) relative to the Theory of Planned Behaviour-variables and food choice motives. Affective variables also appear to have more influence on the acceptance of more insect-based (compared to less insect-based or more traditional) products, suggesting that emotional responses may be especially relevant for innovative protein products.	

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Authors (year)	Country	Sample Size	Type of study	Protein source category	Independent/exploratory variables	Dependent/predicted variables	Outcomes	Most important factor(s) influencing consumer acceptance/responses
90. Slade (2018)	Canada	533	Online survey	Cultured meat, plant-based meat	Purchase frequency of meat, burgers and meat substitutes, importance of price, taste, healthiness, social impact, environmental impact and animal welfare in purchase decision, support for genetically modified, organic, local or processed food, attitudes (e.g., toward farming, other food technologies), vegetarianism, acquaintance with a vegetarian, age, education level, income, gender	Willingness to purchase plant-based and cultured meat burgers	<p>affective) framing of messages did not influence consumer acceptance. However, participants with weak (vs. strong) personal health or environmental norms were more willing to eat burgers when these burgers were accompanied by an affective (vs. cognitive) message.</p> <p>Willingness to purchase plant-based or cultured meat burgers is related to age, gender, views of other food technologies and attitudes towards the environment and agriculture. Although participants were informed that all burgers tasted the same, 65 percent would purchase the beef burger, 21 percent would purchase the plant-based burger, 11 percent the cultured meat burger, and 4 percent purchase nothing.</p> <p>Preferences for plant-based and cultured meat burgers are highly correlated.</p>	Age, gender, views of other food technologies, attitudes towards the environment and agriculture
91. Tucker (2014)	New Zealand	69	Focus Groups	Cultured meat and insects	Stated reasons for willingness to consume (specific types of) genetically modified produce, in vitro meat, nose-to-tail products, and products falling under the extend living protein range (e.g., insects, feral cats, and rabbits)	Willingness to consume (specific types of) genetically modified produce, in vitro meat, nose-to-tail products, and products falling under the extend living protein range (e.g., insects, feral cats, and rabbits)	<p>Ecological reasons for considering the consumption of meat alternatives or alternative protein sources is acknowledged and considered important by most participants. However, applying these views in practice is hindered by recurrent sensory objections to the consumption of protein-based foods or reduction of meat consumption.</p>	Ecological reasons for considering alternative protein sources or meat alternatives, sensory objections to protein-based foods or meat reduction

Authors (year)	Country	Sample size	Type of study	Alternative protein	Most important factor(s) influencing consumer acceptance
<b>Pulses</b>					
1. Allegra et al. (2015)	Italy	197	Questionnaire survey	Legumes	Age and specific motivation for legume consumption (memory vs. impulse)
2. Figueira et al. (2019)	Australia	505	Online survey	Legumes	–
3. Lea et al. (2005)	Australia	50	Focus group interviews	Legumes/pulses, nuts (among other plant foods)	Health-related benefits of plant foods, preparation time of (preparation of) plant foods
4. Lemken et al. (2017)	Germany	1020	Online experiment	Legumes/pulses	Mix of health and environmental claims associated with product
5. Melendrez-Ruiz et al. (2019)	France	120	Experiment	Pulses	Scenario employed during dish-composition task
6. Vainio et al. (2016)	Finland	1048	Survey	Beans and soy	Adherence to a specific diet, motives relating to environmental concerns, health and weight control
7. Warne et al. (2019)	United States & Canada	138	Survey/ experiment	Pulses (lentils)	age, lentil consumption frequency, provision of information on the environmental, economic and nutritional aspects of lentil production
<b>Algae</b>					
8. Birch et al. (2019b)	Australia	521	Online survey	Algae (seaweed)	Food neophobia
9. Birch et al. (2019a)	Australia	521	Online survey	Algae (seaweed)	Food neophobia
10. Brayden et al. (2018)	United States	2155	Survey	Seaweed	Source, certification, origin and price of seafood products
11. Lucas et al. (2019)	France	Survey: 123 Survey: 495	(Online) survey	Seaweed	Location of seaweed consumption/purchase
12. Moons et al. (2018)	Belgium	1325	Survey	Algae	Health consciousness, willingness to compromise on taste
13. Weinrich and Eshiewy (2019)	Germany, The Netherlands, & France	940 (315 in Germany, 308 in NL, 315 in France)	Experiment	Meat substitutes based on micro-algae	Meat consumption habit/frequency, whether or not the meat substitute was organic/local, degree to which meat substitute was less environmentally impactful compared to pork/beef, attitudes toward meat and meat substitutes
<b>Insects</b>					
14. Adámek et al. (2018)	Czech Republic	96	Survey	Insects	Beliefs about insects as food (e.g., in terms of healthiness)
15. Ali (2016)	United States	116	Online survey	Insects	Visibility of insects within pictured food products
16. Baker et al. (2016)	United States	<b>Study 1:</b> 221 <b>Study 2:</b> 200 <b>Study 3:</b> 201	Experiments	Insects	Product image and description, consumption setting
17. Balzan et al. (2016)	Italy	32	Focus group interviews	Insects	Preparation form of insect-based food, experience with preparing insect-based food
18. La Barbera et al. (2019)	Not specified (most likely a west-European country, perhaps Italy)	280	Online survey	Insects	Food neophobia is a better predictor (compared to disgust sensitivity) of intention to try processed insects and animals fed with insects. However, disgust sensitivity appears to be a better predictor of intention to introduce raw insects into own daily diet.
19. Barton et al. (2020)	(Atlantic) Canada	Survey: 107 Experiment: 102	Survey/ experiment	Insects	Participants' tasting of protein powders (some containing cricket powder)
20. Barsics et al. (2017)	Belgium	135	Experiment	Insects	Presence (versus absence) of label indicating insect ingredient in bread, information session attendance, Price of mealworm burger/truffle, expected quality of mealworm burger/truffle
21. Berger et al. (2018)	Germany	<b>Study 1:</b> 80 <b>Study 2:</b> 160	Experiments	Insects	
22. Berger et al. (2019)	<b>Study 1:</b> Switzerland <b>Study 2:</b> Germany	<b>Study 1:</b> 120 <b>Study 2:</b> 90	Experiments	<b>Studies 1 &amp; 2:</b> Insects	<b>Study 1:</b> Participants' exposure to positive, negative, or neutral peer ratings of a nutrition bar (secretly containing mealworm) <b>Study 2:</b> Participants' exposure to a high, middle, or low rating of a mealworm burger by an expert, insect-based disgust sensitivity
23. Caparros Megido et al. (2016)	Belgium	79	Experiment	Insects	Gender, previous experience with insect consumption
24. Cavallo and Materia (2018)	Italy	135	Online experiment	Insects	Visibility of insect shape, cacao flavour, neophobia, sustainability certification, education level
25. Cicatiello et al. (2016)	Italy	201	Survey	Insects	Familiarity with foreign food, education level, gender, experience with eating insect food
26. de-Magistris et al. (2015)	The Netherlands	155	Choice experiment	Insects	Product nutritional claim and logo, visibility of insect in food product.
27. Fisher & Steenbekkers (2018)	The Netherlands	140	Quasi-experimental study	Insects	Degree to which insect products are marketed in one's own culture, disgust and affective attitudes towards eating insects
28. Gallen et al. (2019)	France	37	Experiment	Insects	Degree to which insect product had been processed, type of insect flavouring
29. Gere et al. (2017)	Hungary	400	Online survey	Insects	Desire for new food alternatives, intention to reduce meat intake, food neophobia
30. Hartmann et al. (2015)	Germany and China	502 (Germany), 443 (China)	Survey	Insects	Ethnicity, preparation of edible insect (processed or unprocessed), food neophobia, perceived social acceptance, taste expectations, previous insect consumption
31. Hartmann and Siegrist (2016)	Switzerland	104	Experiment	Insects	Cookie content (cricket flour vs. corn flour)

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Authors (year)	Country	Sample size	Type of study	Alternative protein	Most important factor(s) influencing consumer acceptance
32. House (2016)	The Netherlands	33	Semi-structured interviews	Insects	Price, taste and availability of insect-based food, degree of fit between insect food and current eating patterns
33. Jensen and Lieberoth (2019)	Denmark	189	survey and sensory test	Insects	Perceived social norm regarding insect consumption
34. Kornher et al. (2019)	Germany	311	Experiment	Insects	Food neophobia, attention paid to CO2 emissions of food production importance attached to health statements on food products frequency of weekly meat consumption
35. La Barbera et al. (2018)	Italy	118	Experiment	Insects	Disgust experienced towards insect-eating
36. Laureati et al. (2016)	Italy	341 (68 in experiment)	Survey, experiment	Insects	Age, gender, cultural background, food neophobia
37. Lammers et al. (2019)	Germany	516	Online survey	Insects	Food neophobia, food disgust, previous insect consumption
38. Lensvelt and Steenbekkers (2014)	The Netherlands and Australia	Survey: 209 Experiment: 133	Online survey, experiment	Insects	Price, quality, convenience, and naturalness of insect food, environmental benefits of insect-eating, trying insect food
39. Lombardi et al. (2019)	Italy	200	Experiment	Insects	Food neophobia, beliefs and attitudes about insects, specific information about insects provided to participants
40. Menozzi et al. (2017)	Italy	231	Survey	Insects	Attitudes and perceived behavioural control, intention to eat insects, belief that eating insects benefits health and environment, disgust towards (eating) insects, lack of availability of insect food, incompatibility of insect products with local food culture
41. Myers and Pettigrew (2018)	Australia	77	Interviews	Insects	Knowledge/awareness of environmental and nutritional advantages of entomophagy, perceived cultural norms regarding entomophagy
42. Orkusz et al. (2020)	Poland	Survey: 464 Sensory test: 402	Survey, sensory test	Insects	Food neophobia
43. Orsi et al. (2019)	Germany	393	Online survey	Insects	Food neophobia, disgust towards insects, visibility of insects in food product
44. Palmieri et al. (2019)	Italy	456	Online survey	Insects	Concern for health-related and environmental effects of food, food neophobia/neophilia, food technophobia, previous insect-based food consumption, motives for eating insects, perception of health-related risks of insect consumption
45. Piha et al. (2018)	Finland, Sweden, Germany, Czech	887	Online survey	Insects	Subjective and objective knowledge of product, product-related experience, food neophobia, general attitudes toward product
46. Poortvliet et al. (2019)	The Netherlands	130	Experiment	Insects	Product type, food choice motives
47. Powell et al. (2019)	United Kingdom	510	Experiment	Insects	Trait disgust propensity, participants' evaluation of product attributes
48. Rumpold and Langen (2019)	Germany	149	Survey, sensory test	Insects	Provision to participants of a random piece of information about edible insects
49. Schäufele et al. (2019)	Germany	342	Experiment	Insects	Perceived social acceptability of eating insects
50. Schlup and Brunner (2018)	Switzerland	379	Survey	Insects	Convenience orientation, discernibility of insects in food, expected food healthiness, need for familiarity, food neophobia, food technology neophobia, perceived health benefits of meat, gender and prior consumption of insects
51. Sogari (2015)	Italy	46	Experiment	Insects	Curiosity about eating insects, perceived environmental benefits of eating insects
52. Sogari et al. (2016)	Italy	109	Focus group	Insects	Curiosity about eating insects, disgust towards insects, opinions of family and friends
53. Sogari et al. (2018)	Italy	88	Experiment	Insects	Gender, tasting of insect products (jelly based on cricket flour or jelly with whole, visible cricket)
54. Sogari, Bogueva & Marinova (2019)	Australia	survey 1: 227 survey 2: 328	Online surveys	Insects	Self-reported potential reasons for including edible insects and insect-based products into one's diet, opinions on edible insects as an alternative food source, meat consumption frequency, gender
55. Sogari, Menozzi, and Mora (2019)	Italy	88	Experiment	Insects	Gender, food neophobia, initial exposure to edible insect products, willingness to try the edible insects
56. Tan et al. (2015)	Thailand and the Netherlands	54	Focus groups	Insects	Cultural exposure to insects as food, experiences with insects as food
57. Tan, Fischer, van Trijp, & Stieger (2016)	The Netherlands	103	Experiment	Insects	Perceived food appropriateness
58. Tan, Tibboel, & Stieger (2017)	The Netherlands	100	Experiment	Insects	Perceived food appropriateness
59. Tan, van den Berg, & Stieger (2016)	The Netherlands	976	Experiment	Insects	Perceived appropriateness of mealworms as food, specific product combination
60. Tan, Verbaan, & Stieger (2017)	The Netherlands	214	Experiment	Insects	Perceived appropriateness of food preparation

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Authors (year)	Country	Sample size	Type of study	Alternative protein	Most important factor(s) influencing consumer acceptance
61. Vanhonacker et al. (2013)	Belgium	221	Survey	Insects, soy	Awareness of and concern about environmental impact of animal production and meat consumption, enjoyment and frequency of meat consumption
62. Van Thielen et al. (2019)	Belgium	388	Telephone survey	Insects	Not applicable.
63. Verbeke (2015)	Belgium	368	Online survey	Insects	Food neophobia, intention to reduce fresh meat consumption, interest in environmental impact of food choices
64. Verneau et al. (2016)	Denmark and Italy	282	Experiment	Insects	Provision of information about individual vs. societal benefits of eating insects, implicit negative attitudes towards insect-eating
65. Wilkinson et al. (2018)	Australia	820	Online survey	Insects	Taste, appearance, safety and quality of edible insects, previous insect consumption
66. Woolf et al. (2019)	United States	397	Online survey	Insects	Previous ICF consumption
<b>Cultured meat</b>					
67. Bekker et al. (2017)	The Netherlands	<b>Study 1:</b> 190 <b>Study 2:</b> 194 <b>Study 3:</b> 192	Experiments	Cultured meat	Provision of positive versus negative information about cultured meat
68. Bryant et al. (2019) Strategies ...	United States	1185	Experiment	Cultured meat	Promotional messages/arguments concerning clean meat (specifically the 'conventional meat is unnatural'-message)
69. Bryant and Dillard (2019)	United States	480	Experiment	Cultured meat	Experimental framing of cultured meat.
70. Mancini and Antonioli (2019)	Italy	525	Online survey	Cultured meat	Prior familiarity with cultured meat, information provided to participants concerning cultured meat
71. Siegrist and Sütterlin (2017)	Switzerland	<b>Studies 1a, 1b, and 2:</b> 244 <b>Study 3:</b> 253	Experiments	Cultured meat	Information about e-numbers, information about health effects, perceived naturalness of traditional or in-vitro meat
72. Siegrist et al. (2018)	Switzerland	<b>Study 1:</b> 204 <b>Study 2:</b> 298	Experiments	Cultured meat	Perceived naturalness of cultured or conventional meat
73. Verbeke et al. (2015)	Belgium, Portugal, United Kingdom	179	Focus groups (on- and offline)	Cultured meat	–
74. Wilks et al. (2019)	United States	1193	Online survey	Cultured meat	Age, gender, political conservatism, distrust in science, conspiratorial ideation, food neophobia, disgust sensitivity
<b>(Partially) plant-based meat alternatives</b>					
75. Elzerman et al. (2011)	The Netherlands	93	Experiment	Meat substitutes	Perceived appropriateness of meat substitute-meal combination
76. Hoek et al. (2011)	The Netherlands and United Kingdom	553	Survey	Meat substitutes; pulses (mainly soy), cereal, or fungi.	not recommend to focus on communication of ethical arguments, but to significantly improve the sensory quality and resemblance to meat.
77. Hoek et al. (2013)	The Netherlands	89	Experiment	Meat substitutes	Type of product eaten (chicken vs. meat substitute), prior frequency of meat substitute consumption, prior chicken consumption
78. Gravely and Fraser (2018)	Canada	7 supermarkets, 24 consumers, 5 key informants	Survey	Alternative, plant-based protein sources	Supermarkets' shelf space allotments for plant-based protein products (meters of shelf space), supermarkets' promotion of plant-based protein products (presence vs. absence of special sales or descriptive signs), plant-based product shelf location in supermarket, consumers' shopping strategies
79. Schösler et al. (2014)	The Netherlands	1083	Online survey	Meat substitutes/ plant-based protein products	Internalised food-related motivation, intrinsic enjoyment of eating and cooking
80. Siegrist and Hartmann (2019)	Switzerland	5586	Online survey	Meat substitutes (not only plant-based)	Ratings of the environmental impact of different foods, health consciousness, food disgust sensitivity, gender, age, household income, education level
81. Weinrich (2018)	Germany, France & The Netherlands	43	Focus groups	Meat substitutes (not only plant-based)	Not applicable.
82. Apostolidis & McLeay (2016)	UK	247	Choice experiment	Meat substitutes (not only plant-based)	The type of mince, fat content, country of origin and price are major factors that influence choice
<b>Multiple meat alternatives</b>					
83. Bryant et al. (2019) A survey ...	United States, India and China	3030	Online survey	Cultured meat and plant-based meat	Participants' diet (e.g., vegan), frequency of meat consumption, food neophobia, political views, income, familiarity with clean (cultured) meat, meat attachment, attitudes toward clean meat (e.g., in terms of healthiness, ethics and appeal).
84. de Boer et al. (2013)	The Netherlands	1083	Survey	Legumes, seaweed, hybrid meat	Taste-oriented food choice motives, reflection-oriented food choice motives, meat and fish consumption habits
85. Circus and Robinson (2019)	United Kingdom	139	interviews and an online survey	Cultured meat, insects, plant-based meat substitutes	attachment to conventional meat, and highlighted the complexity of interactions between personal preference and more global perspectives.
86. Gómez-Luciano et al. (2019)	Spain and the Dominican Republic	401	Online and face-to-face survey	Cultured meat, insects	Gender, education level, age
87. Grasso et al. (2019)	UK, Netherlands, Poland, Spain, Finland	1825	Online survey	Insects, cultured meat, algae	Food fussiness, food choice motives, green eating behaviour

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Authors (year)	Country	Sample size	Type of study	Alternative protein	Most important factor(s) influencing consumer acceptance
88. Iannuzzi et al. (2019)	Italy	587	Online survey	Insects, algae	Participants' awareness of hidden/novel pizza ingredients
89. Onwezen, van den Puttelaar, et al. (2019)	The Netherlands	<b>Study 1:</b> 2461 <b>Study 2:</b> 2771 <b>Study 3:</b> 1001	Experiments	Insects, seaweed, cultured meat, pulses	<b>Study 1–3:</b> Positive and negative emotional responses to product <b>Study 3:</b> Personal norms regarding one's health/the environment, type of message given to participants (cognitive vs. affective)
90. Slade (2018)	Canada	533	Online survey	Cultured meat, plant-based meat	Age, gender, views of other food technologies, attitudes towards the environment and agriculture
91. Tucker (2014)	New Zealand	69	Focus Groups	Cultured meat and insects	Ecological reasons for considering alternative protein sources or meat alternatives, sensory objections to protein-based foods or meat reduction

## Ethical statement

The current manuscript involves a systematic review. We did not collect data by ourselves and therefore our research did not involve human participants, human material, or human data in any direct way. Subsequently a statement on ethics approval is not required.

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