Institute of Psychology
Polish Academy of Sciences

Graduate School for Social Research

Institute of Psychology, Polish Academy of Sciences

# Psychological and social barriers to the acceptance of insect-based food: labelling, information, and social perception

[Bariery psychologiczne i społeczne w akceptacji żywności na bazie owadów: etykietowanie, informacje, i percepcja społeczna]

mgr Katarzyna Goncikowska

Doctoral thesis under the supervision of
prof. dr hab. Wojciech Pisula
dr hab. Klaudia Modlińska, prof. IP PAN

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**Abstract**

This dissertation examined the psychological and social determinants of consumer acceptance of insect-based food in Poland. Across the four publications, acceptance was treated as multidimensional rather than as a single, fixed attitude, with affective, cognitive, and social factors influencing contact with the product, its purchase, and its consumption. Three quantitative studies and one qualitative study addressed four aims; (1) how the influence of labelling and the visual presence of insect ingredients affect acceptance (behavioural experiment, $N = 99$); (2) how general acceptance of insects as a meat/protein substitute relates to personal willingness to consume them at the population level (nationally representative Polish sample, $N = 1,096$); (3) whether informational framing (nutritional or environmental) reduces affect-driven rejection (online experiment, $N = 659$); and (4) how the figure of the insect consumer is socially constructed (reflexive thematic analysis, $N = 19$).

Four main findings emerged across the cycle. First, the label "contains insects" suppressed willingness to eat the product regardless of whether insects were visible, indicating idea-based rather than sensory rejection. Second, a significant discrepancy was observed between the general acceptance of insect protein and personal intention to consume it, and this gap widened due to food neophobia and disgust sensitivity. Third, informational materials failed to alleviate negative product assessments; products entirely lacking insect references were evaluated most positively, and prior positive attitudes towards entomophagy and variety-seeking traits were the main predictors of acceptance, whereas food neophobia and disgust had little impact on willingness to try. Fourth, eating insects was treated as a socially visible act, as the insect consumer was stereotyped in terms of normality, conformity and perceived status, with observers' disgust appearing to play a prominent role in shaping these attributions. Together, these findings suggest that rejection of insect-based food in this cultural context is an affectively grounded and socially reinforced, and is therefore unlikely to be overcome by information alone. Insect consumption is further embedded in processes of social construction and stereotyping of the person who incorporates insects into their diet, in which moral disgust might serve a central function.

*Keywords*: entomophagy, insect-based food, disgust, neophobia, food labelling, social perception, stereotyping, affect heuristic

## Streszczenie

Niniejsza rozprawa doktorska podejmuje zagadnienie czynników psychologicznych i społecznych kształtujących akceptację żywności na bazie owadów wśród konsumentów w Polsce. W czterech wchodzących w jej skład publikacjach, akceptacja została ujęta nie jako pojedyncza, stała postawa, lecz jako efekt procesów afektywnych, poznawczych i społecznych, które wspólnie kształtują gotowość konsumenta do kontaktu z żywnością zawierającą owady, jej nabywania oraz spożywania.

Trzy badania ilościowe i jedno badanie jakościowe odpowiadały na następujące cztery cele badawcze: (1) jak wpływ informacji na etykiecie oraz wizualna obecność składników owadzich wpływają na akceptację produktu (eksperyment behawioralny, $N = 99$); (2) jak ogólna akceptacja owadów jako substytutu mięsa wiąże się z deklarowaną osobistą gotowością do ich spożywania (ogólnopolska próba reprezentatywna, $N = 1\ 096$); (3) czy ramowanie informacyjne, żywieniowo-zdrowotne lub środowiskowe, redukuje niechęć do spożycia owadów (eksperyment online, $N = 659$); oraz (4) jak osoby niespożywające owadów konstruują społecznie postać osoby, która włącza produkty z owadami do swojej diety (refleksyjna analiza tematyczna, $N = 19$).

Na podstawie całego cyklu badań można sformułować cztery główne wnioski. Po pierwsze, etykieta informująca o zawartości owadów w produkcie obniżała gotowość do jego spożycia, niezależnie od tego, czy owady były w nim widoczne, co wskazuje na odrzucenie oparte na idei, a nie na bodźcu sensorycznym. Po drugie, odnotowano istotną rozbieżność między ogólną akceptacją produktu zawierającego białko owadzie a intencją jego spożycia. Rozbieżność ta była dodatkowo nasilana przez neofobię pokarmową oraz wrażliwość na obrzydzenie. Po trzecie, materiały informacyjne okazały się nieskuteczne w poprawie negatywnych postaw wobec oferowanych artykułów, przy czym najlepiej oceniano te warianty, które w żaden sposób nie nawiązywały do obecności owadów; głównymi determinantami akceptacji były wcześniejsze pozytywne nastawienie do entomofagii oraz poszukiwanie różnorodności w diecie; natomiast czynniki takie jak neofobia żywieniowa czy wstręt miały znikome znaczenie dla gotowości badanych do degustacji. Po czwarte, fakt spożywania przez daną osobę owadów został ujęty jako akt widoczny społecznie; postać konsumenta owadów podlegała stereotypizacji w kategoriach normalności oraz postrzeganego statusu społecznego; przy czym obrzydzenie jednostki wydaje się odgrywać istotną rolę w kształtowaniu tych atrybucji. Łącznie wyniki sugerują, że odrzucenie

żywności opartej na owadach w analizowanym kontekście kulturowym ma charakter emocjonalny i jest społecznie wzmacniane, co sprawia, że jego przezwyciężenie wyłącznie za pomocą interwencji informacyjnych wydaje się mało prawdopodobne. Spożywanie owadów osadzone jest w szerszych procesach społecznej konstrukcji i stereotypizacji osób stosujących inną niż uznawana za normę dietę, przy czym obrzydzenie moralne wydaje się pełnić znaczącą funkcję.

*Słowa kluczowe:* entomofagia, żywność zawierająca owady, obrzydzenie, neofobia pokarmowa, etykietowanie żywności, percepcja społeczna, stereotypizacja, heurystyka afektu

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# 1. Introduction

The global food system faces considerable pressure to identify sustainable and nutritious protein sources capable of supporting a projected population of over nine billion people (van Huis et al., 2013; Hunter et al., 2017). The subject of edible insects is being discussed with regard to its potential as a source (Lorini et al., 2021). They have been shown to be rich in protein, essential fatty acids, and micronutrients, and their rearing and farming generate lower greenhouse gas emissions and require fewer resources than conventional livestock production (van Huis et al., 2013). What is more, insect-derived substances have a long history of use in traditional medicine in a variety of cultural contexts. They are also the subject of renewed clinical interest in Western evidence-based practice (Cherniack, 2010). Despite their rational advantages, insect-based foods remain a niche product in Western countries, and rates of voluntary adoption have consistently been low (Modlinska et al., 2021; Verbeke, 2015).

The central question posed in this dissertation is why Western consumers reject the consumption of insects, despite intellectual acknowledgement of this product's potential. The present dissertation aims to address this question through a series of empirical studies situated at the intersection of consumer, social, behavioural, and food psychology. The four studies examine acceptance not as a single attitudinal variable but as a multilevel psychological phenomenon, shaped by the affective immediacy of disgust, the informational framing of product labelling, the cognitive gap between “abstract” acceptance and consumption intent, and the social meanings attributed to those who do, or do not, consume insects. When considered as a whole, the studies present a coherent narrative that follows the consumer from the moment of product encounter, through the processing of product information, to the social-identity implications of publicly identifying as someone who eats insects.

## 1.1. A brief history of entomophagy and its contemporary relevance

Entomophagy, defined as the practice of consuming insects as food, is neither novel nor exotic on the global scale (van Huis et al., 2013; Raheem et al., 2019). Approximately two billion people in more than 100 countries regularly consume insects as part of their diet, and at least 2,000 edible species have been documented (Payne et al., 2016; van Huis et al., 2013). The practice has evolutionary roots in archaeological evidence, and comparative primate data suggest that insects were a dietary component throughout much of human prehistory (Raheem et al., 2019). Many traditional cuisines across sub-Saharan Africa (e.g. Democratic Republic of Congo,

Zimbabwe), Southeast Asia (e.g. Thailand, India, Nepal, Japan, China, South Korea), Oceania (e.g. Papua New Guinea, Australia), and Latin America (e.g. Brazil, Colombia, Mexico) continue to incorporate insects as a primary or supplementary protein source (DeFoliart, 1999; Looy et al., 2014; Raheem et al., 2018; Yhoung-Aree & Viwatpanich, 2005).

The contemporary scientific and policy interest in entomophagy was substantially piqued by the Food and Agriculture Organisation report (2013), which systematically documented the nutritional, economic, and ecological arguments for promoting insect-based nutrition on a global scale (van Huis et al., 2013). Within the European Union, this interest has been accompanied by a regulatory development in the form of the Novel Food Regulation (EU) 2015/2283, in force since Jan 1, 2018, which established a framework for the pre-market authorisation of novel food items, including insect species. Four species had received approval for use in food products destined for human consumption: *Acheta domesticus* (house cricket), *Alphitobius diaperinus* (lesser mealworm), *Locusta migratoria* (migratory locust), and *Tenebrio molitor* (yellow mealworm) (European Commission, 2023). Consequently, this legal action has prompted a significant shift in focus towards the question of consumer acceptance, both within the applied sphere, public discourse, and the academic domain.

Poland is a country with very limited historical exposure to entomophagy as a culinary tradition, and with strong food culture norms centred on conventional animal protein, the Polish population provides a particularly informative case for studying the conditions under which novel and culturally unfamiliar foods are accepted or rejected (Goncikowska et al., 2023; Modlinska et al., 2021).

### 1.2. Contemporary research in the psychological aspects of insect-based food acceptance

Research on consumer responses to insect-based food has grown substantially since the mid-2010s and has converged on a core set of psychological variables that consistently predict acceptance and rejection (Macready, Alhujaili, & Nocella, 2023). Disgust is the most prevalent negative predictor (Hartmann & Siegrist, 2017; La Barbera et al., 2018). It is an emotion that induces thoughts and behaviours aimed at avoiding the objects that trigger it (Rozin & Fallon, 1987). Rozin's foundational theoretical framework posits that disgust functions as an evolved oral-defence mechanism, culturally developed to protect against a wide range of symbolic contaminations (Rozin et al., 1993; Rozin & Fallon, 1987). *Pathogen disgust* refers to an

evolutionary defence against infectious objects, such as spoiled food, signs of disease, and bodily fluids (Curtis & Biran, 2001; Tybur et al., 2009). Martins and Pliner (2006) have noted that novel foods of animal origin are more likely to elicit a reaction of disgust than unfamiliar foods of non-animal origin. Research has shown that even brief imagined contact with insect-based products reliably elicits disgust responses that translate into rejection or avoidance behaviour (Hartmann & Siegrist, 2020; Looy et al., 2014; Oaten et al., 2009; Tybur et al., 2013). It is important to note that this disgust response is not easily overridden by informational interventions (Hartmann & Siegrist, 2017; La Barbera et al., 2018). The affective reaction to insects as food appears to operate largely independently of cognitive assessments of their nutritional or environmental value (Siegrist & Hartmann, 2020). Further meta-analytic evidence supports this position: across 37 studies, strong emotional aversions were found to reduce the effectiveness of informational interventions, with cognitive strategies showing a consistently limited impact on affect-based food rejection (Wassmann et al., 2021).

Food neophobia, defined as the tendency to avoid unfamiliar foods, constitutes a second major barrier and is strongly correlated with disgust sensitivity in the context of insect consumption (Hartmann & Siegrist, 2020; Verbeke, 2015). Neophobia is a general disposition, but it is expressed most strongly towards foods that a person has never encountered, and insect-based products are unfamiliar to most consumers in Western countries (Sogari, Menozzi & Mora, 2019). This lack of familiarity, in turn, leads to rejection, creating a self-reinforcing cycle of avoidance (Siegrist & Hartmann, 2020). This framing also connects to the broader tension inherent in human omnivory (Rozin, 1976). Humans are biologically predisposed to dietary variety (Pliner & Hobden, 1992). However, unfamiliar foods are simultaneously perceived as potential threats. This motivates avoidance independent of any factual assessment of safety or nutritional value (Sidali et al., 2019).

Gender and familiarity emerge as predictive factors in this literature; men and individuals with prior exposure to insect-based foods report higher general acceptance of insects as a meat substitute than women and those without such experience (Modlinska et al., 2021; Verbeke, 2015).

Research indicates that social norms shape willingness to consume insects. Descriptive norms, that is, beliefs about what others in one's social group eat, have a causal influence on consumption intention that is partially independent of personal attitudes (Carlsson et al., 2021).

The role of product form and visual features has also been the focus of significant empirical research. Research conducted across several Western European countries indicates that consumers are more willing to try insect-based products when the insect ingredient is either invisible or barely detectable. For example, when the insect ingredient is incorporated into products such as flour or protein isolate, rather than being presented as a whole insect that is easily identifiable to the consumer (House, 2016; Verbeke, 2015). However, other findings (Macready, Alhujaili, & Nocella, 2023) indicate that this effect is partial and context-dependent. In fact, research has shown that information that a product contains insects, regardless of their visibility, is sufficient to elicit negative feelings and reduced acceptance (Gmuer et al., 2016; Modlinska et al., 2020).

## 1.3. The psychology of food acceptance

### 1.3.1. Disgust, distaste and ideational rejection of novel food

The psychological literature on food rejection distinguishes between two motivational systems that are particularly relevant to insect-based food: distaste, which is based on sensory aversiveness, and disgust, which is based on the perceived nature or origin of the stimulus (Rozin & Fallon, 1987). In the context of entomophagy and insect-related studies, the rejection response is predominantly driven by disgust rather than by distaste. Many subjects report aversion even before any sensory contact, and this aversion persists even when the specific insect ingredient is unperceivable (Rozin & Fallon, 1987). This pattern aligns with the concept of ideational rejection, as described by Rozin and Fallon (1987), where the perceived cognitive representation of the substance, rather than its sensory characteristics, elicits a negative emotional response. The cognitive representation that drives ideational rejection is itself culturally learned. Tan and colleagues (2015) demonstrated that Dutch respondents viewed the same insect species (mealworms) as a source of nutrition, whereas Thai respondents associated them with decay. Therefore, disgust perception is evoked by the consumer's culturally specific associations with it (Olsson et al., 2019).

### 1.3.2. Affect, heuristics, and food choice

In order to understand why insects are rejected despite their recognised nutritional and ecological benefits, it is necessary to move beyond attitudinal models and engage with theories of affective decision-making. Slovic and colleagues (2007) proposed the affect heuristic as a general mechanism by which people consult their instant emotional responses, or affective cues, as a

rapid and efficient source of information when evaluating objects and actions. Within this theoretical framework, the aversive response to insects functions as both a direct and indirect factor in rejection. It biases information processing, reduces the weight assigned to positive arguments, and generates an overall assessment that is challenging to revise through deliberate reasoning alone (Siegrist & Hartmann, 2020; Vassie et al., 2005). Each perception contains some affect, which emphasises its importance (Zajonc, 1980, p. 154). Disgust was found to be one of the strongest negative factors affecting people's willingness to consume insect-based food. At the same time, the visual detectability of insect content showed a comparably strong positive association. This suggests that people's emotional response to a stimulus, rather than their cognitive appraisal of its properties, drives their evaluative response (Wassmann et al., 2021).

#### 1.3.3. Moral disgust and social purity norms: disgust beyond the individual

A psychological analysis of insect rejection cannot be limited to the individual level, because disgust, particularly in the domain of food, is not purely a private emotional state. This emotion is also a social and moral one, in that it conveys normative judgements about the acceptability of objects and behaviours (Rozin et al., 1999). *Moral disgust* (Chapman & Anderson, 2013; Rozin et al., 2009; Tybur et al., 2013) is expressed towards moral violations and social transgressions. Furthermore, it is shaped, reinforced, and expressed within social contexts. As demonstrated by Rozin and colleagues (1997), disgust can be mobilised to serve moral and social values, thereby transforming what initially manifests as a personal inclination into a rejection that is charged with normative significance. Their research on vegetarianism demonstrated that moral-ecological motivations for meat avoidance elicited significantly higher disgust responses towards meat than health-based motivations. This illustrates how a dietary choice can become morally encoded and emotionally fortified through a process the authors termed *moralization* (Rozin et al., 1997).

The implications of such practices for the field of entomophagy are significant; specifically, when the consumption of insects becomes associated with violations of purity norms, and when such practice is experienced not merely as distasteful but as morally unacceptable, the resulting resistance acquires a quality that hinders its ability to be corrected by any given set of information.

Schnall and colleagues (2008) provided experimental evidence that incidentally induced disgust, arising from stimuli entirely unrelated to the target of judgment, can increase the severity of moral condemnation. The disgust system is designed to respond to contamination signals

automatically and regardless of their accuracy, before they are cognitively verified, which makes it less responsive to correction than other evaluative responses (Oaten et al., 2009). The information is then evaluated through that response rather than on its own merits, a pattern consistent with the affect heuristic and with evidence that affect can precede cognitive appraisal (Slovic et al., 2007; Zajonc, 1980). This aligns with the broader finding that strong food-related aversions blunt the effect of informational interventions (Wassmann et al., 2021). The implication is not that information is irrelevant, but that its ability to influence behaviour becomes limited once disgust has been activated.

#### 1.3.4. Identity, social categorisation, and food as a symbolic act

The selection of food represents not solely an affective and cognitive process, but also a social categorisation. According to social identity theory (Tajfel & Turner, 1979) and self-categorisation theory (Turner et al., 1987), individuals derive part of their sense of self from their social group identifications, and dietary practices are among the most visible markers of such belonging. The phrase "you are what you eat" (Rozin et al., 1986) refers to the belief that people may, in some sense, acquire or reveal qualities through the foods they consume (Nemeroff & Rozin, 1989; Rozin et al., 1986). In social perception, this idea is reflected in observers' tendency to infer personality traits, social identity, and moral qualities from others' dietary choices (Nemeroff & Rozin, 1989).

People who follow a vegetarian or vegan diet are seen as more than just individuals with different dietary preferences. Instead, they are viewed as people who hold certain moral, ecological, and ideological beliefs (MacInnis & Hodson, 2017; Rosenfeld & Burrow, 2017). By extension, people who eat insect-based food may end up being read by others in much the same way, i.e. as the kind of person whose food choices make a statement about who they are, rather than as someone who simply happens to eat a particular product. The figure of the insect consumer, therefore, may function as a social category against which observers calibrate their own normality, conformity and status (Bourdieu, 1984).

## 2. Research goals, hypotheses, and overview of the completed doctoral research

In Poland, eating insects is not a common dietary practice, and there is little historical tradition to draw on. This made it a useful setting for exploring why people reject insect-based food, despite generally accepting that it is nutritious and sustainable. To address this, the dissertation examined insect eating on several levels at once: the reaction at the moment of contact with the food, the

way people reason about it, the social meaning attached to those who eat it, and the personal beliefs that frame all three. Western reluctance has no single cause; it seems to draw on bodily reactions, patterns of reasoning, social perceptions and personal beliefs. The dissertation, therefore, examined insect eating at four levels of analysis. Different research methods were applied. A tasting experiment recorded behaviour at the point of contact; a nationally representative survey captured population-level attitudes; an online experiment tested whether information could influence perceptions; and a qualitative interview study examined how people talk about insect-eaters. The following section gives an overview of each study. Table 1 below summarises and presents the tested hypotheses, showing the specific publications in which these assumptions were examined.

**Table 1**

*Overview of the dissertation studies and the publications in which each was examined*

| **Study (publication)** | **Level of analysis** | **Sample** | **Main hypotheses/research questions** | **Findings of the study** |
|---|---|---|---|---|
| **Study 1**<br>Modlińska et al. (2020),<br>*Nutrients* | Behavioural | 99 adults (81 F, 18 M), aged 18–45, mostly students; tasting experiment | H1: An insect label lowers product evaluation and intake.<br>H2: Insect-like appearance lowers evaluation; disgust sensitivity predicts lower willingness; variety-seeking predicts higher willingness. | The label mattered more than appearance: products labelled as containing insects were eaten later and in smaller amounts (H1 supported). Appearance did not affect behaviour (H2 rejected). Trait effects were only partial (H3 partly supported). |
| **Study 2**<br>Modlińska et al. (2021),<br>*Foods* | Population level | 1,096 Polish adults; nationally representative CAWI experiment | H1: General acceptance of insects as a meat substitute does not equal willingness to buy/eat them.<br>H2: Familiarity and environmental concern predict general acceptance.<br>H3: Food neophobia and disgust predict lower personal willingness; variety-seeking predicts higher. | General acceptance and personal willingness were uncorrelated and had different predictors (H1 supported). Acceptance was predicted by familiarity, gender, and environmental concern (H2); personal willingness by neophobia, disgust, and variety-seeking (H3). |

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|---|---|---|---|---|
| **Study 3**<br>Goncikowska et al. (2023),<br>*J. Food Products Marketing* | Perceptual/cognitive | 659 Polish adults; two-phase CAWI experiment | H1: Benefit information offsets the negative effect of insect content.<br>H2: A picture of the insect strengthens the negative effect of the label.<br>H3: Acceptance differs between women and men. | Benefit texts did not make the product more acceptable (H1 rejected). A picture lowered evaluations further, mainly among men (H2 supported). Acceptance differed by sex (H3 supported). |
| **Study 4**<br>Goncikowska et al. (2026),<br>*Preprint* | Social psychological construction | 19 Polish adults (15 F, 4 M), aged 19–62; semistructured interviews; Reflexive Thematic Analysis | RQ1–RQ4: How is insect-eating understood; how are insect-eaters perceived; what social-psychological mechanisms (disgust, stereotyping) shape these perceptions; how do they relate to product attributes? | Resistance extended beyond the product to the person: insect-eaters were read as either open and progressive or strange and deviant. Disgust, tradition, and social stigma shaped rejection alongside product features. |

*Note.* The four studies address four levels of analysis: behavioural, population-level attitudinal, perceptual-cognitive, and social-psychological construction. The rows are grouped by level of analysis, from behavioural responses to social and identity-level meaning. This grouping is a way of organising the studies, not a tested sequence. The publications are presented in narrative order (1, 3, 2, 4) rather than in publication order (1, 2, 3, 4).

The present dissertation introduces a series of studies that examined different visual and textual features of product packaging, population-level patterns of acceptance, the persuasive efficacy of different informational frames, and the social identity implications of insect consumption. It comprises four studies, three of which have been published in peer-reviewed journals and one of which is published as a preprint. When considered as a whole, the findings provide an attempt to find the answer for: first, the importance of labelling over sensory experience (Study 1); then, the population-level affective barriers that exist between acceptance and intent (Study 2); followed by the experiment on informational framing in the presence of visual and visceral disgust cues (Study 3); and finally, the social-normative and identity-based structures that maintain cultural resistance to entomophagy (Study 4).

### 2.1. The effect of labelling and visual properties on the acceptance of foods containing insects.

Modlińska, K., Adamczyk, D., **Goncikowska, K.**, Maison, D., & Pisula, W. (2020). The effect of labelling and visual properties on the acceptance of foods containing insects. *Nutrients*, *12*(9), 2498. https://doi.org/10.3390/nu12092498

The first study in this dissertation (Modlinska et al., 2020) examined what happens when a familiar food product is marked as containing insects. The study's aim was to find out what

drives the attitude to insect-containing foods: the information that a product contains insects, or the visible appearance of the product itself.

The sample included 99 adults (81 female and 18 male), aged between 18 and 45 years, most of whom were university students. The investigation employed an experimental design in which participants evaluated food products that varied in the degree of explicit labelling relating to insects and in the visual impact of insect-related content. Participants were randomly assigned to conditions that varied in two factors independently (product labelled as containing insects/product with visible pieces resembling insect parts). They were exposed to familiar food products (cookies) that differed in their labels and appearances. Each participant received three products (a cookie, a muffin, and a date ball). The study recorded both self-reported product evaluations and behavioural measures. Additionally, participants completed a series of questionnaires measuring food neophobia, general neophobia, food technology neophobia, sensitivity to disgust, and variety-seeking tendency. The products themselves did not contain insects, which means that the study tested responses to information and visual suggestion rather than to the actual sensory properties of insects. The hypotheses followed the presented logic:

(H1) Information about insect-based ingredients on the product label would translate into lower product evaluation scores and would have an impact on the behavioural reactions to the product (cf. Barnett & Spence, 2016; Herz & von Clef, 2001; Lee, Shimizu, Kniffin & Wansink, 2013; Rozin, Millman & Nemerov, 1986; Wansink, Park, Sonka & Morganosky, 2000).

(H2) Product appearance (traces of ingredients suggesting insect content) would translate into lower product evaluation scores and would have an impact on the behavioural reactions to a product (e.g., Gmuer, Guth, Hartmann & Siegrist, 2016; Hartmann & Siegrist, 2016; Ruby, Rozin & Chan, 2015; Schösler, De Boer & Boersema, 2012).

(H3) The perception of the product and behavioural indicators would be controlled by different psychological features. People with higher food neophobia, sensitivity to disgust, food technology neophobia, and general neophobia were expected to be less willing to try products described as containing insect-derived ingredients (product evaluation and behavioural reactions to the products), while people with a high level of variety-seeking tendency would be more open to this kind of novel food (e.g., Dermody & Chatterjee, 2016; Lockwood, 2013; Sogari, Menozzi & Mora, 2018; Van Trijp & Steenkamp, 1992).

The results showed that acceptance depended more strongly on labelling than on appearance,

supporting H1. Products labelled as containing insects were tasted later, consumed less frequently, and eaten in smaller quantities than products without such information, regardless of whether visible insect-like traces were present. In contrast, H2 was not supported at the behavioural level: the appearance manipulation did not affect consumption volume or latency to tasting as expected, and no behavioural differences emerged between smooth samples and those containing visible insect-like elements. However, both the insect label and the less familiar appearance reduced declared willingness to try the product. Support for H3 was partial. Food neophobia predicted the amount eaten only for a date ball, the least familiar of the three products, whereas disgust sensitivity and food technology neophobia did not show the expected negative effects. Thus, individual traits influenced acceptance selectively, depending on the product and outcome measure. Variety-seeking showed the opposite pattern: participants higher in openness to food novelty started eating sooner, suggesting that consumers who enjoy experimenting with food may be more receptive to insect-based products.

Overall, the findings indicate that textual information about insect content was a stronger barrier to acceptance than the product's visual appearance. Although participants were less willing to try foods labelled as containing insects, their ratings of taste, smell, and appearance did not differ substantially across products. This pattern is consistent with ideational rejection, in which the belief that a food contains insects reduces acceptance independently of its sensory properties (Rozin et al., 1986; Rozin & Fallon, 1987). Qualitative interviews reinforced this interpretation, showing that information about insect content alone was often sufficient to evoke reluctance, hesitation, or doubt.

### 2.2. Relationship between acceptance of insects as an alternative to meat and willingness to consume insect-based food: A study on a representative sample of the Polish population.

Modlińska, K., Adamczyk, D., Maison, D., **Goncikowska, K.**, & Pisula, W. (2021). Relationship between acceptance of insects as an alternative to meat and willingness to consume insect-based food: A study on a representative sample of the Polish population. *Foods*, *10*(10), 2420. https://doi.org/10.3390/foods10102420

The second study (Modlińska et al., 2021) took a closer look by shifting the focus from individual tasting experiments to a broader investigation on a representative sample of Polish adults. It investigated whether general acceptance of the use of insects as meat and/or a protein-source substitute (general acceptance) was indeed related to personal willingness to buy and consume insect-based food.

A representative sample of 1,096 Polish adults completed a CAWI (Computer-Assisted Web Interview) survey. The research utilised a sample proportionate to the demographics of the Polish population, specifically with regard to age, gender, level of education, and city size. By moving beyond a student-based sample, this study contributed to the dissertation by offering a broader, population-level perspective on declared acceptance. Alongside these primary demographic metrics, the study assessed variables such as food neophobia, variety-seeking behaviour, familiarity with entomophagy, and sensitivity to disgust. The hypotheses were as follows:

(H1) General acceptance of insects as a meat substitute would not necessarily translate into willingness to buy and consume insect-based food. Individuals might theoretically endorse the use of insects as a meat alternative in general, yet remain personally hesitant to purchase or consume insect-based products. This was based on prior work suggesting that knowledge of the environmental and nutritional benefits of insect consumption may not be sufficient to influence consumers' willingness to eat insects (Sogari et al., 2019; Wassmann et al., 2021).

(H2) Respondents more familiar with entomophagy and more attentive to the environmental impact of food choices (environmental and health awareness) would be more accepting of insects as a meat substitute. Environmental and health awareness would positively predict acceptance of insects as a meat substitute, but would not predict willingness to purchase or consume insect-based foods. This expectation was based on previous research linking familiarity and prior exposure with greater acceptance of insects as food, and environmental concern with openness to sustainable meat substitutes (Gumussoy et al., 2021; Ismail et al., 2020; Legendre et al., 2019; Tan et al., 2015; Verbeke, 2015).

(H3) Willingness to buy and consume insect-based food was expected to be related to psychological features involved in the acceptance or rejection of novel food. Individuals exhibiting higher food neophobia or a high sensitivity to disgust were expected to be less willing to consume insect-based food, while those with a higher variety-seeking tendency were hypothesised to be more open to such novel food sources. This expectation was based on previous research on food neophobia, disgust, and variety seeking in the context of novel and insect-based foods (Castro & Chambers, 2019; Pliner & Salvy, 2006; La Barbera et al., 2018; Faccio & Fovino, 2019; Modlińska et al., 2020; Sogari et al., 2019; Van Trijp & Steenkamp, 1992).

The findings confirmed the primary distinction between general acceptance of insects as a meat

alternative and personal willingness to purchase or consume insect-based foods (H1). These two outcomes were uncorrelated and predicted by different factors, indicating that conceptual support for entomophagy does not necessarily translate into readiness to eat insects oneself. General acceptance was predicted by familiarity with entomophagy, gender, attention to the environmental consequences of food choices, and preference for convenience (H2). Men were more likely to support the general idea of insects as a substitute for meat, but this did not translate into a greater personal willingness to consume insect-based products. Diet was not a significant predictor: vegetarians, vegans, and omnivores accepted insects as a meat substitute to a similar extent, suggesting that openness to meat alternatives does not automatically imply openness to insects. Psychological variables such as disgust sensitivity, food neophobia, and variety seeking were not associated with this broader, conceptual form of acceptance.

However, personal willingness to buy and consume insect-based foods was predicted by food-related psychological traits (H3). Higher food neophobia and disgust sensitivity were associated with lower willingness, whereas higher variety seeking was associated with greater willingness. Thus, the personal inclination to eat insects appeared to be shaped more strongly by affective and novelty-related barriers than by rational approval of insects as a sustainable meat alternative.

These results are relevant to earlier attempts to profile consumers willing to accept insects as food, particularly regarding how acceptance is operationalised in such studies (Verbeke, 2015). They show that general support for insects as a meat substitute and willingness to eat insect-based products should not be treated as equivalent outcomes. General acceptance was linked to familiarity and environmental concern, whereas personal willingness was shaped mainly by food neophobia and disgust sensitivity (La Barbera et al., 2018; Pliner & Salvy, 2006; Rozin & Fallon, 1987; Sogari et al., 2019). This suggests that promotional strategies based solely on presenting insects as a rational or sustainable alternative to meat may be insufficient to change personal eating intentions.

The role of familiarity was more nuanced. Although many participants were aware of entomophagy, often through travel or knowledge about other cultures, direct experience of eating insects was rare. Their familiarity, therefore, reflected abstract awareness rather than embodied practice. This may explain why familiarity predicted acceptance of the general concept but did not translate into a concrete willingness to consume insect-based foods. However, because the

study measured declared willingness rather than actual consumption, the findings should be interpreted as evidence of attitudes and self-reported behavioural intentions rather than eating behaviour.

### 2.3. The influence of various information about insect content and its advantages on the acceptance of foods containing insects.

**Goncikowska, K.**, Modlińska, K., Adamczyk, D., Altuntaş, U. C., Maison, D., & Pisula, W. (2023). The influence of various information about insect content and its advantages on the acceptance of foods containing insects. *Journal of Food Products Marketing*, *29*(3). https://doi.org/10.1080/10454446.2023.2206364

The third study (Goncikowska et al., 2023) examined the role of information in the evaluation of insect products. First, we investigated whether information about the benefits of entomophagy can improve the assessment of food products containing insects (and therefore reduce the negative effect of labelling that a product contains insects). Second, we studied the role of verbal and visual information about insect content on the product packaging.

The study used a two-phase CAWI design with 659 Polish participants. In the first phase, participants completed questionnaires measuring individual characteristics. One week later, they were randomly presented with one of three introductory texts: a health-related text, an environmental text, or a neutral control text about insects. They then evaluated one of three versions of a Bolognese sauce: a product with no reference to insects, a product labelled as containing crickets, or a product labelled as containing crickets and accompanied by an image of a cricket on the packaging. Participants assessed the product on overall evaluation, willingness to try it, expected taste, healthiness, environmental friendliness, and expected market demand.

The hypotheses followed this logic:

(H1) Educational input about the benefits of consuming insects was expected to alleviate the negative effect of information about insect content provided on the packaging. This expectation was based on previous studies suggesting that information about environmental or nutritional benefits may improve the evaluation of novel or insect-based food products (Baker et al., 2016; Dagevos, 2021; De Magistris et al., 2015).

(H2) The negative effect of a text label indicating insect content was expected to be stronger when the packaging also included an image of the insect. This expectation was based on research showing that packaging, labels, and visual materials shape product impressions, emotional reactions, and purchase-related expectations. In the context of insect-based foods, previous studies also showed that content-revealing labels reduce product acceptance and purchase

intention (Baker et al., 2016; Bou-Mitri et al., 2020; De Magistris et al., 2015; Kao & Du, 2020; Marques da Rosa et al., 2019; Modlińska et al., 2020; Poor et al., 2013; Sundar & Kardes, 2015; Venter et al., 2011).

(H3) Differences were expected between women and men in the level of acceptance of insect-based products. This expectation was based on previous findings showing that women are usually more reluctant than men to accept insects as food ingredients (Florença et al., 2021; Hartmann et al., 2015; Menozzi et al., 2017).

The first hypothesis was not supported. Short health- or environment-focused texts did not reduce the negative effect of insect information on product evaluation. Although the environmental text increased perceived environmental friendliness and the health-related text increased expected market demand, these effects did not translate into greater acceptance of the insect-based product as food. This suggests that brief educational messages are insufficient to overcome the reluctance elicited by insect content on packaging.

The second hypothesis was partly supported. Products without any reference to insects were evaluated most positively, whereas products labelled as containing crickets received lower ratings. The additional image of a cricket also changed the scoring, but this effect differed by gender. Among men, the image further reduced product evaluation, willingness to try, expected tastiness, and expected market demand. Among women, the verbal label alone was already sufficient to lower acceptance, and adding the image did not produce an additional negative effect. This pattern was also consistent with the third hypothesis, indicating gender differences in responses to insect-based products.

Individual characteristics played a selective role. Food neophobia was associated with lower overall product evaluation, but did not predict willingness to try, expected taste, healthiness, environmental benefits, or market demand. Variety-seeking tendency showed a more consistent positive effect: participants higher in variety seeking evaluated the product more favourably, were more willing to try it, and rated it higher on expected tastiness, healthiness, environmental friendliness, and market demand. General neophobia and disgust sensitivity did not significantly affect the analysed outcomes. The strongest and most consistent predictor was attitude toward entomophagy, as the participants with more positive attitudes rated the products more favourably across all measures and expressed greater willingness to try them. Age had a smaller positive effect, with older participants giving slightly higher overall ratings on some measures.

Overall, the findings show that the communication of insect content on packaging matters. Brief benefit-based information did not counteract the negative effect of insect labelling, whereas making insect content visually salient intensified rejection among men. These results are consistent with research suggesting that insects are difficult to normalise as food in Western and Central European contexts, where they are not culturally established as edible products. They also align with packaging research showing that visual cues can attract attention and strengthen emotional responses. The study contributed to the dissertation by demonstrating that acceptance depends not only on what is communicated about entomophagy but also on how visibly insect content is presented. Because participants evaluated packaging rather than tasted the product, the findings should be interpreted as evidence of product perception and declared willingness rather than actual eating behaviour.

### 2.4. Who eats bugs, and what does it say about them? Disgust, stereotyping, and the social construction of the insect consumer

**Goncikowska, K.**, Modlińska, K., & Pisula, W. (2026). Who eats bugs, and what does it say about them? Disgust, stereotyping, and the social construction of the insect consumer. https://osf.io/preprints/psyarxiv/ag9zn_v2

The fourth study (Goncikowska et al., 2026) shifted the focus from the product itself to the social implications of eating insects. This study investigated whether the meaning attached to insects extends from the product to the person who consumes it, and whether insect-eating functions as a social signal. It examined how Polish adults understand insect-eating as a dietary practice, how they perceive insect-eaters, and how disgust, stereotyping, tradition, and politics shape these perceptions. The study was grounded in research on disgust, food rejection and the social meaning of dietary practices (De Garine, 2001; Rozin & Fallon, 1987; Rozin et al., 2016), as well as in works on social categorisation and identity threat (Tajfel & Turner, 1979). The research questions were:

(RQ1) How do individuals conceptualise insect-eating as a dietary practice, and what contextual meanings (such as necessity, novelty, or cultural tradition) do they associate with it?

(RQ2) How do perceptions of insect-eaters shape social attitudes and potential barriers to adopting insect consumption? Are insect-eaters perceived as a distinct social group, and if so, what traits are attributed to them?

(RQ3) What social and psychological mechanisms, including disgust, dehumanisation, and group-based stereotyping, contribute to negative perceptions of insect-eaters, and to what extent are insect-eaters framed in culturally transgressive terms?

(RQ4) How are perceptions of insect-based food related to perceived product attributes, attitudes toward novelty, and health and environmental concerns?

The study used a qualitative design based on semi-structured face-to-face interviews with 19 Polish adults. The protocol included an opening conversation about food practices and food identity, an adjective sorting task, an environment sorting task, and a final discussion about entomophagy and the figure of the insect consumer. In the adjective sorting task, participants assigned positive and negative traits to either “a person who eats insects” or “a person who does not eat insects”. In the environment sorting task, they associated photographs of different landscapes and environments with insect-eaters or non-insect-eaters. These tasks were used to elicit spontaneous categorisations that might not emerge directly in ordinary conversation and to provide comparable material across interviews. The data were analysed using Reflexive Thematic Analysis following Braun and Clarke (2021).

The analysis identified four main themes. The first concerned the boundary between disgust and acceptance: visible insect forms were a key reason for rejection, whereas processed, hidden, or familiarised forms were easier to imagine as acceptable. The second theme focused on the social image of the insect consumer. Participants constructed insect-eaters in contrasting ways: as open-minded, knowledgeable, and environmentally aware, but also as strange, poor, deviant, or outside the norm. These images were often politically coded, with insect-eaters associated by some participants with urban, left-wing, feminist, LGBT-related, or progressive identities, in contrast to a conservative and traditionalist opposite. Eating insects, therefore, became a marker not only of what a person ate, but also of who they were imagined to be. The third theme addressed the social costs of eating differently, including tradition, anticipated judgment, and political associations. Participants often contrasted insects with familiar Polish foods and suggested that eating insects could expose a person to mockery, rejection, or negative evaluation from family, peers, or wider society. The fourth theme described two opposing narratives about why people eat insects. One framed entomophagy as a necessity, a matter of poverty, or a means of survival, often in non-Western contexts. The other framed it as curiosity, experimentation, and modern food culture, associated with voluntary choice, cosmopolitanism, and urban Western settings.

Participants did not describe rejection of insect-based food primarily as a lack of knowledge. Many were able to recognise nutritional or environmental arguments in favour of entomophagy,

yet still found insects difficult to imagine as ordinary food. Rejection was instead linked to disgust, contamination, visible insect body parts, and the need to transform insects into processed, hidden, or otherwise familiar forms. The interviews also showed that insect-eaters were evaluated as a distinct social figure. The same practice could lead to contrasting interpretations: the insect consumer could be seen as open, progressive, and environmentally aware, or as strange, deviant, and socially inappropriate.

This study extended the dissertation beyond the product level by showing that resistance to entomophagy is also tied to the social meanings attached to insect consumers. Acceptance cannot, therefore, be explained by product features or individual psychological traits alone. It is also shaped by the imagined identity, values, and social position of the person who eats insects. The small and demographically skewed sample, consisting predominantly of women, urban residents, and highly educated participants, limits generalisation and may have influenced the range of narratives obtained. Nevertheless, the findings suggest that resistance to insect-based food is intertwined with how the insect consumer is conceptualised, evaluated, and positioned within familiar cultural and political categories.

## 3. General discussion

The four studies examined whether psychological and social barriers to the acceptance of insect-based foods can be reduced through changes in product presentation, information, and social context. Together, they show that these barriers are only partly modifiable. Informational and contextual factors can influence acceptance, but they do not consistently override the emotional responses elicited by insect-based products. Across the dissertation, disgust has emerged as a central mechanism shaping the rejection of insects as food (Rozin & Fallon, 1987; La Barbera et al., 2018). However, information about the health and environmental benefits of insect consumption was not effective in encouraging people to eat insects. It is in line with studies indicating that cognitive reasoning can be ineffective when strong negative affect is present (Dupont & Fiebelkorn, 2021). This may help explain why utilitarian information fails to translate awareness into willingness, as it reduces disgust less than hedonic cues about taste or familiarity (Naranjo-Guevara et al., 2023). Factual knowledge and negative affect persist side by side.

The findings also show that acceptance of insect-based foods cannot be fully explained by the psychology of an individual alone. Eating insects appears to be a socially meaningful act that

activates stereotyping processes, carries identity implications, and is embedded in normative expectations about appropriate food behaviour (De Garine, 2001; Rozin & Fallon, 1987; Rozin et al., 2016). Thus, reluctance toward entomophagy is not only a response to the product itself, but also to what consuming it may signal about the person.

This social dimension has often been overlooked in experimental studies, which typically examine individual preferences in isolation and treat acceptance as a private attitude (Gmuer et al., 2016; Hartmann & Siegrist, 2017; Ruby et al., 2015). A systematic review of insect acceptance in Western societies documents an in-depth overview of factors influencing the acceptance towards insect-based products in detail (as affective individual predictors of insect acceptance), but the social evaluation of their consumer is not among the predictors it reviews (Kröger et al., 2022). In our qualitative study, the negative connotations of insects were projected onto the imagined consumer, who was at times evaluated as abnormal, deviant, or socially inappropriate. This extends the interpretation of entomophagy resistance beyond individual food rejection and suggests that disgust may play a role in broader processes of social boundary-making. Thus, reluctance to eat insects may be reinforced not only by the anticipated sensory experience, but also by the anticipated social meaning of being seen as someone who eats insects. The present findings, by showing that rejection of insect-based foods extends to their consumers, suggest that the gap in the literature on the social context of eating may lead to an underestimation of the social inhibitions that constrain real-world consumption of insect-based foods.

The main contribution of the dissertation is therefore the integration of product-level, individual-level, and social-level mechanisms of rejection. Acceptance is shaped not only by what the product is, how it is labelled, or what information accompanies it, but also by what its consumption means socially. In the Polish context, insects as food appear to simultaneously activate affective rejection, cultural unfamiliarity, and social categorisation.

A similar pattern appears for other non-normative diets. In a representative Polish sample, vegan candidates were judged as less competent and less suited to stereotypically masculine roles, an effect driven by their diet rather than their qualifications (Adamczyk & Maison, 2023). Though such social rejection is not inevitable. Reactions to non-normative eaters depend on the observer's identity and motivation, meaning they can shift rather than remain fixed (De Groeve & Rosenfeld, 2022). The findings also carry implications for food policy, product development,

and public health communication. For policymakers and food industry practitioners, the data suggest that communication based on rational arguments is insufficient as a standalone intervention, particularly for consumers with high disgust sensitivity or food neophobia. Interventions that address affect more directly may be more effective at shifting acceptance across the population. These include repeated low-risk exposure, social normalisation, or the redesign of product presentation to reduce the visibility of insect-related cues. The attitude-behaviour gap found in the Polish representative sample further indicates that survey-based acceptance measures, common in market research, may overestimate actual purchase and consumption intent, and should be complemented with behavioural or choice-based indicators.

### **3.1.** Implications, limitations and future directions

The dissertation has several theoretical, methodological, and applied implications. Theoretically, it contributes to research on food rejection by showing that the rejection of insect-based foods cannot be explained only by sensory dislike or lack of information. Across the studies, rejection often occurred before actual sensory contact with insects and was triggered by labelling, imagined content, or social meaning. This supports the interpretation of insect-food rejection as partly ideational: the knowledge or belief that a product contains insects can be sufficient to lower acceptance, even when the product itself is familiar or when the insect ingredient is not visible.

The findings also extend psychological accounts of novel food acceptance by showing that affective reactions and cognitive evaluations may diverge. Participants could recognise insects as nutritious, sustainable, or rationally defensible, yet remain unwilling to buy, taste, or consume insect-based foods. In this context, insect-based foods appear to be evaluated not only through deliberate reasoning about benefits and risks, but also through rapid affective responses connected with disgust, contamination, unfamiliarity, and perceived inappropriateness.

A further theoretical contribution concerns the social meaning of food choice. The dissertation shows that entomophagy is not only a product category but also a socially interpretable practice. Eating insects can signal openness, environmental concern, cosmopolitanism, or progressiveness, but it can also be interpreted as deviant, primitive, low-status, or politically marked. This finding links research on entomophagy with broader psychological literature on food, identity, social categorisation, and stigma. It suggests that the acceptance of novel foods should be studied not

only as an individual preference but also as a social act embedded in group norms and cultural boundaries.

However, our studies also have some limitations. The experiments reported in Publications 1 and 3 relied on self-reported acceptance measures and hypothetical choice scenarios rather than on actual purchasing or consumption, which limits their ecological validity. The attitude-behaviour gap documented in Publication 2 shows directly that declared willingness to try a product does not reliably predict actual behaviour. Survey studies are also burdened with self-selection bias. Behavioural measures such as latency and amount eaten are more ecologically valid, but they cannot capture the meaning participants attach to their own behaviour. Reflexive Thematic Analysis was used in Publication 4 because it does not treat participants' explicit accounts as the only data. Instead, it reads patterns across the material to identify themes that lie beneath individual rationalisations. The qualitative and exploratory nature of Publication 4 adds a further constraint, as its design identified socially significant perceptions, but was not suited for estimating their level or magnitude in the general population.

These limitations point to several directions for future research. Behavioural outcome measures, such as real-tasting paradigms or field studies (e.g., in retail settings), would capture consumption as it actually occurs. Future qualitative studies could examine the social aspects of entomophagy in group settings, such as focus groups, to explore the role of peer influence, descriptive social norms, and in-group or out-group dynamics in shaping acceptance and the performance of disgust as a social signal.

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## Appendices

**Publication 1**: *The effect of labelling and visual properties on the acceptance of foods containing insects.*

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# The Effect of Labelling and Visual Properties on the Acceptance of Foods Containing Insects

**Klaudia Modlinska [1,*], Dominika Adamczyk [2], Katarzyna Goncikowska [2], Dominika Maison [2] and Wojciech Pisula [1]**

[1] Institute of Psychology, Polish Academy of Sciences, 1 Jaracza St., 00-378 Warsaw, Poland; wojciech.pisula@wp.pl

[2] Faculty of Psychology, University of Warsaw, 5/6 Stawki St., 00-183 Warsaw, Poland; dominika.adamczyk@psych.uw.edu.pl (D.A.); katarzyna.goncikowska@gmail.com (K.G.); dominika@psych.uw.edu.pl (D.M.)

* Correspondence: kmodlinska@wp.pl

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**Abstract:** Introducing insects as a source of nutrients (e.g., protein) plays a key role in many countries' environmental policies. However, westerners generally reject insects as an ingredient of food products and meals. The aim of our study was to assess if explicitly labelling food as containing insects and/or implying it by manipulating the appearance of food influences the participants' perception of food products or their behavioral reaction to such products. Participants were asked to try a range of foods, none of which contained ingredients derived from insects. However, the experimental conditions varied with regard to food labelling (insect content) and appearance (traces of insect-like ingredients). We observed the participants' non-verbal behavioral reactions to the foods. Next, the respondents filled in a questionnaire evaluating the food's properties. Additionally, we asked the participants to fill in a set of questionnaires measuring other variables (food neophobia, disgust, variety seeking, etc.) The results showed that products labelled as containing insects are consumed with reluctance and in lower quantities despite their appearance. In addition, people with lower general neophobia and a higher tendency to seek variety tried the insect-labelled samples sooner than people from the other groups. Recommendations for marketing strategies are provided.

**Keywords:** food labelling; entomophagy; insect-based foods; edible insects; food sustainability; perception of food; novel food; disgust; neophobia; variety seeking; food technology neophobia; consumer studies; behavior

## 1. Introduction

While food shortages mainly affect developing countries, where malnutrition is a problem for millions [1], in highly developed countries the conventional methods of food production burden the environment and pose a threat to animal welfare. Introducing insect-based food products could contribute to solving both issues [2].

Entomophagy is present in many cultures and is the main source of nutritious food for many communities [3]. Insects are a source of protein (and amino acids), fats, vitamins (e.g., vitamin B12), beta-carotene, several minerals, fiber and other valuable substances [4–8]. Insect production requires less space [9] and leaves a significantly smaller ecological footprint than livestock farming, and is more ecologically sustainable [10,11]. Moreover, as insects are evolutionarily distant from humans, they are less likely to carry pathogens that could pose a risk to human health [7,12].

Although nowadays the consumption of insects by humans is regularly discussed in the media, attempts at changing people's eating habits and introducing these new types of food have so far

generally met with individual and social rejection. Although some recent studies show a positive effect of information on the willingness to try insect-based foods (e.g., [13–16]), it seems that, in general, rational arguments stressing the advantages of insect production and consumption are not sufficient to change our eating habits [17,18] (see also [19]). In general, westerners are largely opposed to eating insects, as they are an unfamiliar food source that deviates from cultural norms and are expected to have undesirable sensory properties [20] (cf. [21]).

It seems that the main psychological barriers to consuming this kind of novel food are disgust and fear [22–24]. Most people object not only to eating insects, but also to the very idea of eating insects [22,23], and their negative reactions to insects may be very deeply rooted and automatic [25]. The first explanation for this reaction is disgust. Disgust is an emotion that elicits thoughts and behaviors that result in avoiding the objects that trigger it [26]. Things that elicit disgust differ largely from one culture to another; they are acquired in the learning process and are deeply rooted in social norms. Disgust correlates with the evolutionary need to avoid infection, dirt and disease, and may lead to fear [23]. In the case of food, this fear is manifested in anxious hesitation to consume unknown items, which is called food neophobia [27]. Food neophobia correlates positively with general neophobia [27], which may increase reluctance towards unfamiliarity. Therefore, it is likely that persons with a high level of food neophobia, as well as a high level of general neophobia, would be prone to the feeling of disgust (see [28–30]). Persons who fit this profile are very likely to be the least willing to include insects in their diet [18]. Moreover, in the case of such new commercially available products as insects and insect flour, and their mostly unknown production processes, Food Technology Neophobia [31] may also play a crucial part. On the other hand, it is possible that other characteristics such as the Variety Seeking Tendency [32], which involves an intrinsic desire for variety in many aspects of life, including food consumption, may increase the willingness to try new food products [33].

Although the main psychological variables influencing the acceptance/rejection of insect-based foods seem to have been identified, the problem of a limited willingness to incorporate such foods into everyday diet has not been resolved. Over the past few decades, researchers have been trying to devise a strategy to convince people that insects are indeed edible, safe, and tasty. It may be hypothesized that one such strategy could involve adapting foods containing insects to the consumers' general eating preferences. It is clear, for instance, that consumers prefer fatty and sweet products (e.g., [34,35]). Serving insects in the form of, or as an ingredient of, snacks or sweet foods may increase their acceptance and create positive associations with such types of food, facilitating habituation to insect-based foods. On the other hand, studies by Tan et al. [36] showed that sweet-flavored insects were considered less appropriate than savory insect-based meals, especially when the entire insect body or insect body parts were easily discernible.

Another way of reducing the level of food neophobia may be to add insects to familiar dishes [14] (cf. [37]). However, the form in which they are added also plays a part. It seems that adding ground insects to a meal could reduce reluctance to consume it by reducing exposure to the visual stimulus (e.g., [20]). In the case of unconventional animal-derived foods, evoking the image of the entire animal often elicits strong objection to the food offered and is connected with strong negative emotions [38]. When eating animals, we usually consume pieces that do not resemble living individuals; we are reluctant to eat animal heads, entire limbs, etc. Perhaps in the case of insects, the fact that they are often served whole elicits similar reactions in humans by making it clear what they are about to consume. Moreover, adding entire insects to meals may give the impression that a food is polluted or rotten. Evidence to support this claim has been provided in a study by Gmuer et al. [39], which showed that potato chips which contained insect flour or insect elements were assessed less negatively than chips mixed with whole insects (see also [29,40,41]). Other studies, however, show no such correlation (e.g., [42,43]). In addition, the widely applied marketing strategy of presenting insects as sustainable substitutes for animal protein is also problematic, as it gives rise to an expectation that the products will be similar to meat in texture and taste, as is the case with plant-based products made to look similar to their meat-based counterparts [17] (cf. [30]).

Nevertheless, it seems that the reluctance to eat insects is so strong that the very awareness of consuming them elicits an aversive reaction, which may then be generalized to other accompanying products. This hypothesis seems to have been confirmed by Rozin et al. [44] in a study where participants assessed a drink more negatively if the cup they drank from had been in contact with a sterile insect before it was used. Such a reaction may be explained by the participants' feeling that the cup had been contaminated during contact with the insect, and the disgust triggered by that perception was generalized to the drink. In the case of commercially available products, information on insect content is provided in visual form on packaging or it is provided in the product name, which may have a similar effect. Studies carried out to date have shown that both verbal and visual information on packaging has a significant impact on how consumers evaluate the taste and smell of the substances they ingest (e.g., [45–48]). The very indication of insect content on the packaging may affect consumers' assessment of the product quality. Moreover, it may be assumed that ingredients whose appearance suggests the presence of traces of insects in a product may additionally reinforce the label effect by reinforcing the impression that the product has been contaminated (cf. [23]).

Based on the above, we are convinced that more research is needed to further explore the factors influencing peoples' attitude to eating insect-based foods and to identify marketing strategies and educational campaigns. We would like to propose the study protocol involving an assessment of several variables that have been identified in other studies (the results of which, however, are in some cases inconclusive) or that stem from our predictions. In our study, we intended to check, first of all, whether the mere fact of providing information about insect content (label) would influence the sensory evaluation and acceptance of different foods. In this way, we wanted to replicate the findings obtained by Mancini and colleagues [14]. However, we decided to use sweet foods (pastry, sweets), as we hypothesized that snacks would be more likely to encourage people to try this kind of food, especially bearing in mind the general preference for sweetness among consumers. Secondly, we hoped to broaden the scope of the study by evaluating the effect of visibility of insect parts on the level of acceptance of insect-based foods, as studies that have analyzed these aspects have been inconclusive. We expected that the differences in the results obtained by other researchers could have arisen from a specific "presentation" of insects, but also from an interactive effect of the information on insect content and the appearance of food. In addition, we planned to control the mediating effect of commonly studied psychological variables, such as food neophobia and disgust. However, we also incorporated other measures in the study; we used the food technology neophobia scale and the variety-seeking tendency scale to further explore the mechanism underlying the acceptance of insect-based food.

We intended to analyze these aspects by checking experimentally reactions to food products depending on (a) the information about insect content provided on product labelling, and (b) the appearance of products suggestive of traces of insect-like ingredients. To address these issues, we conducted an experiment whereby we observed participants' reactions to specific products: a cookie, a muffin, and a date ball. The experiment resembled a classic product test in which the consumers tried and assessed three products in terms of taste, smell, appearance, etc. Depending on the experimental conditions ($2 \times 2$), the products differed either (a) with regard to the information about the presence or absence of insect content, or (b) in appearance: they are artificially "dotted" to suggest insect content or not. In reality, none of the products used in the experiment contained insects or insect-derived ingredients.

Another important novel element of our experiment, when compared to many previous studies, was the fact that we not only measured participant reactions in qualitative scale-based terms (declaration of willingness to taste a specific product), but we also observed several non-verbal behavioral indicators (e.g., we measured the time and frequency of sampling products and how much of the product was ingested). What is more, after the experiment, we conducted interviews with the participants, which served as a source of additional information to enrich the discussion section of the paper and allow us to suggest possible marketing strategies.

Based on the results of previous studies, we formulated the following hypotheses:

**Hypothesis 1 (H1).** *Information about insect-based ingredients on the product label will translate into lower product evaluation scores and will have an impact on the behavioral reactions to the product (cf. [44–48]).*

**Hypothesis 2 (H2).** *Product appearance (traces of ingredients suggesting insect content) will translate into lower product evaluation scores and will have an impact on the behavioral reactions to a product (e.g., [20,29,39,41]).*

**Hypothesis 3 (H3).** *The perception of the product and behavioral indicators will be controlled by different psychological features. People with higher food neophobia, sensitivity to disgust, food technology neophobia, and general neophobia are expected to be less willing to try products described as containing insect-derived ingredients (product evaluation and behavioral reactions to the products), while people with a high level of variety-seeking tendency will be more open to this kind of novel food (e.g., [22,23,32,43]).*

## 2. Methods

### *2.1. Participants*

The participants were recruited by means of announcements posted online, on website panels, and individual personal requests. All participants gave their oral consent to participate in the study. They also confirmed that they did not suffer from any form of food allergy or intolerance. One person was excluded from the study after having a strong emotional reaction to the food samples and after disclosing an existing psychiatric condition. The final sample comprised 99 participants (81 females and 18 males). The participants were aged between 18 and 45 years old, while the average age was 22. They were mostly university students who came from big cities (>50,000 inhabitants).

The participants were randomly assigned to four experimental groups. In each group, the male to female ratio was comparable. They were told that the purpose of the experiment was to study food preferences. Before the experiment, they were not informed that the experiment involved tasting insect-based products, so their attitudes and expectations did not affect the answers given in the questionnaires and the participants who tasted products with no indication of insects did not feel they were being misled, or that the products they were supposed to try contained hidden insect parts. The data was collected anonymously. Each person was assigned an individual number to allow the data from all parts of the experiment to be linked.

### *2.2. Procedure and Methods*

The study consisted of three parts. In Part 1 the participants were asked to fill in a set of questionnaires. In Part 2 a behavioral experiment was conducted. Part 3 involved conducting a short interview with the participants.

Part 1—Questionnaires

The participants answered a set of questionnaires preceded by socio-demographic questions. They were also asked about their diet preferences (whether they followed a meat or non-meat diet). This information was collected to control the characteristics of the experimental groups and to avoid any possible impact of this variable on the behavioral data collected in Part 2. All questionnaires were administered in a paper-and-pen form. The time to complete the questionnaires was not limited.

Part 2—Behavioral assessment

After completing the questionnaires, the participants were asked to move to another room, where behavioral assessment was conducted. They were seated at a small table and received instructions about the experimental procedure. The participants were randomly assigned to one of four experimental set-ups (Table 1). Each person received a set of three food products (A—a cookie, B—a muffin, C—a date ball). The products were placed on a paper plate, and a label with the name of the product was placed above each item (Figure 1). In two of the four groups, the labels explicitly stated that the products contained insects and in the two other groups, there was no information about insect content. In addition, half of the participants were given samples that could suggest the presence of mildly

processed insects in the food (e.g., chunks of cranberries or nuts easily discernible in the products), while the other half were served "smooth" products. The experimental group set-up followed the ANOVA 2 × 2 procedure (Table 1).

**Table 1.** Experimental group set-up. The products in groups 1A and 2A (no visual clues suggestive of insect content) and in groups 1B and 2B (presence of visual clues suggestive of insect content) looked identical, but differed in the information provided on the labels.

| | | **Label**—Explicit Information about the Presence or Absence of Insect Content | |
|---|---|---|---|
| | | **No Insect Content "1"** | **Insect Content "2"** |
| **Appearance**—presence or absence of visual features of the product suggestive of insect content | No visual clues suggestive of insect content "A" | Condition 1A | Condition 2A |
| | Visual clues suggestive of insect content "B" | Condition 1B | Condition 2B |


**Figure 1.** A set of three food products: (from left to right:) a cookie, a muffin, a date ball. Labels attached to food products: **Group 1A:** Rice flour cookie; amaranth flour cupcakes; plain date balls—products labelled as not containing insects. **Group 2A:** Cricket flour cookie; mealworm flour cupcakes; beetle flour date balls—products labelled as containing insects. **Group 1B:** cookies with chunks of cranberries; cupcakes with chunks of walnuts; date balls with linseed—products labelled as not containing insects. **Group 2B:** Cookies with crickets; cupcakes with particles of mealworm larvae; date balls with May beetle particles—products labelled as containing insects.

The participants were asked to try the products in a given order. The questionnaires assessing the properties of each of the three products were placed above the plate in front of each participant. The questionnaire concerned the respondents' willingness to try the product; the visual attractiveness of the product; smell; taste; and willingness to eat more of the product. The respondents were asked to indicate their answers on a 10-point linear scale with descriptive explanations provided at the end-points. In addition, each participant received a napkin and a cup filled with water. The participants were told that they were free to eat as much of any of the products as they wanted, and that they were free not to try any of them if they did not want to.

Each participant's behavior during the food-tasting session was recorded with a video camera placed approx. 2 meters in front of the participant.

Part 3—Interview

After the tasting session, the participants moved to an adjacent room for a short qualitative semi-structured individual interview. The interviews were aimed at broadening the scope of data collected in the study and at providing a context for the quantitative data collected. The scenario comprised a few precisely defined thematic areas, but the questions pertaining to those areas were not pre-determined and they were individually adapted to the respondent and interview dynamics.

The aim of the interview was to examine the opinions and experiences of the respondents with respect to entomophagy; to gain a more in-depth knowledge about the participants' experience of the food-tasting session; to understand the motivations behind the (un)willingness to try the products; and to examine the declared readiness to include insects in the daily diet and the participants' view on the social aspects of insect-based diets. The participants were asked about their previous experience with entomophagy (e.g., whether they had ever heard of this phenomenon before, whether they had ever tried insects, whether they believed that insects could be part of a normal human diet and what potential consequences of such a diet could be). Next, the participants were asked about their impressions from the tasting session and the likelihood of including insects in their own diet. The interviewees were encouraged to elaborate on their answers so that a wider range of information could be collected.

The interviews were recorded and transcribed.

### *2.3. Ethical Statement*

All subjects gave their informed consent for inclusion before they participated in the study. The study was conducted in accordance with the Declaration of Helsinki, and the protocol was approved by the Commission of Ethics of Scientific Research of the Faculty of Psychology, University of Warsaw, Poland (No. 21/03/2019). Additionally, the participants signed a consent form agreeing to the processing of their personal data (including audio and video recordings). They were also assured that they could withdraw from the experiment at any point of the procedure and that all the data collected during the study (including the recordings) would only be available to the research team members.

### *2.4. Questionnaires*

All the questionnaires were translated from English into Polish using the back-translation method [49,50]. First, the questionnaires were translated from English into Polish by a professional translator, then a different translator translated the Polish version back into English. The original English and the back-translated versions were compared by a native English speaker. The text was edited according to the native English speakers' comments, following which the reformulated items were translated into English by a translator not familiar with the content of the comments or the original questionnaire; they were then compared with the original by a native English speaker. The final Polish versions of the questionnaires were then consolidated. The internal consistency of the Polish versions of the questionnaires was determined using Cronbach's alpha.

#### 2.4.1. FNS

The Food Neophobia Scale (FNS), developed by Pilner and Hobden [33], is often used to measure the willingness to try new foods [51]. It consists of ten items on a scale from 1 ("strongly disagree") to 7 ("strongly agree"); five statements are positive (indicative of neophilic attitudes) and five are negative (indicative of neophobic attitudes). Examples of statements include: "I don't trust new foods" and "At dinner parties, I will try a new food". The internal consistency of the Polish version of the scale in our study measured using Cronbach's alpha was estimated at 0.87.

#### 2.4.2. GNS

The General Neophobia Scale (GNS) is a scale measuring the general level of neophobia. It was developed by Pliner and Hobden [33] together with the Food Neophobia Scale. It is an eight-item 7-point Likert scale from 1 ("strongly disagree") to 7 ("strongly agree"). Examples of statements include: "I am afraid of the unknown" and "Whenever I am on vacation, I can't wait to get home". The internal consistency of the Polish version of the scale in our study measured using Cronbach's alpha was estimated at 0.91.

#### 2.4.3. FTNS

The Food Technology Neophobia Scale (FTNS; [31]) is a tool suitable for measuring the willingness to try new food products manufactured using new food technologies and attitudes to new food technologies. It consists of thirteen items scaled from 1 ("strongly disagree") to 7 ("strongly agree"). Examples of statements include: "It can be risky to switch to new food technologies too quickly" and "New products produced using new food technologies can help people have a balanced diet". The internal consistency of the Polish version of the scale in our study measured using Cronbach's alpha was estimated at 0.88.

#### 2.4.4. The Disgust Sensitivity Scale

The Disgust Sensitivity Scale (Version 1; [52]) is a measure of individual differences in sensitivity to disgust. It is a scale with thirty-two items: the first sixteen are binary "true" or "false" questions, the rest assess how disgusting a given experience seems on a scale from 0 ("not disgusting at all") to 2 ("very disgusting"). Example items include: "Even if I was hungry, I would not drink a bowl of my favourite soup if it had been stirred by a used but thoroughly washed flyswatter" and "Seeing a cockroach in someone else's house doesn't bother me". The internal consistency of the Polish version of the scales in our study measured using Cronbach's alpha was estimated at 0.825.

#### 2.4.5. VARSEEK-Scale

The Variety Seeking Tendency Scale (VARSEEK-Scale; [32]) is a scale measuring individual variety-seeking tendency in food choices [53]. The respondents assessed eight statements on a five-point Likert scale (from "completely disagree" to "completely agree"). Examples of statements include: "I prefer to eat food products I am used to" and "When I eat out, I like to try the most unusual items, even if I am not sure I would like them". The internal consistency of the Polish version of the scale in our study measured using Cronbach's alpha was estimated at 0.89.

### *2.5. Data Processing and Statistical Analysis*

In addition to using the questionnaires measuring specific psychological traits, we also analyzed the behavioral data collected during the experimental (product tasting) phase. This data was analyzed on the basis of video recordings made during the experiment. We used BORIS software [54] to code behaviors on the basis of the recorded material, which made it possible to define selected behaviors and to assess their duration and frequency. We scored the behaviors the participants engaged in during the entire experimental phase. Consequently, we were able to assign specific scores to the duration of separate bouts of behavior, their frequency, and the total time participants spent engaging in specific behaviors. We measured the following variables: latency to pick up food products from the plate; latency to begin eating; amount of food eaten (for each product separately); time spent eating; time and frequency of sniffing food products, time and frequency of looking at the food products; frequency of drinking water during the tasting session. In addition, we analyzed the scores awarded by the participants for the products tasted.

The measurements of different behaviors taken in the course of the experiment (as a response to the exposure to food products) were analyzed using an analysis of covariance (ANCOVA) with Label

(2) × Appearance (2) as between-subject factors. The behavioral measurements served as dependent variables, while Label and Appearance manipulations stood for independent variables. Scores from the questionnaires served as covariates. For multiple comparisons, the Bonferroni correction was applied to reduce the likelihood of Type I error. Differences were considered significant for $p$ values of <0.05.

For the amount of food eaten, a repeated measures ANOVA was conducted to analyze the effect of possible differences between the three food products (A—cookie, B—muffin, C—date ball) on a given variable. Label (2) × Appearance (2) were used as between-subject factors and Sample as the within-subject factor (3). Scores obtained from the questionnaires served as covariates.

Descriptive statistics are set out in Appendix A.

The audio data collected during the interviews was transcribed and then subjected to the thematic analysis, which is a method for developing qualitative data consisting of identification, analysis and description of thematic areas [55]. In this type of analysis, a thematic unit is treated as an element related to the research problem that includes an important aspect of data. Two interview moderators, i.e., persons responsible for interviewing the respondents, encoded and analyzed the transcriptions. Next, the created codes were cross-checked. An important advantage of thematic analysis is its flexibility, which makes it possible to adopt a research strategy best suited to the phenomenon under examination. In our study, the thematic analysis focused on various aspects of insect consumption and general attitudes towards insects. However, account was taken of the exploratory nature of the study and the novelty of the phenomenon, and thus the low level of the participants' familiarity with the topic.

## 3. Results

Characteristics of the participants. First, we checked the characteristics of the study participants, especially whether they were distributed equally between the four groups with respect to the demographic variables and the basic psychological measures included in the study (Table 2). Statistical analysis showed no significant differences between the four experimental set-ups with regard to gender balance, age, level of education, and psychological variables. Even though the number of women was four times higher than the number of men, the ratio of men to women was the same in each set-up.

**Table 2.** Characteristics of the study groups. Abbreviation sd refers to the standard deviation.

| Variable | Group 1A $N = 24$ | Group 1B $N = 25$ | Group 2A $N = 25$ | Group 2B $N = 25$ | Statistics |
|---|---|---|---|---|---|
| Sex (women—F; men—M) | 18F/6M | 22F/3M | 19F/6M | 21F/4M | $\chi^2(3) = 1.893$, $p = 0.959$ |
| Age—mean (sd) | 22.1 (3.7) | 22.5 (5.3) | 22.2 (5.4) | 23 (6.9) | $F(3; 95) = 0.139$, $p = 0.936$ |
| Education (secondary/student/higher) | 0/21/3 | 2/19/4 | 1/20/4 | 1/22/2 | $\chi^2(5) = 3.071$, $p = 0.800$ |
| Diets (meat/non-meat) | 16/8 | 13/12 | 11/14 | 14/11 | $\chi^2(9) = 10.637$, $p = 0.301$ |
| Food Neophobia—mean (sd) | 32.3 (8.5) | 32.2 (11.4) | 30.8 (11.8) | 29.2 (12.3) | $F(3; 95) = 0.435$, $p = 0.729$ |
| General Neophobia—mean (sd) | 26.0 (10.8) | 30.4 (11.0) | 32.0 (11.5) | 27.6 (10.8) | $F(3; 95) = 1.499$, $p = 0.220$ |
| Food Technology Neophobia—mean (sd) | 46.6 (12.7) | 46.4 (10.1) | 51.3 (13.9) | 50.4 (13.5) | $F(3; 95) = 0.980$, $p = 0.405$ |
| Variety Seeking Tendency—mean (sd) | 30.8 (5.6) | 31.0 (6.4) | 31.7 (6.0) | 31.2 (7.3) | $F(3; 95) = 0.094$, $p = 0.963$ |
| Disgust—mean (sd) | 15.2 (5.6) | 16.1 (4.4) | 14.1 (4.6) | 15.7 (4.8) | $F(3; 95) = 0.777$, $p = 0.510$ |

### *3.1. Effect of Label and Appearance on Food Acceptance (Behavioural Data)*

Latency to pick up food. The analysis of the latency to pick up the food products from the plate showed a main effect of Label ($F(1, 89) = 6.456$, $p = 0.013$, $eta^2 = 0.068$). Products labelled as containing insects were picked up later than those with labels not indicating any insect content ($t = 2.541$, $p = 0.013$, $d = 0.507$). There was no interactive effect of Label and Appearance, nor a main effect of Appearance. We also found main effects of the covariates General Neophobia ($F(1, 89) = 5.825$, $p = 0.018$, $eta^2 = 0.061$) and Variety Seeking ($F(1, 89) = 6.896$, $p = 0.01$, $eta^2 = 0.072$). There was a positive correlation between the latency to pick up food and General Neophobia scores ($r = 0.206$, $p < 0.05$), while a negative correlation was observed for Variety Seeking Tendency ($r = -0.219$, $p < 0.05$). This may suggest that participants with a higher level of general neophobia started eating food samples later than those with a lower level of general neophobia. Participants with a higher level of variety seeking tendency started eating sooner than those demonstrating a lower level of this characteristic.

Latency to begin eating. In the case of latency to begin eating, we observed a main effect of Label ($F(1, 88) = 5.570$, $p = 0.020$, $eta^2 = 0.059$). Participants began to digest food samples labelled as containing insects later than those with labels not indicating any insect content ($t = 2.360$, $p = 0.020$, $d = 0.503$). There was no interactive effect of Label and Appearance, nor a main effect of Appearance. There was no effect of covariates.

Sniffing and looking at products. Analyses of the time and frequency of sniffing the food products and the time and frequency of looking at the food products showed no differences between the groups, which means that participants examined olfactory and visual properties of the samples for a comparable amount of time despite their different labels and appearances. No effect of covariates was found.

Amount of food eaten. A repeated measures ANOVA for the amount of food eaten revealed a main effect of Label for all three food samples ($F(1, 90) = 23.918$, $p = 0.001$, $eta^2 = 0.210$), but there was no main effect of Appearance or Sample – Figure 2. There were no interactive effects of Sample and Label, nor an interactive effect of Sample and Appearance. This may indicate that the food samples were found to be equally tasty, and the effect of Label was similar for all the samples. Samples labelled as containing insects were consumed in lower quantities then those with labels not indicating insect content regardless of the type of food (sample A: $t = 6.282$, $p < 0.001$, $d = 0.884$; sample B: $t = 2.637$, $p < 0.001$, $d = 0.551$; sample C: $t = 4.646$, $p < 0.001$, $d = 0.963$). A significant effect of the Food Neophobia covariate was also found ($F(1, 90) = 4.283$, $p = 0.041$, $eta^2 = 0.045$). The correlation between Food Neophobia scores and the amount of food eaten was found to be negative, but only for sample C ($r = -0.21$, $p = 0.037$).

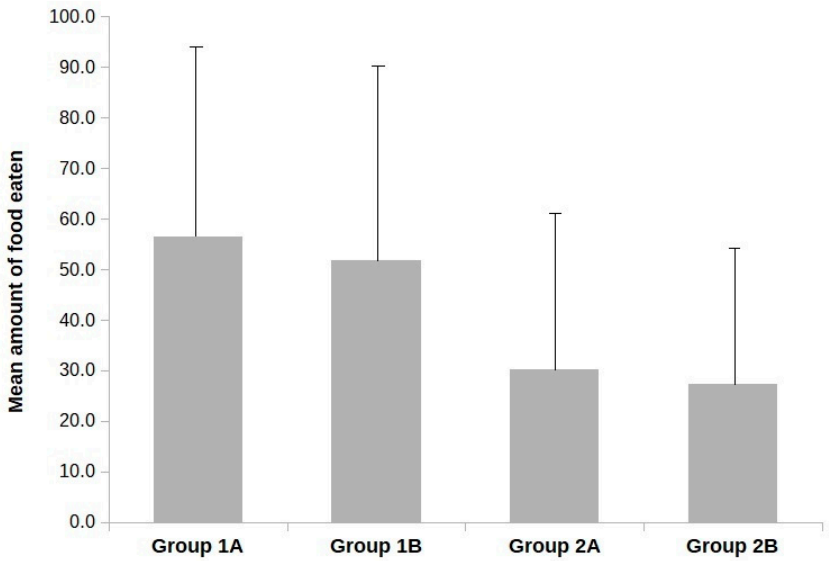


**Figure 2.** Mean amount of food eaten in each group.

Time spent eating. An ANCOVA analysis conducted for the time spent eating yielded a significant effect for Label ($F(1, 89) = 5.922$, $p = 0.017$, $eta^2 = 0.062$), with participants exposed to meals labelled as containing insects eating for a shorter time than individuals who were offered samples with labels not indicating insect content ($t = -2.433$, $p = 0.017$, $d = 0.527$). There was no main effect of Appearance, nor an interactive effect of Label and Appearance.

A similar effect was observed in the case of the frequency of eating bouts. The analysis showed only a main effect of Label ($F(1, 89) = 10.541$, $p = 0.002$, $eta^2 = 0.106$). Participants who ingested food labelled as containing insects ate less frequently than those who were offered food with labels not indicating insect content. These two results may be correlated, as the shorter consumption time probably involves less frequent bites. No effect of covariates was observed.

*Frequency of drinking water.* Differences between the groups were observed in the frequency of drinking water when ingesting food. An ANCOVA revealed an interactive effect of Label and Appearance ($F(1, 89) = 4.625$, $p = 0.034$, $eta^2 = 0.049$). A post-hoc analysis showed that participants who ate the samples with labels and appearance not indicating insect content drank water more frequently than those who ate the products labelled as containing insects with a matching appearance ($t = 3.214$, $p = 0.011$, $d = 0.793$) and than those who ate the products labelled as containing insects with a "smooth" appearance ($t = 2.906$, $p = 0.028$, $d = 0.121$). No effect of covariates was observed.

The above results support the first hypothesis. The effect of Label was found in the latency to pick up food, latency to begin eating, amount of food eaten, and time spent eating variations. Food labelled as containing insects was tasted later and in smaller quantities than food labelled as not containing insects.

However, we found no support for the second hypothesis. There were no differences in the behavioral measures between the foods with traces of insect-like parts and those with a smooth appearance.

Additionally, no interactive effect of Label and Appearance was observed.

The third hypothesis was only partially confirmed. The level of food neophobia correlated only with the amount of food eaten for sample C. General neophobia level and variety seeking tendency level correlated with the latency to pick up food. However, we did not find any confounding effect of disgust and food technology neophobia.

### *3.2. Influence of Label and Appearance on Food Evaluation (Product Questionnaires)*

We conducted an ANCOVA analysis of food evaluation scores depending on product information (label) and food appearance. For the first question about the willingness to try the products offered, there was a main effect of Label ($F(1, 89) = 5.379$, $p = 0.023$, $eta^2 = 0.056$) and a main effect of Appearance ($F(1, 89) = 4.460$, $p = 0.037$, $eta^2 = 0.047$), but no interactive effect was observed. Participants declared less willingness to try the products labelled as containing insects ($t = 2.319$, $p = 0.023$, $d = 0.471$) and the "smooth" products with no easily discernible elements ($t = 2.112$, $p = 0.037$, $d = 0.414$). However, there were no differences between the experimental groups with regard to the scores awarded for appearance, smell, taste, and willingness to eat more of the product. There was no effect of covariates.

These findings support the first and second hypotheses, but only as regards the first question of the questionnaire.

### *3.3. Qualitative Data Analysis—Interviews*

Previous experience of eating insects. Prior to the experiment, all respondents had some experience of entomophagy. In most cases, however, this involved observing insect-eating behaviors in other people (on television, the internet) rather than through direct personal experience of ingesting insects. Insects are perceived as exotic and are associated with Asian (particularly Vietnamese, Chinese, Cambodian, Indian) or African food, as shown on travel or survival TV shows. The few persons who had themselves tried dishes containing insects before participating in the experiment, tried insects bought by their friends as "souvenirs" from far-away countries.

> *"For sure, only not in our culture. In Asia, if I'm not mistaken, Thailand, I think. Chinese markets are what I always associate [with insects], like on travel shows, with tonnes of colourful larvae. It is certainly controversial for Europeans—it would most likely be for me, but [I would be willing to try insects] out of curiosity what that would be like ( . . . )."*

Barriers to eating insects. The first reaction to ingesting insects was disgust. In the participants' opinion, insects are slimy and evoke associations with filth, basements, and waste. These associations are further reinforced by the image of insects on TV shows, especially on children's programs.

Because we associate bugs with something disgusting, bugs in food are more often associated with throwing away food and not eating it. Bugs are eaten by wild animals and not by humans.

> *I would be afraid that I would feel the structure of this thing and that it would simply be disgusting: limbs or feelers or something like that. I think everyone is afraid that an insect can come alive in your mouth. Out of some internal fear—they are so disgusting and unpleasant.*

The respondents claimed that in our culture "one does not eat insects—it is as simple as that". Some participants, even though they were unable to specifically identify what makes insects so disgusting, pointed to the cultural aspects and the importance of upbringing: "we are simply not used to [eating insects]".

> *It is a cultural thing. For us, [insects] are exotic, disgusting, because we have learned to think [about them] this way. [They are] food, as any other type of food, specific for particular regions. And this works this way for us too—we eat pickled cucumbers and sauerkraut, which for some people is simply rotten food. So if we looked at it completely objectively, it seems that eating rotten food is a bigger problem than eating processed insects.*

On the other hand, the participants stated it would be sufficient to "get over oneself and try". They claimed to see a potential advantage in the wider availability of insects and in their potential to become something commonplace and therefore not rejected by the society in general.

> *It is all in your head—we have always been told that an insect is just an insect, it is disgusting, it is a pest. I think this has a huge impact. Insects are not soft and fluffy, but they have hard shells or something, so they don't look too good either, to be perfectly honest.*

Perceived advantages of eating insects. Many respondents pointed to insects' high nutritional value as an advantage; they evoked their high protein content and occasionally mentioned other unspecified vitamins and nutrients.

Some respondents mentioned the economic aspects of industrial insect farming. Insects are thought to be inexpensive and easy to produce and transport. Occasionally, the participants described insects as a potential future substitute for meat. Such statements, however, mostly came from vegetarians, who also expressed concerns over the ethical aspects of insect farming. Their answers indicated that they were not certain whether insects were animals. A criterion commonly used for assessing the morality of eating insects was their ability to feel pain. The respondents were not sure whether insects feel pain.

> *Perhaps also because, for example, when we kill and eat mammals, they certainly feel more pain than insects—it is as simple as that. Maybe it would be more . . . humane . . . this may be the wrong word here . . . but maybe we could follow that path to reduce the number of animals bred for meat.*

Experiences from the tasting session. The main reason for which the participants decided to try the cookies with insects was curiosity. After seeing a "normal" looking cookie, they were curious whether it tasted different from what they expected from its appearance.

*No, I was wondering if I was going to get anything from the new technologies and if it was going to look strange and resemble God knows what, but I was positively surprised, because it looked tasty. Yes, at first, yes, to some degree, in general, when I saw the labels I thought 'What did they give me? There is no way I'm trying it.' But when I had a look, all looked good and this encouraged me to try it. If I had got an insect on my plate, I would never have tried it. When I tried the first one, I completely switched off thinking that I was eating insects.*

The decision to try the products was also made easier by the fact that the products looked appetizing and nice. Another safeguard encouraging the participants to try the cookies was the scientific setting; participating in a research experiment guaranteed the safety and hygiene of the products ingested ("you would not give me anything poisonous to eat"). According to the study participants, one of the potential barriers could be the lack of hygiene linked to eating insects, resulting from the aforementioned associations with filth.

The study participants were unable to precisely identify their expectations and assumptions with regard to the taste of the cookies. They expected the cookies to taste strange or different, "like a bug", but they were unable to say what they specifically meant. After trying the products, they referred to their own preferences for desserts rather than to the insect content. Their experience was not particularly positive or negative.

Potential for adding insects to everyday diet. The study participants imagined a potential insect consumer to be a young person who is open to new experiences, with a positive attitude, who eats meat but wants to reduce the amount of meat in their diet or to stop eating it completely. In the participants' opinion, insects could become a fashionable "curiosity" in certain social circles.

The respondents suggested that insect-based food may not be a good idea for the elderly or for vegetarians or vegans (due to the unclear status of insects as animals being able to feel pain). Despite the perceived advantages of insects, their market potential and the positive experiences from the tasting session, most participants claimed that insects were not an appropriate food for them. Yet, some answers suggested a willingness to try insects if they were commercially available. The participants thought, however, that it would rather be a one-off experience than a decision to include insects in their diet on a regular basis. They expressed a wish to reduce the amount of meat and not a need to include other types of meat in their diet. They did not see any direct value for themselves resulting from including insects in their everyday diet.

*It can always be a new taste. I'm curious, I must admit. This can always be a new food form. I doubt that I would be eating [insects] in any large quantities—I'm more interested to just try [them]. I doubt I would try the same form. I have eaten a cookie, maybe [I could eat] an entire cricket, but it only happened once, and that's probably enough. Yes, I would most likely not include [insects] in my diet, but I would only try [them], in small amounts, out of curiosity.*

The participants believed that the way of serving and the manner of presenting insects could help encourage more people to eat insect-based products. It would be best if insect bodies or parts were not discernible, i.e., if they were added in powder form as a ground protein additive. Some insect types evoke more disgust than others, and the participants stated explicitly that their names should not be provided on product labels or should be indicated in another way that does not elicit negative associations (e.g., larvae). Overcoming the barrier involving associations with filth could be facilitated, in the view of some participants, by the mere presence of products containing insects in grocery shops. They believe that making a product widely available on the market makes people perceive it as being tested and suitable for human consumption. Other respondents pointed to the need to create appropriate insect production safety certificates.

## 4. Discussion

The analysis of the data collected during the experiment revealed a significant effect of Label on product evaluation. Products labelled as containing insects were ingested in smaller quantities and

less frequently, regardless of their appearance. In addition, the latency to pick up and eat products was higher in the case of products labelled as containing insects. The effect of label was also found in a study by Mancini and colleagues [14]. The addition of elements imitating insect parts had no effect on consumption levels. This shows that labelling a product as containing insects is, in itself, sufficient to elicit a reluctance to ingest it and results in a decrease in the amount of food ingested. This effect seems to occur regardless of the form in which the insects are served (insect parts or insect flour). Moreover, the type of insect (larvae, crickets, or cockroaches) specified on the label did not affect the quantity of food ingested, which was comparable for all three products. Additionally, when filling in the food evaluation questionnaires, the respondents stated that they were less willing to try products containing insects regardless of insect type and appearance.

While the effect of Label observed in our study is in line with our expectations and confirms the commonly expressed reluctance and aversion to ingesting insect-based products or products with insect content [22–24], the fact that no effect of appearance was observed raises several questions. It cannot be ruled out that the appearance of the elements imitating insect parts affected the outcome of the evaluation. The elements were sufficiently small that they did not resemble whole insects or discernible insect body parts (limbs, wings, etc.) It seems that the form of the added elements did not elicit associations with contamination or pollution [44]. At the same time, this effect may confirm earlier observations that adding processed insects elicits fewer negative impressions than adding whole insects (e.g., [20,39]). It may be suggested that the required level of processing need not reduce insects to flour—it is sufficient that consumers are unable to discern insect body parts in the product.

It is interesting, however, that although the respondents were less willing to try products containing insects, there was no difference in scores awarded for sensory qualities. All the products received similar scores on the taste, smell, and appearance scales. Moreover, there was no difference between the groups with regard to the respondents' willingness to eat those products again. Possible explanations for this may be found in the interviews carried out after the tasting session. The participants stated that they had expected a specific insect taste, and when it turned out that the products labelled as containing insects did not have a new or an unfamiliar taste, they scored the products in the same way as they would score any other cake or pastry. These results are in line with the findings of Sogari and colleagues [43], who showed that both unprocessed and processed insect-based products generate more positive perceptions after tasting compared to expectations. This may suggest that the absence of an unfamiliar taste decreased the novelty effect, thereby reducing neophobia (cf. [27,56]). This is borne out by the fact that in most of the conducted analyses there was no effect of food neophobia as a covariate (cf. [20,57]). The forms of the products (cookie, muffin) were familiar and their taste did not differ from the taste of regular cakes, which may explain why this factor was not observed in the analysis. The only less-commonly known product was the date ball. In this case, food neophobia was only manifested in the amount of food eaten. Participants scoring higher on the food neophobia scale ingested less of the product labelled as containing insects than persons with lower food neophobia levels. Of the three products used in our study, the date ball is the least common and the least widely available in shops. This reduced availability may have elicited a neophobic reaction to an unfamiliar product in some participants [27,56].

The reluctance to try products labelled as containing insects, measured by the latency to pick up food, revealed an effect of the General Neophobia and Variety Seeking Tendency covariates. Participants scoring high on the GN scale picked up the products labelled as containing insects after a longer time than those with low GN levels. Conversely, respondents with high VST scores picked them up sooner than those scoring low on the VST scale. This suggests that the effect of novelty of the products labelled as containing insects manifested itself immediately when participants came into contact with the products. After the product was assessed as safe, however, this effect decreased. The absence of the novelty effect was also observed in the investigative behavior measurements. There were no differences between the groups with regard to the amount of time spent sniffing and looking at the products.

The frequency of water drinking is difficult to explain. There was an interactive effect of Label and Appearance for this variable. When ingesting products in the case of which no insect content was either explicitly indicated on the label or implied by the additional particles, the participants drank water more frequently than when eating products with explicitly stated or implied insect content. It seems that those respondents who ingested non-insect products ate more of the food and therefore needed to drink more water when ingesting it.

The initial reaction to insect-based food that people commonly express verbally is disgust, as confirmed by previous studies (cf. [20,57,58]) and by the interviews conducted in our study. However, this variable was not observed in the behavioral assessment measures, which may be linked, as mentioned above, to the appearance of the elements added to the products that did not elicit associations with contamination or pollution (cf. [44]) and did not resemble whole animal bodies. Low disgust levels may also stem from the experimental setting; in the interviews, the respondents said that they were convinced that in a scientific experiment they would be given safe and hygienic products. They also mentioned that the products were aesthetically pleasing and their dessert form encouraged the participants to try them. This may indicate that serving insects as ingredients in favorite desserts may be a good strategy (cf. [36]), but it may also depend on the food preferences typical of a specific culture. Moreover, it seems that the feeling of disgust reported when thinking about ingesting insects is replaced by other emotions during contact with an aesthetically pleasing product prepared and served in a safe setting.

This may suggest that it is possible to create such products and eating conditions that could help reduce the effect of disgust. If a product is familiar (cf. [14]), has an aesthetically pleasing form, and if consumers are convinced it is safe, such a product may be accepted despite information on insect content (cf. [58,59]). Outside research settings, product safety is determined on the basis of where it is sold. The respondents stated that a product's widespread commercial availability in shops would encourage them to think that it is safe and that its sales are monitored (cf. [60]). Official safety certificates awarded by appropriate institutions or organizations could have a similar effect. Widespread availability would also convey the impression of a product being widely consumed by others (social proof—[61]). Limited availability, coupled with the fact that they are sold in tourism and pet shops, leads people to still perceive insect-based products to be exotic and foreign.

To conclude, the results of our study confirm the first hypothesis. However, the second hypothesis was not confirmed. The participants, regardless of the appearance of the products, ingested products labelled as containing insects in smaller amounts. In the interviews, the respondents implied that the information about insect content was in itself enough to evoke reluctance and doubts as to whether they should try the product. They pointed out that images of insects on product packaging would also create a negative impression and suggested that certain types of insects (e.g., mealworm larvae) were more disgusting than others.

It seems, however, that it is without consequence whether insects are added in the form of small pieces or flour, as long as whole insects or their body parts are not easily discernible. It is a good strategy to add insects to well-liked products. Insects should be added to familiar products, with familiar taste/smell/texture, and the elements added should not change those properties. The products themselves should have an aesthetically pleasing appearance. All those measures may help convince consumers that such products are safe. In this way, the consumers' preferences for specific products may be generalized to insect-based products.

The study has many implications for management and marketing strategies. First, the results of the study showed that the manner of communicating information on insect-based ingredients has a huge impact on the perception of the product and its future marketing success. The presence of such information is enough to reduce interest in the product. Therefore, placing such products on the market should be preceded by extensive consumer research conducted with a view to selecting the right message and labelling to eliminate that negative effect. Second, to ensure a product's marketing success, it is important to select the right target group. Our research has shown that the group most

open to insect-based food are experimenters and variety seekers; on the other hand, the group most reluctant to accept such products are people with high levels of neophobia. This result suggests that an effective positioning strategy of a product containing insect ingredients should refer to "variety seeking" or "experimenting". This study also showed no differences in the evaluation of taste regardless of whether the products had been labelled as containing insects or not. At the same time, unwillingness to try products labelled as containing insects suggests that the problem does not lie in the taste of the product (which has also been confirmed by other studies), but rather in some sort of prejudice against products that contain insects. This is linked to the third implication: it is probably worthwhile to place such products on the market using a "sampling strategy", such as food tasting campaigns in shops, which can help consumers overcome their mental block and try these products.

A very significant aspect of our study is the fact that we used several behavioral measures and not only participants' declarations, as is the case with many studies conducted to date. In doing so, we were able to observe real-life multidimensional reactions to the products used. The interviews conducted after the behavioral assessment phase proved helpful for interpreting the quantitative results and provided ideas for future research and practical solutions.

The study, however, has certain limitations. The study population was characterized by a significant gender imbalance, which prevented us from analyzing the effect of the gender variable. Nevertheless, there was no theoretical basis for assuming such an effect, and we strove to ensure that the gender ratio was identical in each group. The same applied to the remaining demographic data, i.e., level of education and age, as well as dietary preferences—no differences were observed for those variables between the groups. Another limitation was that the majority of participants were students, which may reduce the ability to generalize the results to the general population. However, the participants in our study were full-time as well as evening-course students. The latter represent a broader spectrum of population, as they are often older than full-time students; they often work full-time and have families, which may reduce the effect of the specificity of the study group. Nevertheless, future research should be conducted on a more socio-economically diverse sample to help identify the general mechanisms underlying the phenomenon examined and to ensure the relevance of the findings for marketing strategies. Another important factor that should be considered is personal food preference, especially attitudes towards meat consumption. The results of the interviews show that people following a vegetarian diet are not sure about the appropriateness of consuming insects, as they do not fully understand whether arthropods are able to feel pain, etc.

It is crucial to examine cultural differences between the populations (e.g., participants from different countries), as populations may differ in their food preferences. It is possible that this factor substantially influences acceptance of insects as food and the choice of specific products. Cross-cultural comparative studies (including Asian countries) would also shed light on the universality of the mechanisms underlying the acceptance/rejection of entomophagy.

With regard to the possibility of applying research results in practice, future studies should examine other measures identifying different personal characteristics, such as the tendency to take risks, curiosity, and the need for exploration, as well as variables related to health and moral values.

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## Appendix A

| Descriptive Statistics of All Quantitative Measures Registered in This Study. | | | | |
|---|---|---|---|---|
| | **Group** | **N** | **Mean** | **Standard Deviation** |
| Latency to pick up food sample | 1A | 24 | 10.743 | 7.751 |
| | 1B | 25 | 20.191 | 18.22 |
| | 2A | 25 | 35.315 | 43.451 |
| | 2B | 25 | 21.604 | 18.359 |
| Latency to begin eating | 1A | 24 | 22.018 | 15.059 |
| | 1B | 25 | 28.31 | 17.194 |
| | 2A | 25 | 33.991 | 18.752 |
| | 2B | 25 | 34.015 | 19.735 |
| Frequency of sniffing food samples | 1A | 24 | 3.708 | 2.136 |
| | 1B | 25 | 4.32 | 1.52 |
| | 2A | 25 | 3.333 | 2.099 |
| | 2B | 25 | 4.08 | 2.1 |
| Frequency of looking at food samples | 1A | 24 | 12 | 6.386 |
| | 1B | 25 | 12.76 | 9.791 |
| | 2A | 25 | 8.375 | 5.046 |
| | 2B | 25 | 11.28 | 8.503 |
| Time spent sniffing food samples | 1A | 24 | 6.21 | 4.728 |
| | 1B | 25 | 5.992 | 3.505 |
| | 2A | 25 | 5.601 | 5.158 |
| | 2B | 25 | 4.596 | 2.404 |
| Time spent looking at food samples | 1A | 24 | 36.309 | 25.171 |
| | 1B | 25 | 44.262 | 36.747 |
| | 2A | 25 | 28.044 | 20.075 |
| | 2B | 25 | 34.713 | 25.275 |
| Amount of eaten sample A | 1A | 24 | 43.681 | 35.925 |
| | 1B | 25 | 39.061 | 39.095 |
| | 2A | 25 | 14.543 | 19.209 |
| | 2B | 25 | 16.305 | 21.256 |
| Amount of eaten sample B | 1A | 24 | 45.169 | 40.854 |
| | 1B | 25 | 39.27 | 35.224 |
| | 2A | 25 | 26.29 | 30.39 |
| | 2B | 25 | 27.511 | 30.362 |
| Amount of eaten sample C | 1A | 24 | 80.306 | 32.5 |
| | 1B | 25 | 77.298 | 37.458 |
| | 2A | 25 | 50.038 | 44.672 |
| | 2B | 25 | 37.981 | 38.167 |

| Descriptive Statistics of All Quantitative Measures Registered in This Study. | | | | |
|---|---|---|---|---|
| | **Group** | **N** | **Mean** | **Standard Deviation** |
| Time spent eating | 1A | 24 | 402.23 | 153.93 |
| | 1B | 25 | 405.18 | 196.216 |
| | 2A | 25 | 316.694 | 139.009 |
| | 2B | 25 | 327.623 | 131.485 |
| Frequency of the eating bouts | 1A | 24 | 9 | 4.181 |
| | 1B | 25 | 8.72 | 6.724 |
| | 2A | 25 | 5.875 | 4.875 |
| | 2B | 25 | 5.84 | 4.22 |
| Frequency of drinking water | 1A | 24 | 36.309 | 25.171 |
| | 1B | 25 | 44.262 | 36.747 |
| | 2A | 25 | 28.044 | 20.075 |
| | 2B | 25 | 34.713 | 25.275 |

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*Article*

# Relationship between Acceptance of Insects as an Alternative to Meat and Willingness to Consume Insect-Based Food—A Study on a Representative Sample of the Polish Population

**Klaudia Modlinska [1,*], Dominika Adamczyk [2], Dominika Maison [2], Katarzyna Goncikowska [1] and Wojciech Pisula [1]**

[1] Institute of Psychology, Polish Academy of Science, Jaracza 1, 00-378 Warsaw, Poland; katarzyna.goncikowska@gmail.com (K.G.); wojciech.pisula@wp.pl (W.P.)
[2] Faculty of Psychology, University of Warsaw, Stawki 5/7, 00-183 Warsaw, Poland; dominika.adamczyk@psych.uw.edu.pl (D.A.); dominika@psych.uw.edu.pl (D.M.)
* Correspondence: kmodlinska@wp.pl

**Abstract:** Despite their nutritional and ecological potential, insect-based food is rarely accepted by consumers. There may be a discrepancy between the consumers' understanding of the need to reduce meat consumption and their personal food preferences. Our goal was to investigate the relationship between the acceptance of insects as a meat substitute, the willingness to buy and consume insect-based food, and the underlying factors. The study was conducted on a representative sample of the Polish population, and as in previous studies, our results showed that men who are more familiar with entomophagy pay more attention to the environmental impact of their food choices, are convenience-orientated and are more willing to accept insects as a meat substitute. However, people with higher levels of food neophobia and disgust sensitivity and lower levels of variety-seeking tendency are less willing to consume insects. Our study showed that the acceptance of insects as an alternative to meat (general perspective) does not translate into a willingness to buy and eat them (individual perspective). Consumers who declare their acceptance of insects as a meat substitute might not be willing to purchase insects for their consumption.

**Keywords:** insects as food; food neophobia; variety-seeking; environmental concerns; disgust; consumer studies; eating; food choices; sustainable meat alternative



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## 1. Introduction

Although growing evidence suggests that reducing meat consumption is inevitable due to the environmental impact and ethical issues linked to meat production, the consumption of meat substitutes among Western consumers is still low (e.g., [1]). The strongest objections are voiced with regard to insects (e.g., [2,3]), which could be a sustainable source of protein and other essential nutrients [3–6]. Even in several developing countries such as Kenya, where inhabitants are culturally accustomed to consuming certain types of insects, attempts at introducing novel insect-based food often meet with resistance [7]. Moreover, the consumption of insects is in decline in countries where it used to be the norm [8,9].

To date, several factors have been identified as barriers to introducing insects into the daily diet. The main variable is food neophobia: the reluctance to eat novel food [10]. Persons with high levels of this psychological trait are among those most resistant to the idea of ingesting insects (e.g., [11–13]). These findings demonstrate the importance of familiarity with a particular product for its acceptance as food [14–17]. Prior exposure to the consumption of insects creates an indicator of cultural appropriateness of this kind of food [18–20] and translates into greater willingness to ingest it [21].

Another significant factor linked to the reluctance to consume insects is disgust [22], which results from associating insects with dirt and decay [23]. Disgust is often assumed

to be one of the major arguments for rejecting insects, as indicated by consumers ([24–27], but [27,28]).

On the other hand, some influential factors have been identified as promoters of insect consumption. An intrinsic desire for variety (the "variety-seeking tendency") is recognised as an essential factor influencing consumer food choice [26]. Its significance was also shown in studies on insect consumption where a high variety-seeking tendency correlated with a greater willingness to eat insect-based food [27,29–32].

Considering the environmental and ethical advantages of insect production, it is also possible that factors influencing lower meat consumption may play a role in the willingness to ingest insects. A set of personally held ideas may influence decisions linked to the choice of food [33]. Individuals who are concerned about the degradation of the natural environment, are more likely to accept novel kinds of food if they are persuaded of their beneficial impact on nature (see [21,26,34,35]).

Health issues are another essential factor that influences dietary choices [36]. Insects may be considered a valuable source of animal nutrients, which are insufficiently present in vegetarian diets, such as amino acids or vitamin B12 [3]. Knowledge about the health benefits of this type of meat substitute may influence the willingness to incorporate it into one's diet (cf. [37,38]).

Analysing all these factors may allow us to create a specific profile of a potential consumer of insect-based foodstuffs. To date, there is a shortage of studies presenting comprehensive findings drawn from representative samples, which hinders the application of research findings to marketing strategies. The first consumer profile of the population willing to adopt insects as food was presented by Verbeke [21]. The study, which was conducted on a representative sample of the Belgian population, indicated that factors such as gender, familiarity, food neophobia, convenience, and pro-environmental food choice motives, as well as attitudes to meat and future meat consumption intentions, play a significant role in predicting the level of acceptance of insects as an alternative to meat. The study showed that the target group for insect-based foodstuffs is younger males without strong attitudes towards meat who are open to trying novel foods (low food neophobia) and interested in the environmental impact of their food choices. The likelihood that such consumers are ready to adopt insects as a meat substitute was estimated at 75%. The author suggests that this study, conducted in Belgium, represents a typical Western consumer profile, which may be true, as most of the identified factors were also found in studies conducted in other countries (e.g., [17,39]).

Other studies examined factors influencing the acceptance of insect-based food, and although they were conducted on large populations, none of them included nationwide samples. A study by Hartmann and colleagues [40] revealed that low scores on the food neophobia scale, positive taste expectations, high scores on social acceptance, and experiences eating insects were significant predictors of a willingness to eat insects in both Germany ($n$ = 502) and China ($n$ = 443). The authors underlined the importance of familiarity with products containing insects for reducing neophobic reactions and negative attitudes towards this kind of food.

Among Hungarian consumers ($n$ = 400), the most willing to accept insect-based food were those who seek novel food options and intend to reduce their meat intake [41]. Findings from studies conducted on Italian consumers showed, similarly to a study by Verbeke [21], that the readiness to accept insects was higher among males than females and among younger consumers than older [39]. Although knowledge about environmental factors of insect production positively affected the level of acceptance of insect-based products among professionals and students, there was no sustainable daily efforts in this respect [39]. In Switzerland ($n$ = 379), several predictors of the willingness to consume insects were identified, such as convenience, the discernibility of insects in food, expected health benefits, need for familiarity, food neophobia, food technology neophobia, perceived health benefits of meat, as well as gender and experience [17]. Again, younger males were identified as the most willing to try insects, but the authors suggest that it may result from a higher rate of

familiarity with this type of food in this group. On the other hand, the attachment to meat was a negative predictor of insect acceptance. Contrary to other studies, food neophobia, although important, was not found to be the key predictor of the willingness to consume insects, and it was closely correlated with familiarity. A survey among Chinese consumers ($n$ = 614) depicted factors such as entomophobia, disgust, knowledge about insects, and demographic variables such as age, household size, household income, and region of residence [42]. A recent study conducted on Italian and Danish consumers ($n$ = 300), the group most willing to adopt insects as food was identified among the so-called rational food consumers (i.e., people who seek information about products, use shopping lists or look for new ways to prepare food) [43].

Despite numerous attempts to create a profile of a prospective consumer of insect-based food, sales and consumption remain low. We hypothesize that it may be due to an overlap of two different dimensions related to insects' consumption, hindering a closer understanding of these phenomena (cf. [19]). First, the need to reduce meat production and consumption creates the market for its substitutes. People aware of environmental and health issues may be more in favor of the idea of meat substitutes (for review [44]; see also [26]). Therefore, it seems that those who paying attention to the environmental impact of food choices may be a suitable target for insect-based foodstuffs. It is likely that asked about acceptance of insect-based foods they would voice a positive attitude. Second, there are multiple psychological factors responsible for willingness to consume novel and unusual food [11–15,24,25,30,31], which may hinder the willingness to purchase and consume insects. Yet, it is possible that acceptance of the idea and a willingness to purchase and consume insects are not correlated, and different factors predict both phenomena. This notion is based on the suggestion of Sogari and colleagues [14] that providing knowledge about the environmental and nutritional benefits of insect consumption is not likely to influence consumers (see also [13]). However, some previous studies (cf. [2,21,45–47]) seem to be based on the idea that the combined analysis of these two areas allows the creation of a profile of a customer willing to buy and eat insects. It is likely that the discrepancy between these two matters may require different educational and marketing strategies.

Therefore, the goal of our study was to investigate the relationship between the acceptance of insects as a meat substitute and the willingness to buy and consume insect-based foodstuffs. In our analyses, we incorporated psychological and demographic variables which had been found to be relevant in previous studies. Regression models were used to conduct the analyses.

## 2. Materials and Methods

The study was conducted from November to December 2020 in an online panel specializing in social studies with the use of a Computer-Assisted Web Interview (CAWI). All participants gave their informed consent after reading detailed information about the experiment. They were asked to click on a link to the study if they agreed to take part. The study had been approved by the Research Ethics Committee at the Faculty of Psychology, University of Warsaw.

To verify the hypothesis about the discrepancy between the acceptance of insects as a meat substitute and the willingness to buy and consume insect-based foodstuffs, we planned a study involving separate analyses of both phenomena followed by an investigation of the relation between them. The study was accompanied by a series of questionnaires and questions measuring levels of factors potentially related to both areas of study. These factors were chosen based on previous studies to allow for the comparison of results.

### 2.1. Participants

A nationwide representative random quota sample of a total of 1096 people was selected from among the online panel (55% women; 45% men), aged 16–78 years (M = 44, SD = 15.15). The sample structure corresponded to the structure of the Polish population

(the quotas were selected based on the distribution of gender, age, education, and the size of the city). The descriptive statistics of the sample are presented in Table 1.

**Table 1.** Descriptive statistics of dependent and explanatory variables ($n$ = 1096).

| Variable | Label | Mean (SD) |
|---|---|---|
| *Dependent variables* | | |
| Attitude to adopt insects as a meat substitute (1 = no, 2 = yes) | MS | 1.23 (0.42) |
| Acceptance of food with insect-derived ingredients (min = 1, max = 7) | EA | 3.57 (1.16) |
| *Explanatory variables* | | |
| Familiarity with insect consumption (min = 4, max = 12) | Fam | 5.20 (1.2) |
| Attitude towards the health characteristics of food (min = 3, max = 21) | FHealth | 14.66 (3.66) |
| Convenience orientation in relation to food (min = 1, max = 7) | FConv | 3.21 (1.74) |
| Attention to the environmental impact of food choices (min = 3, max = 21) | FEnv | 13.57 (4.06) |
| Food neophobia (min = 10, max = 68) | FN | 34.22 (9.41) |
| General neophobia (min = 8, max = 56) | GN | 30.75 (9.35) |
| Disgust Sensitivity (min = 2, max = 24) | DS | 12.72 (2.99) |
| Variety-Seeking (min = 8, max = 56) | VS | 38.54 (7.95) |
| Travelling frequency—business (min = 1, max = 6) | TravB | 1.67 (1.08) |
| Travelling frequency—pleasure (min = 1, max = 6) | TravP | 2.21 (1.11) |
| Gender (1 = female, 2 = male) | Gender | 1.45 (0.50) |
| Age (years) | Age | 43.94 (15.15) |
| Diet (1 = vegetarian, 2 = vegan, 3 = none) | Diet | 2.79 (0.60) |
| Education (1 = primary or secondary, 2 = higher) | Edu | 1.44 (0.49) |
| Place of residence (1–4) | Place | 2.09 (1.03) |

Min and max values present the level of scores reached by participants in the present study.

### 2.2. Questionnaires and Scales

#### 2.2.1. Attitude to Adopting Insects as a Meat Substitute (MS)

Consumer readiness to adopt insects as a meat substitute was measured by asking the participants to provide their response to one item: "Insects could replace meat in our diet". The participants assessed the statement on a 5-point Likert scale (1-totally disagree, 5-totally agree). Contrary to the study by Verbeke [21], we did not provide prior information about the benefits of eating insects (in the original study, the participants were told "[insects] are a good source of high-value proteins; their production requires little space; their feed conversion is efficient; therefore, eating insects provides benefits in terms of sustainability"). We decided to proceed this way because informing participants about the benefits of eating insects and their production could influence their assessment of whether insects could replace meat in their diet [35,48].

#### 2.2.2. Acceptance of Food with Insect-Derived Ingredients (EA)

The participants' acceptance of food with insect-derived ingredients was measured by the Entomophagy Attitude Questionnaire (EAQ) [12]. This tool comprised 10 questions, and participants assessed them on a 7-point Likert scale (from 1-"completely disagree" to 7-"completely agree"). Statements included, "I would be disgusted to eat any dish with insects"; "I think it is fine to give insect-based feed to fish that are farmed for human consumption"; and "I'd be curious to taste a dish with insects if cooked well". The items

were merged into one entomophagy attitude (EA) score. The internal consistency of the Polish version of the scale in our study measured using Cronbach's alpha was estimated at 0.88.

#### 2.2.3. Familiarity with Insect Consumption (Fam)

The participants were also asked four questions regarding their experience and awareness of insect consumption. According to Verbeke [21], the first two questions concerned the awareness of entomophagy as a phenomenon ("Have you heard that in other countries people eat insects on a daily basis?" (yes/no) and "Have you heard that in our country you can buy edible insects in the store?" (yes/ no). Because numerous studies (e.g., [17]) show that previous insect consumption is a strong predictor of willingness to consume insects, the subsequent questions were related to the experience with eating insect-based food ("Have you ever eaten insects or food containing them?"—No, never; I am not sure; Yes, once; Yes, more than once) and preparing this kind of food ("Have you ever tried to make a dish with insects or with ingredients from insects?"—No, never; Yes, a few times; Yes, many times). The information recorded through these questions was summed up, and this variable was used as a proxy for self-reported familiarity (Fam) with the notion of entomophagy.

#### 2.2.4. Attitudes towards Health Characteristics of Food (FHealth)

Consumer attitudes towards the health characteristics of food were measured using three items: "I pay attention to how the food I choose affect my health"; "I know which food is healthy and which is not"; and "When shopping, I choose products that have labels indicating their health benefits". Each item was scored on a 7-point scale (1—totally disagree; 7—totally agree). The three items were merged into one food health (FHealth) interest score—Cronbach's alpha = 0.81.

#### 2.2.5. Convenience Orientation in Relation to Food (FConv)

Convenience orientation in relation to food was measured using one item—"I don't care what I eat, satisfying my hunger is the most important thing". The item was scored on a 7-point scale (1—totally disagree, 7—totally agree), and it indicated an interest in choice based on food convenience (FConv).

#### 2.2.6. Consumers' Attention to the Environmental (FEnv) Impact of Their Food Choices

Consumers' attention to the environmental impact of their food choices was measured using a method similar to the method used in the study by Verbeke [21], but using three items: "When I buy food, I try to pay attention to how its production affects the environment"; "I try to avoid food products whose production is harmful to the environment"; and "I am interested in how food production affects the environment". The first item, following the study by Verbeke [21], was based on Roberts [46], and the other two were additional. All three items were scored on a 7-point scale (1—totally disagree; 7—totally agree). These three items were summed up, and treated as indicators of attention to the environmental impact of the participants' food choices (Cronbach's alpha = 0.86).

#### 2.2.7. Food Neophobia (FN)

Food neophobia was measured by means of the Food Neophobia Scale (FNS) [49], which is used to measure the willingness to try new foods. The scale consists of 10 statements: five positive (indicative of neophilic attitudes) and five negative (indicative of neophobic attitudes). For example: "I don't trust new food"; and "At dinner parties, I will try a new food". Participants assessed the statements on a 7-point scale (1—strongly disagree; 7—strongly agree. The internal consistency of the Polish version of the scale in our study measured using Cronbach's alpha was estimated at 0.84.

#### 2.2.8. General Neophobia (GN)

The general level of neophobia was measured with the General Neophobia Scale (GNS). GNS was developed together with the Food Neophobia Scale by Pilner and Hobden [49]. The scale comprises eight items evaluated on a 7-point Likert scale (1—strongly disagree; 7—strongly agree). Examples of statements include "I am afraid of the unknown"; and "Whenever I am on vacation, I can't wait to get home". The internal consistency of the Polish version of the scale in our study measured using Cronbach's alpha was estimated at 0.91.

#### 2.2.9. Disgust Sensitivity (DS)

Individual differences in sensitivity to disgust were measured with the Disgust Scale-Revised [50]. The scale consists of 22 items: the first 13 are binary "true" or "false" questions, and the rest assess how disgusting a given experience seems on a scale from 0 ("not disgusting at all") to 2 ("very disgusting"). Example items include "Even if I was hungry, I would not drink a bowl of my favorite soup if it had been stirred by a used but thoroughly washed flyswatter"; and "Seeing a cockroach in someone else's house doesn't bother me". The internal consistency of the Polish version of the scales in our study measured using Cronbach's alpha was estimated at 0.83.

#### 2.2.10. Variety Seeking (VS)

The individual level of variety-seeking tendency in the context of food choice was measured with the Variety Seeking Tendency Scale (VARSEEK-Scale) [29]. The respondents assessed eight statements on a five-point Likert scale (1—completely disagree; 5—completely agree). Examples of statements include "I prefer to eat food products I am used to"; and "When I eat out, I like to try the most unusual items, even if I am not sure I would like them". The internal consistency of the Polish version of the scale in our study measured using Cronbach's alpha was estimated at 0.91.

#### 2.2.11. Experience with Traveling for Business (TravB) and for Pleasure (TravP)

The participants were asked about their experience with traveling abroad: "How often did you travel to other countries for business purposes in the past year?"; and "How often did you travel to other countries in the past year for leisure?" For both questions, the participants chose their answer from the following options: Not at all, less than once a year, 1–3 times a year, approximately every quarter, almost every month, more than once a month.

#### 2.2.12. Socio-Demographic Characteristics

In addition, we recorded various socio-demographic characteristics such as age, gender, education (primary/secondary or higher) and place of residence (village, town with a population of <10,000, city with a population of between 100,000 and 500,000, city with a population of >500,000). The participants were also asked about their dietary preferences, choosing from one of three options: vegetarian (people who do not eat meat, including fish and seafood, but who eat other animal products), vegan (people who do not eat meat or any animal products, e.g., eggs, milk, honey), and omnivorous (people who do not limit their consumption of meat or animal products).

### *2.3. Statistical Modeling*

Due to the different construction of data related to the questions about the acceptance of insects as a meat substitute and the willingness to consume insect-based foodstuffs, we employed two regression models to investigate both issues as described in more detail below. The analysis of these separate problems and their predictors was followed by the investigation of the correlation between them using Pearson's r statistic.

#### 2.3.1. Descriptive Analyses

The data were analyzed using a combination of descriptive techniques (means, frequencies, percentages) using SPSS 26.0.0.1. The Student's *t* test and analysis of variance (ANOVA) were employed to assess the differences in the attitude towards insects in different demographic groups.

#### 2.3.2. Binary Logistic Regression

The logistic regression model was used to assess the acceptability of the idea of insects as meat substitutes. As in Verbeke [21], the dependent variable was analyzed as a discreet answer (no/yes). 77.1% of the respondents were against, and 22.9% were in favor of the idea.

Regression equations:

$$\text{Readiness to adopt insects as a meat substitute} = b_0 + b_1 \times \text{gender} + b_2 \times \text{age} + b_3 \times \text{edu} + b_4 \times \text{diet} + b_5 \times \text{FN} + b_6 \times \text{GN} + b_7 \times \text{VS} + b_8 \times \text{DS} + b_9 \times \text{Fam} + b_{10} \times \text{FConv} + b_{11} \times \text{FHealth} + b_{12} \times \text{FEnv}$$

Gender, education, and diet were specified as dummy variables. Regression coefficients were estimated using maximum likelihood estimation and are presented with Wald $\chi^2$ statistics and as odds ratios.

#### 2.3.3. Multiple Regression

The multiple regression model was employed to assess the acceptance of food with insect-derived ingredients. Assumptions of linearity, normality, homoscedasticity, and multicollinearity were checked.

Regression equations:

$$\text{Acceptance of food with insect-derived ingredients} = b_0 + b_1 \text{ x age} + b_2 \times \text{FN} + b_3 \times \text{GN} + b_4 \times \text{VS} + b_5 \times \text{DS} + b_6 \times \text{Fam} + b_7 \times \text{FConv} + b_8 \times \text{FHealth} + b_9 \times \text{FEnv}$$

Regression analyses were conducted using the Jasp v. 0.14.1 [51] statistical software developed by the University of Amsterdam, Netherlands.

## 3. Results

### *3.1. Descriptive Statistics*

Eighty-eight percent of the participants indicated that they had heard that insects were eaten in other countries. Of these, 38% stated that they had heard that it was possible to buy edible insects in Poland. Only 7% had had experience eating insects, and 4% had tried to prepare them.

Self-reported familiarity with insect consumption was linked to the frequency of travel. A higher level of familiarity was associated with a higher frequency of traveling both for business ($r = 0.261$, $p < 0.001$) and for leisure ($r = 0.201$, $p < 0.001$) (Table 2). Familiarity with eating insects also correlated with the importance of food convenience ($r = 0.160$, $p < 0.001$). No correlation was observed between familiarity and the other variables.

**Table 2.** Bivariate Pearson correlations between metric explanatory variables ($n$ = 1096).

| | EA | Fam | FHealth | FConv | FEnv | FN | GN | DS | VS | TravB | TravP | Age |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EA | 1 | | | | | | | | | | | |
| Fam | −0.017 | 1 | | | | | | | | | | |
| FHealth | −0.017 | −0.034 | 1 | | | | | | | | | |
| FConv | −0.019 | 0.160 ** | −0.182 ** | 1 | | | | | | | | |
| FEnv | −0.005 | 0.035 | 0.748 ** | −0.094 ** | 1 | | | | | | | |
| FN | −0.362 ** | 0.016 | −0.006 | −0.010 | −0.029 | 1 | | | | | | |
| GN | −0.162 ** | 0.023 | −0.014 | −0.018 | −0.019 | 0.390 ** | 1 | | | | | |
| DS | −0.066 * | −0.010 | 0.019 | 0.035 | −0.018 | 0.020 | 0.123 ** | 1 | | | | |
| VS | 0.328 ** | 0.008 | 0.026 | −0.006 | 0.046 | −0.735 ** | −0.248 ** | 0.001 | 1 | | | |
| TravB | 0.028 | 0.261 ** | 0.081 ** | 0.211 ** | 0.120 ** | −0.012 | −0.012 | −0.001 | 0.020 | 1 | | |
| TravP | 0.014 | 0.201 ** | 0.116 ** | 0.093 ** | 0.137 ** | −0.016 | −0.002 | 0.028 | 0.028 | 0.532 ** | 1 | |
| Age | 0.014 | −0.046 | 0.098 ** | −0.159 ** | 0.106 ** | −0.068 * | −0.016 | −0.008 | 0.050 | −0.174 ** | −0.114 ** | 1 |

* $p < 0.05$; ** $p < 0.01$.

However, significant correlations were found between the acceptance of food with insect-derived ingredients (EA) and the food neophobia, general neophobia, and disgust sensitivity scales. Higher acceptance of food with insects was associated with lower levels of food neophobia (r = −0.362, $p < 0.001$), general neophobia (r = −0.162, $p < 0.001$) and disgust sensitivity (r = −0.066, $p = 0.029$). On the other hand, the correlation with variety-seeking tendency was positive, and a higher level of acceptance of insect-based foods was associated with a higher level of VS (r = 0.328, $p < 0.001$).

Attitudes towards the health characteristics of food positively correlated with attention to the environmental impact of food choice (r = 0.748; $p < 0.001$) and negatively correlated with a convenience-oriented attitude (r = −0.182, $p < 0.001$).

Attitudes towards health, environmental and conventional aspects of food correlated with age. Older age was linked to more positive attitudes towards health (r = 0.098, $p = 0.001$) and environmental aspects of food (r = 0.106, $p < 0.001$), whereas younger age was associated with more positive attitudes towards convenience (r = −0.159, $p < 0.001$).

Mean scores for the FN, GN, DS, and VS scales are presented in Table 1. As assumed by Pliner and Hobden [38], a positive correlation between FN and GN was observed (r = 0.390, $p < 0.01$). A higher level of food neophobia was associated with a higher level of general neophobia. A lower level of food neophobia was linked to a higher level of variety-seeking tendency (r = −0.735, $p < 0.01$) (Table 2). No significant correlation between food neophobia and disgust sensitivity was found. Although sensitivity to disgust did not correlate with food neophobia and variety seeking, we observed a correlation between sensitivity to disgust and general neophobia. A higher level of disgust sensitivity was associated with a higher level of general neophobia (r = 0.123, $p < 0.001$). The level of general neophobia was also negatively correlated with variety seeking (r = −0.248, $p < 0.001$). These correlations and their directions are in line with the theoretical assumptions indicating negative correlation of general neophobia with sensation seeking and positive correlation between general neophobia and disgust [7].

Some gender differences were also observed. The Student's $t$-test showed that female participants paid more attention to both the health (M = 15.05 for females vs. M = 14.20 for males; $t = 3.86$; $p < 0.001$) and environmental (M = 14.03 for females vs. M = 13.00 for males, $t = 4.21$; $p < 0.001$) aspects of food. However, females tended to be less familiar with the concept of entomophagy (M = 5.11) than the male participants (M = 5.31), $t = -2.70$; $p = 0.007$. No significant differences were found for the other explanatory variables, nor did education level have any significant impact on differences in the other explanatory variables.

Few respondents (12%) reported limiting meat or animal products: 9% described themselves as vegetarians and 3% as vegans. These results are in line with the data obtained in previous surveys over a similar period (e.g., in the 2019 representative sample survey 8.4% of the population identified as vegetarians and vegans [52]).

### *3.2. Insects as a Meat Substitute-Binary Logistic Regression Results*

Logistic binary regression was run to predict acceptance of the idea of insects as meat substitutes from FN, GN, VS, DS, FHealth, FEnv, Fam, Fconv, gender, edu, diet, and

age. Results indicated that there was a significant effect of gender, familiarity with insect consumption (Fam), attention to the environmental impact of food choices (FEnv), and convenience-orientated approach to food choices (FConv)—$\chi^2$ (1083) = 99.581, $p < 0.001$; R2 = 0.132. Table 3 presents detailed results of the binary logistic regression model.

**Table 3.** Results of binary logistic regression model explaining consumers' acceptance of the idea of insects as meat substitute.

| | | | | | Wald Test | | |
|---|---|---|---|---|---|---|---|
| | **Estimate** | **Standard Error** | **Odds Ratio** | **z** | **Wald Statistic** | **df** | ***p*** |
| (Intercept) | −5.663 | 1.103 | 0.003 | −5.135 | 26.367 | 1 | <0.001 |
| FEnv | 0.119 | 0.031 | 1.127 | 3.819 | 14.583 | 1 | <0.001 |
| Fam | 0.272 | 0.061 | 1.313 | 4.434 | 19.661 | 1 | <0.001 |
| FConv | 0.107 | 0.044 | 1.112 | 2.415 | 5.831 | 1 | 0.016 |
| FN | 0.019 | 0.013 | 1.019 | 1.543 | 2.381 | 1 | 0.123 |
| FHealth | −0.030 | 0.034 | 0.970 | −0.880 | 0.775 | 1 | 0.379 |
| GN | 0.000 | 0.009 | 1.000 | 0.027 | $7.365 \times 10^{-4}$ | 1 | 0.978 |
| VS | 0.015 | 0.014 | 1.015 | 1.052 | 1.107 | 1 | 0.293 |
| DS | 0.016 | 0.025 | 1.016 | 0.627 | 0.394 | 1 | 0.530 |
| gender (2) | 0.579 | 0.156 | 1.784 | 3.703 | 13.713 | 1 | <0.001 |
| edu_rek (2) | 0.030 | 0.153 | 1.030 | 0.194 | 0.038 | 1 | 0.846 |
| diet (2) | 0.673 | 0.424 | 1.960 | 1.587 | 2.518 | 1 | 0.113 |
| diet (3) | −0.382 | 0.246 | 0.682 | −1.552 | 2.410 | 1 | 0.121 |

The analysis showed a significant effect of gender but no effect of age or educational level. Males were 1.8 times more likely to admit that insects can be a substitute for meat. Diet had no effect. Vegetarians, vegans, and omnivores accepted insects as a meat substitute at the same level.

Participants who were familiar with the concept of entomophagy were 1.3 times more likely to accept insects as a meat substitute compared to those who were not familiar or who were less familiar with the idea. Similarly, attention to the environmental impact of food choices was responsible for a 1.3-times higher likelihood of accepting insects as meat alternatives. There was also an effect observed in the case of the convenience orientation. Persons who pay attention to their food choices were 1.1-times more likely to accept the idea of insects as a meat substitute.

The most influential factor in the statistic was familiarity (Wald $\chi^2$ = 19.661), followed by attention to environmental impact (Wald $\chi^2$ = 14.583).

None of the psychometric properties (food neophobia, general neophobia, sensitivity to disgust, variety-seeking tendency) had any effect on accepting the idea of insects as meat substitutes.

### *3.3. Acceptance of Food with Insect-Derived Ingredients-Multiple Regression Results*

Multiple regression was run to predict willingness to accept insects as food with insect-derived ingredients from FN, GN, VS, DS, FHealth, FEnv, Fam, Fconv, and age. All assumptions of linearity, normality, homoscedasticity, and multicollinearity were found to be met. The multiple regression model significantly predicted the level of willingness to accept insects as food (F(8,1087) = 20.650, $p < 0.001$; R2 = 0.146). Regression coefficients and standard errors are presented in Table 4.

**Table 4.** Results of multiple regression model explaining consumers' willingness to eat foods with insects.

| Model | | Unstandardized | Standard Error | Standardized | *t* | *p* |
|---|---|---|---|---|---|---|
| $H_0$ | (Intercet) | 3.575 | 0.035 | | 103.242 | <0.001 |
| $H_1$ | (Intercet) | 4.378 | 0.459 | | 9.537 | <0.001 |
| | FN | −0.032 | 0.005 | −0.258 | −5.895 | <0.001 |
| | VS | 0.021 | 0.006 | 0.141 | 3.379 | <0.001 |
| | DS | −0.026 | 0.011 | −0.066 | −2.356 | 0.019 |
| | FHealth | −0.005 | 0.013 | −0.016 | −0.387 | 0.699 |
| | FEnv | 0.001 | 0.012 | 0.005 | 0.111 | 0.912 |
| | Fam | −0.026 | 0.026 | −0.027 | −0.973 | 0.331 |
| | FConv | 0.012 | 0.019 | 0.019 | 0.648 | 0.517 |
| | age | −0.001 | 0.002 | −0.017 | −0.619 | 0.536 |
| | GN | $5.285 \times 10^{-4}$ | 0.004 | 0.004 | 0.139 | 0.890 |

Food neophobia and sensitivity to disgust negatively predicted the willingness to accept insects as food. Higher scores on those variables translated into a lower level of willingness to accept insects. On the other hand, the variety-seeking tendency positively predicted the dependent variable. Persons with higher levels of variety seeking were more willing to accept insects as food.

Food neophobia was found to be the most influential factor accounting for 4% of the variance (controlling for other variables). It was followed by the variety-seeking tendency, which accounted for 1%.

Familiarity with the notion of entomophagy (Fam), attention to the environmental impact of food choices (FEnv), and convenience orientation of food choices (FConv) had no effect on the acceptance of food with insect-derived ingredients.

There was no significant correlation between the two dependent variables used in the regression models: acceptance of the idea of insect-based foods as meat substitutes and willingness to accept food with insect-derived ingredients (r = 0.020; $p = 0.509$).

## 4. Discussion

The data gathered in our study showed that there is a significant discrepancy between the acceptance of the idea of using insects as a meat substitute and the actual willingness to accept food with insect-derived ingredients. Our analyses indicated that both variables are not correlated and that they differ in their explanatory factors. As in Verbeke's study [21], in our study, acceptance of insects as an alternative to meat was predicted by the familiarity with the concept of entomophagy, attention to the environmental impact of food choices, and convenience orientation for food choices. Also, men were more favorable to this idea than women. However, there was no effect of food neophobia or diet preferences. On the other hand, acceptance of insects as food was predicted by food neophobia, disgust sensitivity, and variety-seeking tendency. As the predictors for both issues are similar to those identified in the previous studies, it is reasonable to believe that the differences are not due to the confounding factors or specificity of the population but rather stem from the distinctive nature of the two areas.

A possible explanation for the differences between findings from our study and those from the study by Verbeke [21] is the construction of dependent variables. In our analyses, we aimed to separate, on the one hand, the effect of awareness of the environmental need for decreasing meat production and finding substitutes and on the other hand personal attitudes to the consumption of insects. We hypothesized that there may be a difference between these two attitudes. In the study by Verbeke [21], the question "I would be prepared to eat insects as a substitute for meat" comprised both problems, which may be why his findings combine results from our separate questions. It may be the case also in other studies (e.g., 47, 53).

This explanation was confirmed by our analyses of the explanatory variables. In our study, familiarity and attention to the environmental impact of food predicted the level of acceptance of the general idea of insects as a meat substitute but not the willingness to

eat them (self-behavior declaration). It seems that participants who are familiar with the possibility of incorporating insects into their diets and sensitive to ecological issues may be in favor of the sustainable advantages of insects as meat alternatives (cf. [13,14,48]), but they may be opposed to the idea that they themselves should eat insects. As many previous studies have shown (e.g., [11–13,20,21,27]), people are generally opposed to eating insects, and the main factors responsible for this attitude are food neophobia and sensitivity to disgust. This seems irrelevant to the familiarity with the idea of eating insects somewhere in other countries.

Our findings clearly showed that familiarity was also a complex factor. Most people were aware that insects are eaten in other countries, and this correlated with the frequency of traveling abroad, but very few of them had eaten insects or prepared meals with them. Thus, their familiarity was based on a general concept rather than on experience, and it did not explain the willingness to try insect-based foods (cf. [26]).

Contrary to the findings by Verbeke [21], we did not find any effect on the attitude to meat on either the willingness to eat food with insect-derived ingredients or the acceptance of insects as meat substitutes. Verbeke [21] asked general questions about meat consumption and its advantages, and he excluded vegetarians and vegans from the study. This approach limited conclusions to the omnivorous population and eliminated the groups often involved in searching for meat substitutes (e.g., [53,54]). By asking about the respondents' behaviour (i.e., about a specific diet), we were able to control for this factor. However, we found that diet had no effect on attitudes to insects. The result shows that vegans and vegetarians were no more willing to accept insects as a meat substitute than omnivores were. It is probably because vegans and vegetarians often perceive insects as animals, and they have moral doubts about their farming and consumption (unpublished qualitative data).

As in previous studies (e.g., [21,55]), attitudes towards healthy characteristics of food had no impact on either of the dependent variables. It seems that insects are not perceived as a healthy alternative to meat and that participants might not be aware of their nutritional properties. The association of insects with dirt and contamination [21] may hinder their acceptance as a healthy food source.

## 5. Conclusions

In view of the above, we may conclude that the acceptance of the idea of insects as a meat substitute is not synonymous with the acceptance of the actual consumption of insects. Consumers who declared their acceptance of this kind of alternative to meat may be unwilling to buy insects for their own consumption. In line with findings from previous studies, the highest likelihood of consuming insect-based foods has been observed in persons with a low level of food neophobia and low disgust sensitivity but with a high level of variety-seeking tendency. Moreover, although men are more familiar with the notion of entomophagy and more willing to accept the idea of insects as a meat substitute, they are not more likely than women to ingest them.

It appeared that educating people about sustainable properties of insect-based foodstuffs and aiming marketing strategies in this feature is not sufficient to convince consumers to buy and eat insects. Insects seem to be a proper meat alternative only in theory. A similar effect appears to be evoked by familiarity, which is the factor often identified as a predictor of the willingness to consume insects. Again, it is likely that familiarity with the idea of eating insects increases the acceptance of the basic concept and not a willingness to try real insect-based food.

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# The Influence of Various Information About Insect Content and Its Advantages on the Acceptance of Foods Containing Insects

Katarzyna Goncikowska[a], Klaudia Modlinska[a], Dominika Adamczyk[b], Umut Can Altuntaş[b], Dominika Maison[b], and Wojciech Pisula[a]

[a]Institute of Psychology, Polish Academy of Sciences, Warsaw, Poland; [b]Faculty of Psychology, University of Warsaw, Warsaw, Poland

**ABSTRACT**

Information about the content of food products affects the potential consumers' willingness to purchase certain foodstuffs and include them in their diet. The presentation and scope of information are essential in the case of marketing specific products such as insect-based foods. The purpose of our study was to investigate the influence of information about a product's advantages, coupled with verbal and visual information provided on the packaging, on the participants' assessment of food containing insects. The participants ($N = 659$) were informed about the environmental or health benefits of ingesting insects. They were subsequently presented with a picture of a food product with different types of information about the insect content and asked to evaluate the product. The results suggest that providing images of insects on the packaging results in a lower assessment of the food containing insects. A brief presentation of the advantages of entomophagy has no impact on insect-based food assessment.

**KEYWORDS**

Food labeling; edible insects; perception of food; novel food; consumer behavior

## Introduction

Insects are a source of essential nutrients (Belluco et al., 2013; Bukkens, 1997; Looy et al., 2014; Van Huis et al., 2013; Vane-Wright, 1991), and their production is more sustainable in comparison to livestock farming (Oonincx & De Boer, 2012; Rumpold & Schlüter, 2013; Testa et al., 2017). High-quality rearing of edible insects proved a biologically safe (low risk of zoonoses) alternative to conventional animal products (EFSA Scientific Committee, 2015; Raubenheimer & Rothman, 2013; Van Huis et al., 2013).

Entomophagy (the practice of eating insects) is cultivated by many cultures (Ramos Elorduy, 2009). However, people in Western countries are reluctant to include insects in their diets, and the willingness to eat insects is very low (Hartmann & Siegrist, 2017; Modlinska et al., 2021). Disgust and neophobia are seen as the main reasons behind the rejection of insects as part of the human diet (La Barbera et al., 2018). Unfamiliar foods, especially if they are of animal origin, are likely to be rejected due to the perceived risk associated with them, as well as the imagined repulsive taste and feeling of disgust (Fallon & Rozin, 1983). Disgust is embedded in social norms, and what is considered disgusting is subject to social learning (Tybur et al., 2013). Disgust is also associated with the avoidance of diseases, dirt, and pollution (Lockwood, 2013), which in turn can be associated with insects, which are seen as carriers of contaminants, diseases and biological decomposition (Dermody & Chatterjee, 2016; Sheppard, 2014; Shockley & Dossey, 2014; Veeck, 2010). People develop a combination of curiosity and fear toward foods they had not previously encountered (Rozin & Vollmecke, 1986). This is linked to the omnivore's dilemma, a conflict in which the organism needs to search for new sources

**CONTACT** Klaudia Modlinska kmodlinska@wp.pl Institute of Psychology, Polish Academy of Sciences, Jaracza 1, Warsaw 00-378, Poland

of nutrients and, at the same time, exercise caution with regard to unknown potential foods (food neophobia) - (Armelagos, 2014; Raudenbush & Frank, 1999). Food neophobia has been shown to be one of the main factors influencing consumer attitudes toward entomophagy (Wilkinson et al., 2018; Florença et al., 2021; Olum et al., 2021).

Research suggests that one way to reduce unfamiliarity with insect-based foods and change the negative attitude toward them is to provide educational information about the ingredients (e.g. Dagevos, 2021; Herbert & Beacom, 2021). For example, the production of such foodstuffs can be perceived as beneficial for the environment (Grunert et al., 2018). Consumers who attach a lot of importance to the environmental consequences of food manufacturing will be more likely to buy and consume insect-based foods (Vanhonacker et al., 2013; Verbeke, 2015). Moreover, consumers who place more value on health-related issues and who are better informed about the viability of entomophagy are expected to be more inclined to consume insect-based products (Kornher et al., 2019). The green-appeals (environmental advertising appeals) in materials promoting food products greatly impact their target audiences (Kao & Du, 2020; Schuhwerk & Lefkoff-Hagius, 1995). Thus, information about edible insects' environmental and health-related benefits can be an important element in changing consumers' mind-sets. Some studies show that informing adult consumers about the potential benefits of insect-based food increases their positive perception of insect-based food (Barsics et al., 2017; Lombardi et al., 2019; Mancini, Moruzzo, et al., 2019; Mancini, Sogari, et al., 2019; Palmieri et al., 2019; Rovai et al., 2021; Ruby & Rozin, 2019; Woolf et al., 2019). In a study conducted by Mancini, Sogari, et al. (2019), Italian participants were assigned to a three-hour informative session about entomophagy's environmental and health-related benefits. The findings revealed that the informative session significantly decreased the disgust factor and increased sensory liking (Mancini, Sogari, et al., 2019). A study conducted by De Magistris et al. (2015) also supports these results – health claims informing about the Omega 3 content (together with a logo and the absence of an image of the insect on the packaging) resulted in a higher willingness to purchase the product. Moreover, Palmieri et al. (2019) claim that awareness of the need to purchase sustainable foods is determined implicitly by the quantity and quality of information obtained on insects' environmental and nutritional benefits in the first place. In fact, their research demonstrated that appropriate information has the potential to increase both the acceptability and consumption of insect-based products (Palmieri et al., 2019; Sogari, 2015; Verbeke, 2015; Verneau et al., 2016). Verneau et al. (2016) concluded that when information about the benefits of entomophagy is supplied, the consumer's willingness to eat insects increases and that this willingness translates into behavior. There is every indication that we can transform customers' perceptions by providing people with information about the benefits of this type of food. On the other hand, there are findings that indicate that providing objective information about insect-based food does not necessarily predict a significant increase in the likelihood of consuming insect-based food (Looy & Wood, 2006; Laureati et al., 2016; Tan et al., 2015; Van Thielen et al., 2019). Laureati and her colleagues (2016) found that information about entomophagy's environmental and nutritional benefits had a marginal effect on the acceptance of insects as food. Similarly, Tan et al. (2015) showed that arguments about insect-based food's environmental and health-related benefits failed to encourage participants to consume it. There are findings suggesting that the effect of the informative sessions on consumers' attitudes toward insect-based food is culture-dependent (Berger et al., 2018; Deroy et al., 2015; Mancini, Sogari, et al., 2019). Verneau et al. (2016) demonstrated that attitudes toward entomophagy vary even between different European subcultures. Objective and subjective knowledge predicts the degree of willingness to buy insect-based foods among North European participants, but the same conclusion cannot be drawn for Central European participants (Piha et al., 2018).

Another important way of providing information about insects' content in the foodstuff is product presentation. Information about product composition is often provided on the packaging. Packaging draws the consumers' attention and invites them to form perceptions and impressions about the product, which significantly influences their purchasing decisions (Bou-Mitri et al., 2020; Marques da Rosa et al., 2019; Venter et al., 2011). The use of graphic material can affect their attitude toward a product or brand and emotional reactions or impact the quantity of the product consumed (Kao & Du, 2020; Poor et al., 2013). Consumers form expectations about a range of sensory and non-sensory

attributes of the product based on their beliefs, prior encounters or a product's extraneous aspects (Deliza & MacFie, 1996; Piqueras-Fiszman & Spence, 2011; Rebollar et al., 2017). Texts (labels, lists of ingredients, etc.) and images used on the packaging are two interconnected sources of stimuli. When a consumer sees a picture of a food product and reads the label, this activates a certain information network, and this information can be positive or negative (Sundar & Kardes, 2015). In the context of insect-based foods, it seems that a clear content-revealing label on an insect-based product significantly reduces the intention to purchase the product (Baker et al., 2016; De Magistris et al., 2015), and information about insect content results in a more negative assessment of the product (Modlinska et al., 2020). However, a study by Herbert and Beacom (2021) showed that for people asked to draw out their ideal insect-based snack, 80% of them included insect images on the packaging designs. The authors suggest further research exploring this subject.

As stated above, information about ingredients in food products may be presented in various forms. Apart from visual and verbal information on the packaging, it may be accompanied or preceded by educational input about the benefits of entomophagy. Combining these two approaches may help us understand the role of information about insect content and suggest possible ways of placing such products on the mainstream market. This seems particularly important in view of the contradictory findings from previous research (cf. Baker et al., 2016; De Magistris et al., 2015 cf.Van Thielen et al., 2019).

Therefore, our study aimed to examine the impact of various information about insect content in foodstuffs on the assessment of this type of food and the willingness to buy and consume the respective product. We hypothesized that

(1) the educational input about the benefits of consuming insects provided prior to the presentation of the product might alleviate the negative effect of the information about insect content provided on the packaging (cf. Baker et al., 2016; Dagevos, 2021; De Magistris et al., 2015).
(2) the negative effect of the text on the packaging would be more pronounced when an image of the insect was also provided as a visual cue.
(3) differences in the level of acceptance of insect-based products between the sexes. Previous studies showed that women are more reluctant to accept insects as food ingredients (Florenca et al., 2021; Hartman et al., 2015; Menozzi et al., 2017).

To verify these hypotheses, first, we provided the participants with a short paragraph describing entomophagy's environmental or health-related benefits. Then, the participants were presented with the packaging of a food product with verbal (label) or combined verbal and visual (label and picture) information about the insect's ingredient.

To control for individual factors influencing the attitude to insect-based foods, the experimental phase was preceded by a series of questionnaires measuring food neophobia, general neophobia, sensitivity to disgust, the tendency to seek variety, and general willingness to consume insects. These psychological variables were previously identified as having a significant impact on willingness to accept insect-based foodstuff (Dagevos, 2021; Dermody & Chatterjee, 2016; Kröger et al., 2022; La Barbera et al., 2018; Palmieri et al., 2019; Verbeke, 2015).

## Methods

The experiment was conducted by means of an online survey panel using the Computer-Assisted Web Interview (CAWI) technique. Participants were invited to take part in the study via e-mail. Then they logged in to the website and filled in a series of questionnaires. A week later, the same participants were invited to participate in the study's second part. The participants were selected randomly with specific inclusion criteria such as age, education level and regional distribution. The experiment was approved by the Research Ethics Committee at the Faculty of Psychology, University of Warsaw (decision No. 5/11/2020).

### Participants

The data were collected from a sample of 659 Polish participants. The sample varied in terms of gender, age, and education – see Table 1. The participants were randomly assigned to the experimental setups. They were told that the purpose of the experiment was to study food preferences. All the participants agreed to participate in the study after being informed about its purpose and procedure.

### Procedure

The study was conducted on an online survey panel commonly used for social research with the use of a Computer-Assisted Web Interview (CAWI) - (Couper, 2000). The study consisted of two stages. First, the participants were asked to complete a series of questionnaires measuring the level of selected psychological characteristics and answered a set of socio-demographic questions. We measured the psychological characteristics relevant to the subject of eating insects (described in the Introduction), such as food and general neophobia, sensitivity to disgust, variety-seeking tendency and attitude to entomophagy. We also asked about familiarity with insect-based foods and willingness to buy or prepare insect-containing foods (e.g. *"Have you ever eaten a meal containing insect-based ingredients?"*; *"Would you like to buy insect-based food?"*).

A week later, the same participants were asked to participate in the study's second part. By dividing the study into two parts, we would like to minimize the influence of the content of the questionnaires on the evaluation of the products (e.g. questions from the disgust sensitivity scale, which may have activated feelings of disgust and influenced the rating of the products). In the second part, the participants were asked to read one of two short texts about the benefits associated with insects (health-related or environmental) or the third, "control" text (Appendix 1). In the first text, insects were presented as a healthy alternative to meat, in the second as an environmentally friendly alternative to meat, and in the third text, as the most numerous group of animals. Next, the participants were informed that a new product (Bolognese sauce) would be placed on the Polish market. Each experimental group was shown one of the three versions of the Bolognese sauce packaging with different visual features (Figure 1): Spaghetti Bolognese with the label "Bolognese Sauce" (Product 1); spaghetti Bolognese with the label "Bolognese Sauce with crickets" (Product 2); and spaghetti Bolognese with the label "Bolognese Sauce with crickets" and an image of a cricket (Product 3). The participants were randomly assigned to one of the nine experimental setups (3 educational text x 3 packaging versions).

After the presentation of the product, the participants were asked to evaluate the product ("What is your assessment of the presented product?"). The participants rated the product on a 7-point Likert scale (from 1 "strongly negative" to 7 "strongly positive"). They were then asked how strongly they were inclined to try the product and to what extent the following statements fit their perception of the product: "Tasty," "Healthy," and "Environmentally Friendly" rated on a 7-point-Likert-scale (from 1 "strongly disagree" to 7 "strongly agree"). They were also asked to assess the market demand for those products, rated on a 7-point Likert scale (from 1 "strongly negative" to 7 "strongly positive").

### Questionnaires

Each questionnaire was translated from English into Polish using the back-translation method. First, a professional translator translated the original questionnaires from English to Polish. Subsequently, another translator back-translated the Polish version into English. Both the original English version and the back-translated versions were compared by a native English speaker. The text was edited according to the comments of English native speakers, after which the reformulated items were translated into English by a translator who was not familiar with the comments or the original questionnaire. This was followed by a comparison against the original by an English native speaker.

**Table 1.** Characteristics of the study groups.

| Variable | Group 1 N = 69 | Group 2 N = 76 | Group 3 N = 75 | Group 4 *N* = 74 | Group 5 *N* = 74 | Group 6 *N* = 74 | Group 7 *N* = 73 | Group 8 *N* = 74 | Group 9 *N* = 70 | Statistics |
|---|---|---|---|---|---|---|---|---|---|---|
| Sex (women – F; men – M) | 39F/30 M | 39F/37 M | 42F/33 M | 42F/32 M | 43F/31 M | 37F/37 M | 43F/30 M | 44F/30 M | 37F/33 M | $\chi2(8) = 2.743$, $p = .949$ |
| Age – mean (sd) | 42.5 (15.1) | 43.7 (15.3) | 44.5 (15.3) | 43.4 (14.8) | 42.8 (15.0) | 43.4 (15.0) | 45.1 (14.8) | 43.0 (16.2) | 43.9 (15.1) | $F(8; 650) = 0.214$, $p = .989$ |
| Education (lower-secondary/higher-secondary /higher) | 5/29/35 | 3/41/32 | 2/35/38 | 9/35/30 | 9/33/32 | 7/37/30 | 12/29/32 | 5/32/37 | 4/35/31 | $\chi2(18) = 46.885$, $p = .519$ |

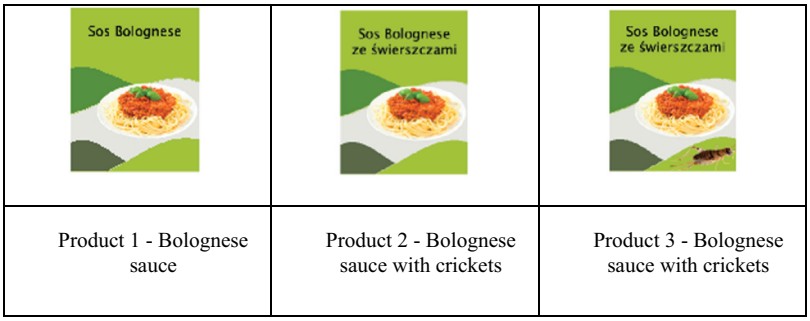


**Figure 1.** Pictures of the products with different information about the insect content presented to the study participants.

The final Polish versions of the questionnaires were converged. Cronbach's alpha was used to determine the internal consistency of the Polish versions of the questionnaires.

### *The Food Neophobia Scale*

The Food Neophobia Scale (FNS – Pilner & Hobden, 1992) was developed to measure the level of avoidance of novel foods. It includes ten items assessed on a scale from 1 ("strongly disagree") to 7 ("strongly agree"); five statements are positive (indicative of neophilic attitudes), and five are negative (indicative of neophobic attitudes). Examples of statements include: "If I don't know what is in a food, I won't try it" and "I am constantly sampling new and different foods." The internal consistency of the Polish version of the scale in our study, measured using Cronbach's alpha, was estimated at 0.84.

### *The General Neophobia Scale*

The General Neophobia Scale (GNS) is a scale measuring the level of general neophobia. It was developed by Pilner and Hobden (1992) together with the Food Neophobia Scale. The scale consists of eight items evaluated on a 7-point Likert scale from 1 ("strongly disagree") to 7 ("strongly agree"). Examples of statements include: "Whenever I'm away, I want to get home to my familiar surroundings" and "I avoid speaking to people I do not know when I go to a party." The internal consistency of the Polish version of the scale in our study, measured using Cronbach's alpha, was estimated at 0.91.

### *The Disgust Sensitivity Scale*

Disgust Scale – Revised (Olatunji et al., 2007) is used for measuring individual differences in sensitivity to disgust. It is a tool with twenty-five items: the first thirteen are binary "true" or "false" questions, and the rest assess how disgusting a given experience seems to be on a scale from 0 ("not disgusting at all") to 2 ("very disgusting"). Example items include: "It would bother me to sleep in a nice hotel room if I knew that a man had died of a heart attack in that room the night before." and "You take a sip of soda and realize that you drank from the glass that an acquaintance of yours had been drinking from." The internal consistency of the Polish version of the scales in our study measured using Cronbach's alpha was estimated at 0.74.

### *VARSEEK-Scale*

The Variety Seeking Tendency Scale (VARSEEK-Scale - Van Trijp & Steenkamp, 1992) is used to measure a person's variety-seeking tendency in the context of food choices. This scale consists of eight statements that were assessed by the participants on a five-point Likert scale (from "completely disagree" to "completely agree"). Examples of statements include: "I am eager to know what kind of foods people from other countries eat" and "Items on the menu that I am unfamiliar with make me curious." The internal consistency of the Polish version of the scale in our study, measured using Cronbach's alpha, was estimated at 0.82.

### Entomophagy Attitude Questionnaire

The Entomophagy Attitude Questionnaire (EAQ - La Barbera et al., 2020) is used for measuring consumers' attitudes toward insect-eating, i.e. entomophagy. The respondents assessed 10 questions on a 7-point Likert scale (from "completely disagree" to "completely agree"). The statements include, for example: "Thinking about the flavor that a bug might have sickened me," "Using insects as feed is a good way of producing meat," and "At dinner with friends, I would try new foods prepared with insect flour." The internal consistency of the Polish version of the scale in our study, measured using Cronbach's alpha, was estimated at 0.88.

### Data processing and statistical analysis

The participants' evaluations of the presented products were examined using an analysis of covariance (ANCOVA). A $3 \times 3$ between-subjects experimental design was used to measure the participants' evaluation of the insect-based food products. The assessments of products were the dependent variables, while Text, Product and Sex constituted the independent variables. The scores obtained from the questionnaires served as covariates. The Tukey test was used for a post hoc comparison. The relationship between the covariates and the assessment of the products was analyzed using the Pearson correlation coefficient. Differences and correlations were considered significant for *p-values* of<0.05.

## Results

Frequency analyses of familiarity with insect-based products revealed that 79% of participants had never eaten foods containing insects (81% of females and 75% of males). 15% of the participants stated that they had not known that insects were eaten in other countries. 39% of the participants had no idea that insects could be bought in our country. Additionally, only 15% of the participants declared that they were interested in buying foods with insects, and 21% would order a dish with insects in a restaurant.

### Overall evaluation of the product

The analysis of the overall evaluation of the presented product showed an interactive effect of Product and Sex ($F(2, 635) = 4.099$, $p = .017$, $\eta 2 = 0.009$) and a main effect of Product ($F(2, 635) = 70.702$, $p < .001$, $\eta 2 = 0.162$). There was no effect of Text or any other interactive or main effects.

Post-hoc analysis revealed that female participants rated the product without the image and label indicating insect content (Product 1) higher than the product with the label indicating insect content but with no picture (Product 2) - ($t = 8.199$; $p < .001$, Cohen's $d = 0.851$) and the product with both the label and picture indicating insect content (Product 3) - ($t = 9.192$; $p < .001$, Cohen's $d = 0.961$). No difference was found between Product 2 and Product 3 in terms of the general evaluation of the product by women. Similarly, male participants rated Product 1 significantly higher than Product 2 ($t = 3.504$; $p = .007$, Cohen's $d = 0.409$), and Product 3 ($t = 7.351$; $p < .001$, Cohen's $d = 0.859$). However, they rated Product 2 significantly higher than Product 3 ($t = 3.862$; $p = .002$, Cohen's $d = 0.451$). There were no differences between the sexes in evaluating the individual products.

### Willingness to taste the product

The analysis of willingness to taste the presented product showed an interactive effect of Product and Sex ($F(2, 635) = 8.0946$, $p < .001$, $\eta 2 = 0.019$) and a main effect of Product ($F(2, 635) = 89.085$, $p < .001$, $\eta 2 = 0.186$). There was no effect of Text or any other interactive or main effects.

Post-hoc analysis revealed that women declared a higher level of willingness to try the product without the image or label indicating insect content (Product 1) than the product with only the label but no picture of the insect (Product 2) - ($t = 10.517$; $p < .001$, Cohen's $d = 1.099$), and the

product with both the label and picture indicating insect content (Product 3) - ($t = 10.907$; $p < .001$, Cohen's $d = 1.140$). No difference was found between Product 2 and Product 3 in terms of willingness to try the product in women. Male participants showed a significantly higher willingness to try Product 1 than Product 2 ($t = 3.570$; $p = .005$, Cohen's $d = 0.417$), and Product 3 ($t = 7.455$; $p < .001$, Cohen's $d = 0.871$). They were also more willing to try Product 2 in comparison with Product 3 ($t = 3.899$; $p = .001$, Cohen's $d = 0.456$). Moreover, male participants showed a higher willingness to try Product 2 than women did ($t$=-3.928; $p = .001$, Cohen's $d = 0.306$).

### Assessment of the expected tastiness of the product

The analysis of the expected tastiness of the presented product showed an interactive effect of Product and Sex ($F(2, 635) = 5.986$, $p = .003$, $\eta 2 = 0.013$) and a main effect of Product ($F$ (2, 635) = 81.738, $p < .001$, $\eta 2 = 0.182$). There was no effect of Text or any other interactive or main effects.

Post-hoc analyses showed that women assessed the expected tastiness of the product without information about insect content (Product 1) higher than the product with the name of the insect indicated in the name of the product (Product 2) - ($t = 9.767$; $p < .001$, Cohen's $d = 1.021$) and the product with the name and picture of the insect (Product 3) - ($t = 10.124$; $p < .001$, Cohen's d = 1.058). There were no differences in the evaluation of the expected tastiness of Product 2 and Product 3 ($t = 0.523$; $p = .995$, Cohen's $d = 0.055$) in women. Men evaluated the expected tastiness of Product 1 higher than that of Product 2 ($t = 3.955$; $p = .001$, Cohen's $d = 0.462$) and that of Product 3 ($t = 7.320$; $p < .001$, Cohen's $d = 0.855$). Male participants also evaluated the expected tastiness of Product 2 higher than that of Product 3 ($t = 3.364$; $p = .011$, Cohen's $d = 0.393$). Moreover, they evaluated the expected tastiness of Product 2 higher than women did ($t$=-3.191; $p = .019$, Cohen's $d = 0.249$).

### Assessment of the expected healthiness of the product

The analysis of the expected health benefits of the presented product showed an interactive effect of Product and Sex ($F(2, 635) = 3.788$, $p = .023$, $\eta 2 = 0.010$) and a main effect of Product ($F$ (2, 635) = 21.383, $p < .001$, $\eta 2 = 0.058$). There was no effect of Text or any other interactive or main effects.

Post-hoc analysis revealed that women rated the product without the label and image indicating insect content (Product 1) as healthier than the product with the label but without the image indicating insect content (Product 2) - ($t = 5.398$; $p < .001$, Cohen's $d = 0.564$) or the product with both the label and picture indicating insect content (Product 3) ($t = 5.420$; $p < .001$, Cohen's $d = 0.567$). No difference was found between Product 2 and Product 3 in the case of women. However, male participants rated Product 1 as healthier than Product 3 ($t = 3.721$; $p = .003$, Cohen's $d = 0.434$). No significant differences were found between Product 1 and Product 2 or between Product 2 and Product 3 in male participants. There were no differences in the evaluation of the individual product between the sexes.

### Assessment of the expected positive environmental impact of the product

The analysis of the expected positive impact of the presented product on the environment showed a main effect of Product ($F(2, 635) = 15.340$, $p < .001$, $\eta 2 = 0.042$) and a main effect of Text ($F(2, 635) = 5.189$, $p = .006$, $\eta 2 = 0.014$). There were no interactive effects.

Post-hoc analysis revealed that the participants rated the product without the image and label indicating insect content (Product 1) as more environmentally friendly than the product with the label but without the image indicating insect content (Product 2) - ($t = 3.557$; $p = .001$, Cohen's $d = 0.277$) and the product with both the label and picture indicating insect content (Product 3) - ($t = 5.464$; $p < .001$, Cohen's $d = 0.426$). No significant differences were found between Product 2 and Product 3.

Moreover, participants who had read the text about the environmental benefits of insect-based products assessed the products as more environmentally friendly than participants who had read the text presenting general information about insects ($t$=-3.209; $p$ = .004, Cohen's $d$ = 0.250).

### Assessment of the expected market demand for the products

A significant interactive effect of Product and Sex was found in terms of the expected market demand for the product ($F$(2, 635) = 7.198, $p$ < .001, η2 = 0.016), a main effect of Text ($F$ (2, 635) = 3.429, $p$ = .033, η2 = 0.008) a the main effect of Product ($F$(2, 635) = 64.825, $p$ < .001, η2 = 0.148). There were no other interactive or main effects.

Post-hoc analysis revealed that women expect higher market demand for the product without the image and label indicating insect content on the packaging (Product 1) than the product with the label but without the image indicating insect content (Product 2) - ($t$ = 9.119; $p$ < .001, Cohen's $d$ = 0.953 and the product with both the label and picture showing the insect used in the product (Product 3) - ($t$ = 8.827; $p$ < .001, Cohen's $d$ = 0.923). No difference was found between Product 2 and Product 3 in women. On the other hand, male participants expected higher market demand for Product 1 than for Product 2 ($t$ = 3.115; $p$ = .024, Cohen's $d$ = 0.364) and Product 3 ($t$ = 6.706; $p$ < .001, Cohen's $d$ = 0.784). Male participants also evaluated the expected market demand for Product 2 as higher than the demand for Product 3 ($t$ = 3.607; $p$ = .004, Cohen's $d$ = 0.421). In addition, they expect a higher market demand than female participants for Product 2 ($t$=-3.381; $p$ = .010, Cohen's $d$ = 0.263).

Moreover, participants who had read the text about the health benefits of insect-based foods expected higher market demand for the presented products than participants who had read the general text about insects ($t$=-2.593; $p$ = .026, Cohen's $d$ = 0.202).

### Analysis of covariates

The analysis of covariates showed the main effects of some of the variables. Food neophobia had an effect on the overall evaluation of the Product ($F$(1,635) = 5.405, $p$ = .020, η2 = 0.006). Participants with higher scores on the Food Neophobia scale rated the presented products lower than participants with lower scores on that scale ($r$=-0.060, $p$ = .122).

The level of variety-seeking tendency affected all the variables analyzed: the overall evaluation of the Product ($F$(1, 635) = 10.654, $p$ = .001, η2 = 0.012); willingness to try the product ($F$ (1, 635) = 9.333, $p$ = .002, η2 = 0.010); assessment of the expected tastiness of the product ($F$ (1, 635) = 12.659, $p$ < .001, η2 = 0.014); assessment of the expected healthiness of the product ($F$(1, 635) = 5.217, $p$ = .023, η2 = 0.007); assessment of the expected positive environmental impact of the product ($F$(1, 635) = 11.209, $p$ < .001, η2 = 0.016); and assessment of the expected market demand for the products ($F$(1, 635) = 8.415, $p$ < .001, η2 = 0.013). Participants with higher levels of Variety Seeking Tendency generally rated the products higher than participants with lower levels of that trait ($r$ = 0.139, $p$ < .001); the same trend was observed for the expected tastiness of the products ($r$ = 0.184, $p$ < .001), their expected healthiness ($r$ = 0.167, $p$ < .001), expected positive environmental impact ($r$ = 0.215, $p$ < .001) and expected market demand ($r$ = 0.152, $p$ < .001). Participants with higher levels of Variety Seeking Tendency were also more willing to try the product ($r$ = 0.184, $p$ < .001).

A similar effect was found for Attitude to Entomophagy. It affected all the variables analyzed: the overall evaluation of the Product ($F$(1, 635) = 41.818, $p$ < .001, η2 = 0.048); willingness to try the product ($F$(1, 635) = 96.602, $p$ < .001, η2 = 0.101); assessment of the expected tastiness of the product ($F$(1, 635) = 51.822, $p$ < .001, η2 = 0.058); assessment of the expected healthiness of the product ($F$ (1, 635) = 29.065, $p$ < .001, η2 = 0.039); assessment of the expected positive environmental impact of the product ($F$(1, 635) = 16.362, $p$ < .001, η2 = 0.023); and assessment of the expected market demand for the products ($F$(1, 635) = 55.623, $p$ < .001, η2 = 0.064). Participants with higher scores on the Attitude to Entomophagy Questionnaire generally rated the products higher than participants

with lower levels of this variable ($r = 0.253$, $p < .001$), and the same trend was observed for scores awarded for the expected tastiness of the products ($r = 0.282$, $p < .001$), expected healthiness ($r = 0.248$, $p < .001$), expected positive environmental impact ($r = 0.289$, $p < .001$), and expected market demand ($r = 0.289$, $p < .001$). Participants with higher scores on the Attitude to Entomophagy Questionnaire were also more willing to try the products ($r = 0.367$, $p < .001$).

The participants' age had an effect on the overall evaluation of the product ($F(1, 635) = 16.766$, $p < .001$, $\eta 2 = 0.019$); the willingness to try the product ($F(1, 635) = 5.497$, $p = .019$, $\eta 2 = 0.006$); assessment of the expected tastiness of the product ($F(1, 635) = 6.107$, $p = .014$, $\eta 2 = 0.007$); assessment of the expected healthiness of the product ($F(1, 635) = 9.539$, $p = .002$, $\eta 2 = 0.013$) and assessment of the expected market demand for the products ($F(1, 635) = 7.239$, $p = .007$, $\eta 2 = 0.008$), but had no effect on the assessment of the expected positive environmental impact of the product ($p > .05$). Older participants generally rated the products higher than their younger counterparts ($r = 0.132$, $p = .001$), which was observed for the expected healthiness ($r = 0.105$, $p = .007$) and expected market demand ($r = 0.079$, $p = .042$) of the products. However, there were no linear correlations between the age of the participants and their willingness to try the product ($p > .05$), between age and expected tastiness ($p > .05$) or between age and expected positive environmental impact ($p > .05$).

There was no effect of General Neophobia or Sensitivity to disgust on any of the variables analyzed ($p > .05$).

## Discussion

The above analyses confirmed the negative effect of information about insect content presented on packaging on the assessment of the product. The study participants rated the product with no indication of insect content on the packaging the highest in all aspects investigated in this study, as compared with the product with a label but no picture indicating insect content and the product with both a label and picture indicating insect-based ingredients. This finding is in line with previous studies showing the negative effect of the information indicating insect content on the perception of the product (Baker et al., 2016; Liceaga, 2021; Mancini, Moruzzo, et al., 2019; Modlinska et al., 2020; Van Huis et al., 2021). However, the comparison of products containing insects reveals that packaging with the name of the insect used in the product combined with the picture of the insect was awarded the lowest scores among male participants in the overall evaluation of the product, as well as in the willingness to taste the product, expected tastiness and expected marketing demand for the product. In terms of object processing theory (), pictures tend to have the superiority effect (Childers & Houston, 1984): they attract more attention, convey more information and seem to be more memorable (cf. Childers & Houston, 1984). Other findings suggest that information containing both verbal and visual components is more likely to elicit negative emotions than information with verbal components only (Seo, 2020). It is likely that the picture of an insect on a food product packaging triggers negative associations more strongly (cf. Rozin et al., 1986; Wagler & Wagler, 2012) than merely the name of the insect used in the product. It is also possible that a picture of an insect makes people fully aware of what they are about to consume. Evoking the image of the entire animal often elicits strong objection to the food offered and is connected with strong negative emotions (cf. Veeck, 2010). Animals are usually consumed in pieces that do not resemble living individuals or their recognizable parts (like heads, entire limbs, etc.). Some studies suggest that products containing insects provided in the form of flour or small parts were assessed less negatively than products containing whole insects (Gmuer et al., 2016). Presenting entire insects in the context of food may give the impression that the food product is contaminated or rotten. This notion may be supported by the finding that the above-described effects were not observed when participants were asked about the expected healthiness of the product. Male participants considered the product without any indication of insect content to be just as healthy as the product containing insects with only the name of the insect on the packaging. The product with the name and picture of the insect was perceived as the least healthy. It seems that images of insects, when associated with food products, decrease the perceived level of safety of such products.

This is in line with the findings from our previous research, where participants declared that the health security of insect-based products is a crucial factor in their decision to consume such food (Modlinska et al., 2020).

However, it should be underlined that these effects were only valid for male participants. Both men and women evaluated products without information about insect content higher than products with such information. Yet, women gave equally low scores to products with only verbal information about insect content and products with verbal information and a picture depicting the insect. This is in line with previous studies showing that women reject insect-based foods more strongly than men do (Hartmann et al., 2015; Menozzi et al., 2017). In a study carried out by Florença et al. (2021) in Portugal, the results show a similar effect – men showed a higher level of acceptance of edible insects than women did. Moreover, their attitude to edible insects was more positive, and they were better informed about the sustainability of the production of this type of food. It is likely that in women, any information about insect content in food leads to lower scores being given to insect-based products, and combined verbal and visual information evokes strong negative associations.

However, there was no interactive effect between the informative text read prior to the presentation of the product and the participants' assessment of the products. The results showed that neither of the informative texts managed to alleviate the negative effect of the information about insect content in all setups investigated in this study. What is more, the texts describing the health and nutritional value of insect-based food did not affect the evaluation of the expected healthiness of the product. Similarly, the text presenting the environmental benefits of approaching insects as the food did not affect the scores of expected environmental friendliness of the product. One of the explanations may be that the objection to eating insects is so strong that reading a short informative text right before evaluating the products may not be sufficient to change the participants' attitudes. Some research findings emphasize the complexity and difficulty of overcoming negative attitudes toward entomophagy among Western consumers and question the impact of short-term solutions on increasing the respondents' willingness to eat insects (Looy & Wood, 2006; Szczepanski et al., 2022; Van Thielen et al., 2019; Verbeke, 2015). 2006) state that overcoming aversion to insect-based food is necessarily a long process that involves widely available information about preparation, positive modeling of attractive taste and post-ingestion experiences. Analyses conducted by Verbeke (2015) show that the increase in the level of willingness to accept insects as food among Belgian consumers was a result of an intensive two-year negative mass media campaign against traditional modes of meat production and concerning topics such as animal welfare, environmental problems, and health risks posed by traditional livestock farming, etc.

It is also possible that the results we obtained show the specificity of the Polish market. The effect of informative sessions on consumer attitudes toward insect-based food is culture-specific (Berger et al., 2018; Deroy et al., 2015; Mancini, Sogari, et al., 2019), and differences may be observed even between European countries (Verneau et al., 2016). Consumers from Central Europe seem to be less influenced than Northern Europeans by subject-specific knowledge in assessing their willingness to buy insect-based foods (Piha et al., 2018). However, the mechanism underpinning this discrepancy is unclear, and more research is needed to investigate the cross-cultural dynamics of attitudes toward entomophagy.

It may also be argued that the lack of impact of the informative texts was due to their format or the type of information presented to the participants. However, the results show a main effect of text in two domains. Participants who read the paragraph describing the environmental advantages of entomophagy rated all the products as more environmentally friendly than participants who were assigned the general text about insects. Similarly, the text outlining the health benefits of eating insects led to higher scores in expected market demand for all the products. This may suggest that the information presented to the participants was well understood and impacted product evaluation. Still, it did not specifically influence the attitudes toward insect content in foodstuffs.

In addition, we observed some individual differences among the respondents. An analysis of the factors involved in the participants' ratings of the products showed that those with higher levels of food neophobia assigned lower scores in the overall evaluation of the presented

products than those with lower levels of this variable. This result is in line with a number of previous studies showing that in cultures where there is no tradition of eating insects, people are neophobic to this type of food (e.g. Ramos Elorduy, 2009; Sogari, Bogueva, et al., 2019; Wilkinson et al., 2018). However, food neophobia had no effect on the respondents' evaluation of other aspects (such as willingness to try the product, etc.). The food neophobia scale is the most commonly used tool to measure reluctance to consume novel foods. It is also a recommended tool in view of a review of instruments developed to measure food neophobia. It is considered a highly reliable and properly validated instrument that maintains its merits over time (Damsbo-Svendsen et al., 2017; Rabadán & Bernabéu, 2021). However, some researchers have recently voiced concerns about its validity (Nezlek et al., 2021). It is possible that this tool is not the best method of measuring the influence of neophobia on such specific food ingredients as insects (cf. Modlinska et al., 2020).

Less ambiguous results were obtained for the Variety-Seeking Tendency (VST). The VST scale measures neophilic attitudes toward food, and its results correlate negatively with food neophobia (Lenglet, 2018). In our study, participants who demonstrated a higher level of VST rated the products higher, showed a higher level of willingness to taste the products, assessed the health benefits of the products higher, evaluated the expected positive impact of the presented products higher, and expected higher market demand for such products than respondents demonstrating a lower level of this trait. These results are in line with previous findings (Bartkowicz, 2020; Dagevos, 2021; Modlinska et al., 2020; Rovai et al., 2021). It seems that the level of VST is a reliable predictor of acceptance of insect-based foods.

Moreover, higher scores awarded to the products correlated with higher scores obtained in the Entomophagy Attitude Questionnaire (EAQ). This is not surprising since the EAQ was developed specifically to measure attitudes toward eating insects (La Barbera et al., 2019). However, these findings may still be considered proof of the validity of the scale.

The results obtained for the age factor were rather surprising. In our study, older participants rated the presented products higher, assessed them as healthier, and expected higher market demand than younger respondents. Most of the previous studies reported an opposite tendency, with a more positive attitude toward entomophagy found in younger people (Palmieri et al., 2019; Sogari et al., 2019a; Sogari et al., 2019b). Our results may reflect the life experience of older adults in Poland. The transition from the communist era (characterized by economic scarcity) to a free market economy exposed many people to a variety of novel food products in a very short time. It is likely that this relatively sudden market development habituated many people (now older adults) to novelty and evoked a positive emotional response to new products.

As in our previous studies (Modlinska et al., 2020, 2022), we did not find any effect of sensitivity to disgust on the evaluation of the products. It is possible that the Disgust Scale-Revised (Olatunji et al., 2007) used in our study is not an optimal tool for measuring attitudes toward insect-based foods, as it measures many aspects of this emotion (morals, body products, etc.) - (cf. Rozin et al., 2008). Moreover, in our study, the participants had no direct contact with insect-based foods but only assessed the packaging of this type of product. It is possible that an image of a common insect in food is not sufficient to elicit disgust.

The results of our study indicate that marketing campaigns emphasizing the health and environmental benefits of eating insects presented along with the product may not be an efficient way of encouraging consumers to buy insect-based foods (e.g. Lammers et al., 2019; Serpico et al., 2021). Although it is a popular strategy, some studies suggest (Berger et al., 2018) that the utilitarian motives for purchasing products containing insects do not play an important role if the benefits are distant in terms of time and personal gain. It is suggested that underlining the hedonic rewards of the novel food (such as exquisite taste or the luxury of the product) may be a better way to introduce insects into the general market (e.g. Gurdian et al., 2022; Herbert & Beacom, 2021). However, the information practices presenting this type of food in the context of a broad range of benefits can reduce product unfamiliarity, which is an important barrier in insect consumption (cf. ; Brée et al., 2023; Legendre et al., 2019).

Although information about food product content seems crucial from the food safety perspective, our results show that the visual presentation of insects on the package reduces the evaluation of the product. Yet, the presentation of an insect on a food package may draw attention to the product and distinguish it from others (Herbert & Beacom, 2021; Kauppi, 2020). This would further increase familiarity with these types of products. Presenting the insect in a context of familiar and preferable ingredients (such as nuts or herbs) - (Kauppi, 2020) or in a "funny" way may alleviate the negative effect (Bruckdorfer and Büttner (2022) did not find a positive effect of insect "cuteness" on the package; however, their study group was characterized by a high willingness to try insects, which may reflect their results).

## Conclusions

The level of acceptance of entomophagy remains low in the Western world despite the nutritional and environmental advantages of including insects in one's diet. Understanding the dynamics of consumer acceptance is crucial to tackling this negative attitude. The present study suggests that the negative impact of packaging labels indicating insect content on product evaluation is greater when an image of the insect used in the products is also provided on the packaging. On the other hand, reading informative texts about the benefits of entomophagy did not have any effect on the evaluation of products and failed to alleviate the negative effect of visual information about insect content on the packaging. The results of our study suggest the need for alternative marketing and presentation strategies in order to increase the likelihood of acceptance of insect-based food products. Moreover, a more extensive and long-term educational approach is needed to tackle Western consumers' reluctance to accept entomophagy.

## Author contributions

**Katarzyna Goncikowska**: Conceptualization, Writing – Original Draft, Formal analysis, Writing – Review & Editing
**Klaudia Modlinska:** Conceptualization, Methodology, Investigation, Formal Analisis, Writing - Original Draft, Writing - Review & Editing
Dominika Adamczyk: Conceptualization, Methodology, Investigation, Data curation, Visualization, Writing - Original Draft
**Umut Can Altuntaş**: Conceptualization, Methodology, Investigation, Formal analysis, Writing – Original Draft
**Dominika Maison**: Conceptualization, Methodology, Writing – Review & Editing
**Wojciech Pisula**: Conceptualization, Resources, Writing – Review & Editing, Project administration, Funding acquisition, Supervision

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## ORCID

Katarzyna Goncikowska http://orcid.org/0000-0001-9763-3370
Klaudia Modlinska http://orcid.org/0000-0002-2161-9019
Dominika Maison http://orcid.org/0000-0002-8946-7517
Wojciech Pisula http://orcid.org/0000-0001-5777-0549

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## Appendix 1

### *Text 1 – Control: Insects – the most numerous group of animals*

In recent years, there has been a growing scientific interest in insects as the most numerous, diverse and widespread group of animals inhabiting almost all environments. Insects belong to the group of arthropods, and it is assumed that there are up to 30 million insect species. The most numerous insects in Poland include butterflies, beetles, hymenoptera and flies. These animals perform a variety of functions in nature, which – from the human point of view – may have a positive (e.g. pollinating flowers, removing dead organic matter and loosening soil) or negative (e.g. destroying forests, crops and food reserves) value. Research is currently ongoing into the potential use of insects in processing plastic waste.
INSECTS – THE MOST DIVERSE GROUP OF ANIMALS

### *Text 2 – Experimental – health: Insects – a healthy alternative to meat*

For several years, there has been growing interest in insects as a source of protein in human food. According to the United Nations Food and Agriculture Organization (FAO), insects could be an alternative to meat. In view of the declining quality of meat, insects may become the food of the future, which will save humanity from hunger and, at the same time, have a positive impact on our health. Insects are, above all, an extremely valuable source of protein. Some species contain three times more protein than beef, so they can be an excellent substitute for meat. They are even more valuable because, in addition to protein, they contain large amounts of valuable nutrients – calcium, iron, zinc and vitamin B.
INSECT FOOD – A SOLUTION FOR OUR HEALTH

### *Text 3 – Experimental – environment: Insects – an environmentally friendly alternative to meat*

For several years, there has been growing interest in insect-based food as a less environmentally damaging source of protein than meat. According to the United Nations Food and Agriculture Organization (FAO), insects can be an alternative to meat. With the current population growth, decreasing freshwater supplies, overfishing of the oceans and climate change, insects could become the food of the future, helping to reduce hunger and mitigate environmental degradation. Insects do not require the clearing of forests for farmland or large amounts of water, they emit far fewer greenhouse gases than livestock, and they do not produce manure. Therefore, they can be a more ecological alternative to pork or beef.
FOOD FROM INSECTS – A SOLUTION FOR THE ENVIRONMENT

**Publication 4**: *Who eats bugs and what does it say about them? Disgust, stereotyping, and the social construction of the insect consumer*

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# Who eats bugs, and what does it say about them? Disgust, stereotyping, and the social construction of the insect consumer

Katarzyna Goncikowska[1], Klaudia Modlinska[1], and Wojciech Pisula[1]
[1]*Institute of Psychology of the Polish Academy of Sciences, Poland*

*Corresponding author at*: Laboratory of Comparative and Evolutionary Psychology, Institute of Psychology, Polish Academy of Sciences, ul. Jaracza 1, 00-378, Warsaw, Poland
*E-mail address*: katarzyna.goncikowska@gmail.com

**Abstract**: The promotion of edible insects as a sustainable source of protein has gained considerable attention. However, consumer resistance remains high in Western countries, driven by disgust, food neophobia, and cultural taboos. Quantitative research has addressed the individual-level barriers to insect consumption, whilst the social and cultural meanings of entomophagy and its practitioners are under-explored, particularly in Central European contexts. The present study explored how Polish adults perceive insect-eating as a dietary practice, how they socially categorise and stereotype insect-eaters, and what psychological and sociocultural mechanisms underlie resistance to entomophagy. Semi-structured face-to-face interviews were conducted with 19 Polish adults (15F, 4M; age range 19–62 years) in August 2025. Data were analysed using Reflexive Thematic Analysis from a constructivist epistemological position. The findings suggest that social and political factors shape dietary rules and have implications for how we design culturally sensitive ways to encourage people to adopt them, and that resistance to certain types of food operates as a form of social categorisation, in which disgust can be transferred from food to its consumer. This approach to analysis allowed for an exploration of how individual barriers, such as disgust, may be transformed and reinforced by social processes and political polarisation. The study suggests that resistance to insect-based food was not organised solely around knowledge. Participants often recognised nutritional or ecological arguments, but still rejected insects because they were associated with disgust, contamination, social deviance, political meanings, and threats to familiar food identity. The study shows that insect-based foods may be rejected not only because they are unfamiliar, but also as markers through which consumers are socially imagined and evaluated.

**Keywords:** entomophagy; entomophage, reflexive thematic analysis; social perception; food disgust; stereotypes; political polarisation

## 1. Introduction and theoretical framework

The anticipated increase in the global population to 9.1 billion by 2050 necessitates a shift towards diets less reliant on traditional animal protein sources (Alexandratos & Bruinsma, 2012; Barton, Richardson, & McSweeney, 2020; Florença et al., 2022). In this context, edible insects (EIs) have been widely promoted as a viable alternative that offers significant sustainability, food security, and nutritional benefits (Aiking, 2011; Oonincx et al., 2010; Premalatha et al., 2011; Kasza et al., 2023; Ruiz et al., 2026; Conway, Jaiswal & Jaiswal, 2024; Guiné et al., 2024).

This article explores the challenges of incorporating entomophagy, or the practice of eating insects, into Western diets. It focuses on the psychological and sociocultural barriers, such as disgust, and the relationship between diet, identity, and stereotyping.

There is increasing focus in current research on understanding the factors that predict acceptance of insect-based foods (Mina, Peira & Bonadonna, 2023). However, acceptance remains consistently low

among consumers in Western countries (Rumpold & van Huis, 2021; Ranga, Noci & Dermiki, 2024; Florença et al., 2022; Mina, Peira & Bonadonna, 2023; Mancini et al., 2019b). Many cultures consider consuming insects gross, despite their high nutritional value (Ruby, Rozin & Chan, 2015). The psychological impediments, mainly disgust and food neophobia, are significant obstacles that must be addressed if this novel food source is to be adopted (Kasza et al., 2023; Ranga, Noci & Dermiki, 2024; Florença et al., 2022; Modlinska et al., 2020; Modlinska et al., 2021; Adamczyk et al., 2023).

### 1.1. Entomophagy as a common but regionally rejected practice

Although Western consumers commonly regard the consumption of insects as exotic, anthropological evidence shows that eating insects has been a dietary practice for thousands of years, and is still common in many contemporary cultures, particularly in sub-Saharan Africa, South and Southeast Asia, Latin America, and Oceania (van Huis et al., 2013; Conway, Jaiswal & Jaiswal, 2024). It is estimated that around two billion people worldwide consume insects as part of their regular diet, and over 1,900 edible species have been recorded (van Huis et al., 2013; Conway, Jaiswal & Jaiswal, 2024). Notably, in many of these regions, insects are consumed for their taste and perceived health benefits rather than out of necessity (Costa-Neto, 2015; Homann et al., 2017), which conflicts with the Western perception of insect consumption as primitive or enforced. Insects have also been endorsed by various international organisations as a sustainable source of protein, given their high feed conversion efficiency and comparatively low environmental impact (van Huis et al., 2013; Florença et al., 2022; Ruiz et al., 2026). Despite this global familiarity and institutional endorsement, consumer acceptance in Western countries remains low and depends on context (Ranga, Noci & Dermiki, 2024; Florença et al., 2022). This asymmetry between a globally established and culturally meaningful practice and its persistent rejection in Western settings motivates the present study.

### 1.2. The Western challenge

Despite their environmental and nutritional merits, and growing food-safety and regulatory literature establishing the conditions of their use in the EU (Belluco et al., 2013; Belluco, Halloran & Ricci, 2017), insects remain absent from traditional diets in many European countries (Kasza et al., 2023; Mancini et al., 2019a) and are still considered taboo in Western cultures (van Huis et al., 2013; Sidali et al., 2019). This fact seems to be the main reason for low acceptance of edible insects (Hartmann et al., 2015). From a consumer's perspective, acceptance of insects as food remains difficult in countries with no recent history of consuming them (Payne et al., 2016). Historically, Europe was not always devoid of entomophagy. Insects were part of the European diet and were consumed by civilisations such as the Egyptians, Greeks, and Romans (Bodenheimer, 1951; Lockwood, 2013; Ramos-Elorduy, 2009). Historical records have documented insect consumption in Eastern Europe into the nineteenth century: salted and smoked grasshoppers were eaten in Russia and by Crimean Tatars, and cockchafers were reportedly consumed by children in parts of Romania (Platta et al., 2024). This historical proximity suggests that the current Polish aversion is culturally constructed rather than geographically inevitable. Over time, they largely disappeared due to changing climates, the availability of alternative foods (i.e., industrialisation of agriculture and food production; Meyer-Rochow, 2009), and affluent groups establishing dietary norms and framing insects as undesirable, thereby reinforcing social stereotypes (Bodenheimer, 1951; Kellert, 1993; Looy, Dunkel & Wood, 2014). This process effectively transformed insect consumption into a cultural taboo. Although insects have recently been reintroduced as a delicacy in some European countries (Ramos-Elorduy, 2009; Verkerk et al., 2007), negative associations, fear of poor taste and

disgust continue to limit their acceptance in Western Europe (Gmuer et al., 2016; Hartmann & Siegrist, 2017; Ruby et al., 2015). In Poland specifically, strong attachment to traditional cuisine has been shown to act as a barrier to dietary innovation (Żakowska-Biemans, 2012), a dynamic that may compound neophobic responses to insect-based foods.

In Western countries, the acceptance of insect-based foods is primarily influenced by factors including benefits, nutritional value, sustainability awareness, familiarity (or past experience), sensory expectations, tradition, cultural norms and fear of new foods i.e. neophobia or disgust (Florença et al., 2022; Gmuer et al., 2016; Hartmann et al., 2015; Ruby, Rozin & Chan, 2015; Schlup & Brunner, 2018; Verbeke, 2015; Rozin, Haidt & McCauley, 2016; Tybur, Lieberman & Griskevicius, 2009; Sogari, Bogueva & Marinova, 2019; Ruby & Rozin, 2019; Pliner & Hobden, 1992; Van Trijp & Steenkamp, 1992; Stone et al., 2021; Penedo et al., 2022; Modlinska et al., 2021). Systematic reviews point to disgust, food neophobia, and a lack of familiarity as recurring barriers (Mina, Peira & Bonadonna, 2023; Modlinska et al., 2021). Multiple studies have shown that higher levels of food neophobia and disgust sensitivity are strong predictors of lower willingness to consume insect-based foods. For instance, Modlinska et al. (2021) found that individuals with higher levels of food neophobia and disgust sensitivity were less willing to consume insects in Poland. Neophobia is further facilitated by sensory expectations, as insects may be perceived as having unpleasant texture or taste before any actual contact (Szlachciuk & Żakowska-Biemans, 2021).

A Swiss study found that the most common reason students gave for not consuming insects was 'disgust' (Penedo et al., 2022). Insects are commonly viewed as a sign of dirt and pestilence (Looy, Dunkel & Wood, 2014) and are associated with contamination and dirt (Myers & Pettigrew, 2018; Deroy et al., 2015), perceptions that are deeply culturally embedded and resistant to change through information alone. Successful strategies in Europe and elsewhere typically combine product processing (reducing visible insect cues, which lowers the sensory rejection of recognisable insect forms; Tan et al., 2016; Tan, Tibboel & Stieger, 2017), targeted branding, tasting events, and information campaigns to increase familiarity and reduce perceived deviance from dietary norms (Kröger et al., 2022; Mina, Peira & Bonadonna, 2023). Sensory appeal (taste) and preference for products containing processed insect ingredients over those containing whole insects were highlighted, providing a key direction for future promotional efforts (Florença et al., 2022; Mishyna et al., 2020). Although regulatory change in the EU (e.g., novel-food pathways and recent approvals of species such as *Tenebrio molitor* - yellow mealworm, *Acheta domesticus* - house cricket or *Locusta migratoria* - migratory locust; European Commission, 2021) has reduced legal uncertainty, market uptake remains contingent on insects being reframed as familiar, safe, and sensorially acceptable through strategic marketing and placement in conventional product formats such as bars, flours, and meat analogues (Penedo et al., 2022; Lammers, Ullmann & Fiebelkorn, 2019). Despite growing media coverage of entomophagy across Europe and other Western regions (Shockley, Allen & Gracer, 2017), consumers' willingness to eat insects remains limited and is often rejected over traditional animal-based proteins (Stone et al., 2021). Despite growing regulatory progress, Mina, Peira and Bonadonna (2023) conclude in their systematic review that "the European insect market is still in an embryonic state" (p. 646), a characterisation consistent with the persistently low consumer uptake documented across Western European samples.

### 1.3. Disgust

Disgust is a central emotional response implicated in the avoidance of novel foods (Rozin & Fallon, 1987; Tybur et al., 2009). It has been defined as a revulsion towards the idea of ingesting offensive substances

(Rozin & Fallon, 1987, p. 23). It has been observed to be rooted in cultural and social norms rather than in the food itself (Sahakian, Godin & Courtin, 2020). This culturally influenced revulsion is powerfully illustrated by the case of meat. In Western societies, meat symbolises prestige and social distinction (Douglas, 1975; Fiddes, 1991), yet simultaneously provokes moral ambivalence and emotions such as disgust and guilt (Navarrete & Fessler, 2003). Consuming it evokes strong emotional and moral responses, such as disgust and distrust, which reflect the broader social meanings attached to human-animal relations (Gouabault & Burton-Jeangros, 2010; Sahakian, Godin & Courtin, 2020). This tension has been conceptualised as the 'meat paradox' - the discomfort experienced when empathising with animals while simultaneously consuming them (Bastian et al., 2012; Graça et al., 2015). Vialles (1994) identified *sarcophagia* as one cultural response to this paradox. This is a system of symbolic avoidances through which the animal origin of meat is ritually concealed, allowing consumption to continue without confronting the act of killing. Sahakian, Godin, and Courtin (2020) describe a structurally identical mechanism in relation to conventional meat consumption. They refer to this mechanism as *moral disengagement,* which is defined as the cognitive separation of the living animal from the product on the plate. This process functions as a resolution to the meat paradox, enabling people to continue consuming meat without confronting the act of killing. The example of meat shows that disgust is not just a biological response, but also a moral and social signal that helps to maintain cultural boundaries around what is considered edible and what defines identity. However, when it comes to insects, the situation is different. Rather than symbolising prestige, they evoke notions of poverty, survival necessity and cultural primitiveness (Looy et al., 2014; van Huis et al., 2013). The increased availability of alternative protein sources meant that wealthy social groups could establish a norm against consuming insects, effectively repositioning insect consumption as a marker of low socioeconomic status or cultural backwardness (Bodenheimer, 1951; Meyer-Rochow, 2009; Looy et al., 2014). Thus, a practice that is nutritionally valuable and culturally embedded in much of the Global South became, in the Western imagination, a signifier of deprivation rather than choice (van Huis et al., 2013; Costa-Neto, 2015). This symbolic shift has significant implications beyond individual disgust, as food choices serve as condensed signals of social identity and group affiliation (De Garine, 2001; Earnshaw & Karpyn, 2020). Consequently, consuming insects in a Western context may be perceived as a sign of social decline or a breach of class-based dietary norms. Specifically in the Polish context, this dynamic is amplified by the political significance that entomophagy has acquired following EU novel food approvals. Here, insect consumption has been portrayed in public discourse as an undesirable practice associated with poverty or ideological constraint, rather than as an intentional or aspirational dietary choice (see, for example, Myers & Pettigrew, 2018; Platta et al., 2025).

Disgust is also identified as the most significant and widespread barrier to consuming insects in Western societies (Conway, Jaiswal & Jaiswal, 2024; Guiné et al., 2024; Ranga, Noci & Dermiki, 2024; Florença et al., 2022; La Barbera et al., 2018; Ruby & Rozin, 2019; Hartmann & Siegrist, 2016; Sogari, Bogueva, & Marinova, 2019; Mina, Peira & Bonadonna, 2023; Jensen & Lieberoth, 2019). It is an evolved avoidance emotion, but it is also strongly influenced by cultural learning and prior experience (Rozin & Fallon, 1987; Rozin et al., 2016). Studies on food-related disgust and entomophagy have shown that greater disgust sensitivity and fear of new foods predict lower acceptance of insect-based products. However, repeated exposure, positive tasting experiences, and informative framing can reduce disgust and increase the willingness to try such products (Gmuer et al., 2016; Kröger et al., 2022). Therefore, while disgust is a powerful inhibitor, it is also a malleable target for interventions aimed at normalising insect consumption in Western settings. Disgust operates as both a sensory and a moral signal. Sahakian, Godin,

and Courtin (2020) use Haidt's CAD triad hypothesis to demonstrate that disgust corresponds with the moral concept of divinity, which involves responses to perceived violations of purity and sanctity. Informational interventions targeting sensory or nutritional concerns often fail to produce lasting changes in attitudes towards entomophagy (Gumussoy et al., 2021; Mina, Peira & Bonadonna, 2023), which suggests that the underlying barrier is ideational rather than merely gustatory (Rozin & Fallon, 1987). Because disgust is elicited by the concept of ingesting an offensive object rather than its actual sensory properties, reframing strategies that increase perceived familiarity appear more effective than those appealing to rational cost-benefit logic alone (Gumussoy et al., 2021). Experimental evidence supports this view as Berger and Wyss (2020) demonstrated across four studies that descriptive social norms causally affect the willingness to consume unprocessed insects, with participants' beliefs about how many peers would eat an insect predicting their own consumption behaviour. Crucially, even subtle, non-normative cues (such as the perceived incentive given to others) were sufficient to shift norm beliefs and, in turn, eating behaviour, suggesting that social context operates upstream of deliberate disgust appraisal.

Researchers Rozin & Fallon (1987) distinguished rejection based on disgust (origin and offensive properties of the item), distaste (dislike of taste, smell, texture, or appearance), danger (anticipated harmful consequences), and inappropriateness (items not classified as food). These categories carry different implications for intervention: whereas distaste may be addressed through sensory reformulation, disgust is ideational and therefore more resistant to product-level modification alone (Rozin & Fallon, 1987; Rozin et al., 2016). It is worth noting that most consumers are unlikely to spontaneously distinguish between disgust, distaste, and inappropriateness as Rozin and Fallon (1987) defined them, and disgust itself may not be a single, homogeneous response (Simpson et al., 2006). In everyday discourse, the term disgust may therefore function as a non-specific label for a heterogeneous cluster of rejection responses, a limitation noted in the self-report literature on food rejection (cf. Rozin et al., 2016). This combination has practical consequences. If the underlying rejection is primarily sensory, strategies aimed at reducing disgust may be misdirected. Conversely, if the barrier is genuinely ideational, rebranding efforts may prove insufficient.

### 1.4. Diet, identity, and stereotyping

Brillat-Savarin (1885, 3) wrote, "*Tell me what you eat, I will tell you who you are*", which is a demonstration of how food can be perceived as a social marker (De Garine, 2001) and social activity (Delormier et al., 2009). Therefore, food is not only sustenance but a social signal; group membership and moral standing are communicated through the curation of diets (Atherton, 2021). Food choices serve as indicators of group membership and moral values, as people use their diet to express their identity, align with social groups, and manage how they are perceived (Hackel et al., 2018; Gerber & Folta, 2022; Earnshaw & Karpyn, 2020). Food as a social marker reflects group identity and boundaries (De Garine, 2001). People often express their sense of belonging or distinction by endorsing or rejecting certain foods, thereby reinforcing stereotypes and social differentiation through their eating practices (De Garine, 2001). What is more, purchasing and wearing branded clothing (Elliott & Leonard, 2004) or purchasing and consuming branded foods may be a way for people to change their social group labels - from "poor" to a perceived status of a person who can afford such goods (Earnshaw & Karpyn, 2020). The same processes apply to plate and food choices. Dietary decisions serve as brief expressions of identity that signal both group membership and moral standing (Bodenheimer, 1951; De Garine, 2001; Earnshaw & Karpyn,

2020). Whether these identity-signalling dynamics extend specifically to insect consumption as an emergent dietary category has, until recently, remained empirically unexplored.

Moreover, food consumption behaviours can also help establish and preserve in-group identity (Earnshaw & Karpyn, 2020). When a food is perceived as stigmatised or divergent from in-group norms, this may affect perceptions of competence, trustworthiness, or cultural compatibility (Earnshaw & Karpyn, 2020). These dynamics apply to novel foods, such as insect products, where consumption may be viewed by some as a sign of cosmopolitan openness and by others as a violation of social norms. In extreme cases, when violations of social norms concern deeply rooted moral or cultural values, they become taboo. In particular, food taboos have long served to define moral and cultural boundaries, distinguishing those who conform from those who transgress (De Garine, 2001). Food taboos serve to reinforce group identity and cohesion by signalling cultural distinctiveness and fostering a sense of belonging (Meyer-Rochow, 2009). These taboos can persist across generations, reflecting historical and social contexts rather than purely nutritional concerns (Meyer-Rochow, 1998; Härkönen, 1998). Historically, such prohibitions, like the Western rejection of consuming human flesh, have been used to separate the "civilised" from the "uncivilised", portraying those who breach them as barbaric or inferior (De Garine, 2001). In this sense, food may be a powerful social marker that reinforces group identity and justifies the exclusion or prejudice of those who challenge dominant dietary norms.

When dietary practices are perceived to violate culturally entrenched norms, individuals partaking in these practices may be subject to stigmatisation, facing the attribution of subhuman or animalistic characteristics, a consequence of *dehumanisation* (Haslam, 2006). Leyens et al. (2000) demonstrated that outgroups are systematically denied uniquely human emotions (*infrahumanisation*). Bastian et al. (2012) showed that moral transgressions, including violations of purity norms, can trigger animalistic dehumanisation.

In the context of entomophagy, the consumed object itself is associated with strong contamination and disgust (Tybur et al., 2013). Voluntary insect consumers may face two challenges. Firstly, they may transgress both conventional food norms and the symbolic boundary between human and animal. Secondly, there may be direct implications for the social stigmatisation of early adopters. However, the latter challenge has yet to be empirically investigated. Specifically in the Polish context, disgust, fear and awareness of insect origin function as powerful deterrents (Modlinska et al., 2020; Modlinska et al., 2021; Platta et al., 2025; Adamczyk et al., 2023). These deterrents lead consumers to prefer hidden entomophagy (i.e., powdered or processed ingredients) as a strategy to avoid the negative social associations associated with visible insect consumption (Platta et al., 2025). This preference for secrecy is similar to the logic of sarcophagy described by Vialles (1994). The stigma is not eliminated, but managed by removing visible markers.

Despite the growing body of research on barriers to insect consumption, remarkably few studies have examined how others perceive people who do eat insects. However, the study by Hartmann and colleagues (2018) provides a notable exception. Utilising a semantic differential scale with Swiss consumers, they found that insect-eaters were rated as more environmentally friendly, health-conscious, imaginative, brave, and knowledgeable than conventional meat consumers. However, these perceptions were captured using closed-ended rating scales, leaving unexplored how people spontaneously construct and articulate their images of insect-eaters in open discourse. The question of whether insect-eaters are perceived as a distinct social category, and if so, what traits, values, and social meanings are attributed to them, remains largely unexamined through qualitative methods that allow participants to generate their own descriptive frameworks.

Therefore, stigma and social-norm processes shape whether entomophagy is interpreted positively (as innovative and sustainable) or negatively (as disgusting and threatening to group identity). Interventions must therefore consider these social meanings, as well as sensory and safety issues; promotion framed purely as information transfer has had limited success (Shelomi, 2015).

The influence of social norms is significant. Social influence, including the opinions of peers and experts, can affect consumers' evaluations of insects (Penedo et al., 2022; Berger & Wyss, 2020; Mina, Peira & Bonadonna, 2023). This suggests that acceptance could be facilitated if entomophagy were to become normalised within social groups (Stone et al., 2021). For example, Jensen and Lieberoth (2019) found that, although disgust predicted initial reluctance to eat mealworms, it was not a consistent predictor of actual behaviour. During an unexpected tasting session, 27.5% of participants who had said they would not eat insects tried mealworms anyway, showing that changes in perceived social norms can override intentions based on disgust. That study emphasised the role of social norms and suggests that disgust toward eating insects reflects social norms rather than innate aversion. When these norms shifted during the tasting session, participants became more willing to try mealworms despite prior rejection. Those who are familiar with the idea of eating insects are 2.6 times more likely to adopt it, and consumers who intend to reduce their fresh meat intake are up to 4.5 times more likely to do so (Verbeke, 2015). For edible insects to be successfully integrated into the Western food market, therefore, changes are needed in the social and cultural norms surrounding them.

### 1.5. The current research

To date, quantitative approaches have dominated research into the acceptance of entomophagy, typically measuring predetermined constructs such as food neophobia, disgust sensitivity and willingness to pay (Hartmann & Siegrist, 2017; La Barbera et al., 2018; Modlinska et al., 2021). Qualitative studies remain scarce (Hartmann & Siegrist, 2017), tending to focus on product evaluation rather than the broader social and psychological meanings individuals construct around insect consumption and those who practise it (Bisconsin-Júnior, 2022). This study aims to address this gap by exploring how entomophagy is perceived, how insect-eaters are categorised socially, and the mechanisms underlying resistance to or acceptance of insects as food, through interviews with Polish adults. The present study is situated in Poland, a country where the practice of consuming insects, known as entomophagy, has become a site of cultural and political debate, particularly following the European Union's novel food approvals (European Commission, 2023; European Digital Media Observatory [EDMO], 2023) and subsequent media disputes, media framed insect consumption as a politically coded threat to traditional dietary culture (Reuters, 2023; Notes from Poland, 2023). In the Polish context, dietary deviation from the meat-eating norm triggers gender-based stereotyping, with vegans being viewed as less masculine and competent, and their diet being associated with political progressivism (Adamczyk et al., 2023). This study builds on this pattern by examining whether a similar social categorisation process applies to insect-eaters. This study contributes context-specific insights to the extant evidence base, which is predominantly Western European and English-language. In view of the lack of prior studies, especially in Central Europe, and the limitations of earlier research that employed closed adjective lists, the current study's exploratory design sought to determine whether the traits participants spontaneously attributed to insect-eaters reflected the language people use to describe this emerging dietary group.

The exploration of societal perceptions of individuals who adopt insect-based diets, or more generally, novel dietary practices, has the potential to provide insights into the broader dynamics of acceptance and

resistance towards environmentally conscious food behaviours. This is particularly important in a world facing ecological challenges and the imperative to adapt sustainably.

*Research Questions (RQs)*

***RQ1*****:** How do individuals conceptualise insect-eating as a dietary practice, and what contextual meanings (such as necessity, novelty, or cultural tradition) do they associate with it?

***RQ2*****:** How do perceptions of insect-eaters shape social attitudes and potential barriers to adopting insect consumption? Are insect-eaters perceived as a distinct social group, and if so, what traits are attributed to them?

***RQ3*****:** What social and psychological mechanisms, including disgust, dehumanisation, and group-based stereotyping, contribute to negative perceptions of insect-eaters, and to what extent are insect-eaters framed in culturally transgressive terms?

***RQ4*****:** How are perceptions of insect-based food related to perceived product attributes, attitudes toward novelty, and health and environmental concerns?

Given the exploratory and qualitative character of the study, the analysis was not designed to test hypotheses in a confirmatory or statistical sense. Instead, the study was guided by a set of theory-informed analytic propositions derived from prior research on disgust, food rejection, social categorisation, dietary identity, and stigma. These propositions functioned as sensitising assumptions that informed the construction of the interview guide and the interpretation of participants' accounts, while allowing unanticipated meanings and patterns to emerge inductively from the data. Analytic propositions were as follows:

***AP1***. Insects as objects of disgust and contamination. Insects were expected to be perceived not only as potential food products, but also as culturally marked objects associated with disgust, dirt, danger, or inappropriateness (Rozin & Fallon, 1987; Rozin, Haidt, & McCauley, 2016; Tybur, Lieberman, & Griskevicius, 2009; Ruby, Rozin, & Chan, 2015; Ruby & Rozin, 2019; Mina, Peira, & Bonadonna, 2023).

***AP2***. Product form as a condition of acceptance. Acceptance of insect-based foods was expected to depend on their physical form, with processed, powdered, or visually disguised products being more acceptable than whole or recognisable insects (Gmuer et al., 2016; Hartmann & Siegrist, 2017; Mishyna et al., 2020; Florença et al., 2022; Kröger et al., 2022).

***AP3***. Insect-eaters as a social category. People who eat insects were expected to be constructed as a socially meaningful category and attributed both positive traits, such as openness, curiosity, ecological awareness, and bravery, and negative traits, such as strangeness, primitiveness, poverty, or deviance (De Garine, 2001; Hartmann & Siegrist, 2017; Earnshaw & Karpyn, 2020).

***AP4.*** Entomophagy as a violation of social and dietary norms. Resistance to entomophagy was expected to involve not only individual disgust, but also broader processes of social boundary-making, stigma, and possible dehumanisation of those who violate dominant food norms (De Garine, 2001; Haslam, 2006; Leyens et al., 2000; Bastian et al., 2012; Meyer-Rochow, 2009).

***AP5***. Entomophagy as a politically coded practice in Poland. In the Polish context, insect consumption was expected to be interpreted not only as a dietary or environmental practice, but also as a politically coded behaviour linked to broader tensions between tradition and progress, conservatism and liberalism, or national food culture and external influence (Adamczyk et al., 2023; European Commission, 2023; European Digital Media Observatory [EDMO], 2023; Reuters, 2023; Notes from Poland, 2023; Platta et al., 2025).

***AP6.*** Health, environmental, and ethical arguments as social justification. Health, environmental, and ethical arguments were expected to make insect consumption more intelligible and socially defensible,

especially when the practice was otherwise perceived as disgusting, unfamiliar, or socially risky (Verbeke, 2015; Berger & Wyss, 2020; Stone et al., 2021; Florença et al., 2022; Penedo et al., 2022; Mina, Peira, & Bonadonna, 2023).

These propositions were not treated as fixed coding categories. Rather, they provided an initial theoretical orientation for the analysis and were revised, complicated, or extended through participants' accounts.

## 2. Method

The study employed a qualitative design. Data were collected through semi-structured face-to-face interviews conducted in August 2025. The interview guide was designed to systematically explore participants' views on entomophagy and address the study's research questions regarding the psychosocial perceptions of insect-eaters.

### 2.1. Participants

The study sample consisted of 19 participants (15F, 4M; aged 19 to 62 years; *M_age* = 34.1; *SD* = 12.2). Inclusion criteria were: age (18 years or older), fluency in Polish, and current residence in Poland. The participants resided in various locations, with 12 individuals in the capital city (Warsaw), 3 in rural areas, and 4 in other urban centres of varying sizes. Twelve participants had completed higher education, four had additionally undertaken doctoral studies (completed or in progress), and three had secondary education. The sample was highly educated, as most participants held a higher education degree (sixteen), and four of these had also undertaken doctoral studies. The remaining three had obtained secondary qualifications. Full demographic information for all participants is provided in Appendix B in the Supplementary Materials. The sample size was determined through the principle of information power (Malterud et al., 2016) as an alternative to data saturation. The following five factors provide a robust foundation for the adequacy of $N = 19$: (a) a narrowly defined study aim, with a specific focus on social perceptions of insect-eaters; (b) a particular sample of Polish adults, representing a diverse socioeconomic background; (c) drawing upon established theoretical frameworks (disgust, social categorisation) to guide the analysis; (d) the utilisation of interviews that yield rich, detailed accounts, ensuring strong dialogue quality; and (e) the implementation of a cross-case analysis strategy. The recruitment process continued until participants' responses began to exhibit repetitive patterns, indicating that the phenomenon had been adequately explored within the population under study.

The resulting gender imbalance reflects the self-selection patterns commonly observed in qualitative food-related research. In these studies, women are consistently more likely to volunteer to participate (Galea & Tracy, 2007; Smith, 2008
). As the present study did not treat gender as an analytical variable and aimed to explore the cultural construction of entomophagy across the sample as a whole, this imbalance was not considered to constrain the thematic analysis. The implications of this distribution are discussed in the Limitations section.

### 2.2. Procedure

The initial part of the interview established participants' background relationship with food by asking about typical dietary habits, daily food preparation, and the main factors influencing food choices (e.g., health, price, convenience), as well as whether they perceived their food choices as linked to personal identity. The interview then focused on perceptions of insect-based foods, emotional and cultural associations, and entomophagy as a social practice, including participants' thoughts on who eats insects

and why, what insect-eating means socially, and how they would feel if someone close to them consumed insect-based foods.

During the interviews, participants also completed two elicitation sorting tasks. Both tasks were designed to elicit spontaneous categorisations that participants might not articulate spontaneously in conversation (Mason, 2018; Catterall & Ibbotson, 2000). Materials for both tasks were prepared on printed cards and laid out on the table in front of the interviewees, who were asked to sort the cards and comment freely as they did so.

In the adjective sorting task, sixteen adjectives were printed individually on small paper cards, eight positive (wonderful, cheerful, intelligent, talented, helpful, moral, kind, friendly) and eight negative (awful, hostile, stupid, lazy, cunning, repulsive, selfish, annoying). Two labelled cards were placed in front of the participant: one reading “a person who eats insects” (an entomophage) and one reading “a person who does not eat insects”. Participants were asked to place each adjective card under whichever label they considered the better fit and to think aloud while doing so. There was no upper limit on the number of cards that could be placed under either label, and participants were told that they could leave a card unsorted or stop the task at any time without giving a reason. The instruction was deliberately kept permissive so that the task captured both the content of the sorting and the participant's response to the task itself, including hesitation or refusal. The adjective task, therefore, worked both as a simple sorting measure of how positive and negative traits were distributed between the two categories and as a discussion prompt for further conversation about social identity and stereotyping.

In the environment sorting task, participants were shown six printed sheets, each displaying six photographs of different landscapes and environments (for example, cityscapes, rural scenes, regions stereotypically associated with particular cultures). Two labelled cards were placed on the table, one reading “people who eat insects” and one reading “people who do not eat insects”. Participants were asked to point at each photograph in turn and to say aloud which of the two groups they associated it with, and why. Pointing rather than physical sorting was used because the photographs were presented in fixed grids of six per sheet. Participants were free to assign the same photograph to both groups, to neither, or to refuse to sort any image; they were also free to stop the task at any time, as in the adjective task. This task was designed to elicit the geographical and cultural settings that participants spontaneously linked with insect-eating.

Advertisements for this study were distributed via word of mouth and researchers’ social media platforms, facilitating rapid recruitment through online networks (Cicatiello et al., 2020; Zielinska et al., 2020). Detailed notes were taken throughout each task to capture participants’ interactions with the materials (e.g., pointing at pictures, arranging cut-out words, organising items), complementing the verbatim transcriptions and ensuring accurate interpretation. The interviews lasted between 40 minutes and 1 hour 45 minutes (58 minutes on average) and were conducted at locations that were sufficiently accessible to the participants. All interviews were audio-recorded and transcribed verbatim, following participants’ informed consent. Interviews were initially auto-transcribed using Microsoft Teams transcription software and subsequently reviewed and corrected by the first author against the original audio recordings to ensure accuracy (Bokhove & Downey, 2018). Strict anonymisation procedures were applied, and identifying information was removed to ensure confidentiality and protect participant privacy. More information in the *Ethical Considerations* (2.5).

### 2.3. Data analysis

Reflexive Thematic Analysis (RTA; Braun & Clarke, 2021; Trainor & Bundon, 2021) was selected as the analytic approach for three main reasons. First, RTA works well for exploratory, interview-based research, where the aim is to develop a rich interpretation of what participants say rather than to confirm categories that the researcher has decided on in advance (Braun & Clarke, 2021). Second, RTA aligns with the constructivist position of this study. Themes are treated as constructs the researcher builds from the data, not as objects waiting in the data to be discovered. Third, the more recent formulation of the method (Braun & Clarke, 2021) was followed rather than the original 2006 paper, because the authors have since clarified two important points. They state that inter-rater agreement is not a meaningful quality criterion for this kind of analysis, and that the researcher's own perspective is a useful analytic resource rather than a source of bias to be removed. For these reasons, the authors did not decide to calculate inter-rater reliability scores in this study. Such measures assume that there is a single correct coding of the data that two researchers should converge on, which is not the assumption underlying reflexive thematic analysis (Braun & Clarke, 2013, 2019, 2021).

The analytic process was executed through six iterative phases: initial familiarisation with the data through repeated readings and detailed note-taking; systematic coding of meaningful features across the dataset; identification of preliminary thematic patterns; review and refinement of emerging themes for coherence and representativeness; definition and naming of final themes; and writing up the analysis, integrating thematic insights with illustrative participant extracts and theoretical interpretation. The findings are presented according to theme, along with the associated participant quotes.

### 2.4. Positionality

Reflexive Thematic Analysis requires researchers to acknowledge how their own background, assumptions, and theoretical commitments shape the analytic process (Braun & Clarke, 2021; Trainor & Bundon, 2021). Following this commitment, and in accordance with APA Journal Article Reporting Standards for Qualitative Research (Levitt et al., 2021), we provide the following positionality statement.

The first author conducted all interviews and led the analysis. As a researcher with prior expertise in food psychology, social perception, and qualitative methodology, the first author engaged reflexively with the data throughout the analytic process, attending to how existing theoretical knowledge of disgust, identity, and stereotyping may have shaped both the interview dynamic and the interpretive choices made during analysis. The author was aware that their existing theoretical knowledge, particularly regarding literature on disgust, social identity, and stereotyping, could influence the dynamics of the interview process and interpretive decisions during analysis. To minimise the risk of imposing prior theory on the material, the initial coding stages were conducted in a bottom-up manner. Constructs from the literature were introduced explicitly only during the later interpretive phases, at which point they were employed to identify and discuss patterns already observed in the data, rather than forcing the material into predefined categories.

After the initial coding of all transcripts, the interviews were read several more times, and codes and themes were adjusted in response to what felt under- or over-represented. This prolonged engagement meant that the interpretation developed gradually rather than in a single analytic pass.

The remaining authors contributed to the ongoing discussion of emerging themes, adding an additional layer of analytic dialogue that supported the development of a coherent, well-grounded thematic structure. It helped to identify any blind spots and ensure that the final thematic structure was closely connected to the participants' accounts. Throughout the analytical process, the researcher's subjectivity was conceived not as a source of bias to be eliminated, but as an analytical resource to be made transparent (Braun &

Clarke, 2021). The reflexive orientation adopted here aligns with Braun and Clarke's (2019) articulation of thematic analysis as a method that requires ongoing researcher reflection rather than a fixed procedural application, treating analytical choices as interpretive acts accountable to the data.

### 2.5. Ethical considerations

The study was conducted in accordance with the Declaration of Helsinki and was approved by the Research Ethics Committee of the Institute of Psychology of the Polish Academy of Sciences on 20 May 2025, decision No. 16/IV/2025.

All interviews were conducted in person. In the absence of project funding, reimbursement of travel costs was not provided. Written informed consent was obtained from all participants, who also signed an extended document detailing the study information. This included data privacy and the processes of pseudo-anonymisation and anonymisation for analyses and publications related to the research project.

As a gesture of appreciation for their time and contribution, each participant was compensated with a short photography session held after the interview. One participant requested another date because they felt tired after the interview, and they received post-produced pictures like the other participants. Each participant received at least one post-produced photograph taken with professional equipment (*Canon EOS-1D X Mark II*) and processed in Capture One. Unedited or RAW-format files were not shared, consistent with professional photographic standards. Photographs were provided solely as a gesture of gratitude and were not used for any research or analytical purpose. No images were used in coding, analysis, dissemination, or any other research purpose, and they were not shared with any third party. Following the completion of the study and the delivery of post-produced photographs to each participant, all image files, including unedited RAW-format originals and processed JPEG exports, were permanently deleted from the researcher's storage devices. This procedure was adopted in accordance with the data minimisation principles outlined in the General Data Protection Regulation (GDPR; European Parliament and Council of the European Union, 2016, Art. 5(1)(e)), and it ensures that no visual material that can be linked to participation in the research remains accessible to third parties.

Each participant was explicitly informed in the written consent form that they retained the right to withdraw from the study at any point during the interview, without providing a reason, and to request the removal of their data or recording from the dataset after the study concluded. To exercise withdrawal, participants could contact the lead researcher. Upon receipt of such a request, the data would be deleted promptly, and the participant would be notified of the deletion. All withdrawal procedures are consistent with RODO/GDPR and good research practice.

Artificial intelligence–assisted tools (e.g., DeepL, DeepL SE, 2025; Grammarly, Grammarly Inc., 2026; Perplexity, Perplexity AI, 2026) were used to identify grammatical ambiguities, long embedded clauses and unclear antecedents. The authors then reviewed and edited the content produced with AI assistance, taking full responsibility for the final version of the publication.

## 3. Results

The analysis was conducted using a reflexive thematic procedure across three complementary data sources elicited within each interview. These data sources comprised an opening warm-up conversation; two mid-interview sorting tasks (adjectives and environments); and a final semi-structured discussion of entomophagy and the figure of the person who includes insects in their diet. The opening conversation served two functions. First, it was used as the primary source of demographic and background information about each participant, including age, occupation, dietary orientation, and self-described

relationship to food (the resulting participant profiles are summarised in Supplementary Material, Appendix B). Second, it elicited substantive talk about disgust, food refusal, and food-related identity that was read alongside the later insect-focused material; statements from this section therefore appear as illustrative quotations in Themes 1 and 2 where relevant. The opening conversation is not presented as a stand-alone results subsection, because the patterns it produced were not analytically separable from the themes that follow. The two sorting tasks are likewise not presented as stand-alone result units; each is integrated into the theme it most directly illuminates (the adjective task within Theme 2 and the environment task within Theme 4). The analysis yielded four overarching themes and fourteen subordinate themes (see Table 1).

**Table 1.** Main themes and sub-themes identified in Reflexive Thematic Analysis

| Theme | Sub-theme | Core Content | RQ Addressed |
|---|---|---|---|
| **T1** Between revulsion and acceptance: how form mediates the disgust boundary | *3.1.1 Parasites, dirt, and wriggling larvae: the visceral rejection of insects as food* | Disgust as a dominant inhibiting factor; gut-level automatic revulsion triggered by insect appearance. Insects were associated with dirt, parasites, contamination, and automatic bodily revulsion, especially when recognisable anatomical features were visible. | *RQ3* |
| | *3.1.2 If I can't see it, I can eat it: invisibility as the price of acceptance* | Physical processing (flour, powder, chips) as key mediator of acceptance; removal of visible anatomical elements eliminates the primary disgust trigger. Acceptance was conditional on processing, masking, or hiding the insect body. Visibility functioned as the main trigger of rejection. | *RQ1, RQ4* |
| **T2** Who eats bugs? Constructing the insect consumer as a social category | *3.2.1 Brave, curious, and green: the idealised insect-eater* | The insect consumer was perceived as open-minded, intelligent, brave, educated, ecologically conscious, willing to try new things, and progressive; adoption as a moral or modern choice. | *RQ2* |
| | *3.2.2 Different, crazy, poor, or primitive: the stigmatised insect-eater* | The same figure of an insect consumer was described through stigma, poverty, or social deviance. Insect eating was associated with low economic status, “inferior” background, or mental deviance; labels of “crazy” or “primitive”. | *RQ2, RQ3* |
| | *3.2.3 Soy lattes and blue hair: the political anatomy of the insect consumer* | Stereotypical profiling of insect consumers was described as left-wing, feminist, LGBT-associated, urban, progressive and not-traditional; adversaries framed as conservative traditionalists | *RQ2, RQ3* |
| | *3.2.4. The adjective sorting task: the attribution of traits to a single food choice* | The adjective task showed how participants connected insect consumption with social traits. The insect consumer was positioned through both positive attributes, such as openness, curiosity, and ecological awareness, and distancing attributes, such as eccentricity, conservatism, or social nonconformity. | *RQ2* |

| | | | |
|---|---|---|---|
| **T3**<br>The social cost of eating differently: tradition, ostracism, and political contamination | *3.3.1 We have cows, why would we need bugs? Tradition against change* | Absence of entomophagy in Polish food culture as a powerful attachment anchor; insects perceived as regressive, status-lowering, and identity-threatening. Eating insects was contrasted with Polish food tradition and interpreted as culturally unnecessary, foreign, or status-lowering. | *RQ1, RQ3* |
| | *3.3.2 What will people think? The secret eater and the fear of judgement* | Participants expected to be judged or made fun of for eating insects, which made insect eating something that might be hidden rather than openly practised. | *RQ3, RQ4* |
| | *3.3.3 Political polarisation: bugs, Brussels, and "the culture war" - when food becomes politics* | Entomophagy was incorporated into anti-EU political narratives and discourse; media-driven fearmongering and culture war polarisation intensified public resistance. People who incorporate insects into their diets and insect eating in general were interpreted through the Polish political scene, ecological pressure, and threats to national food identity. | *RQ3* |
| | *3.3.4. How participants spoke about media coverage* | TV and social media were described as amplifiers of disgust, political division, and (less often) curiosity, or the sense that insect eating is strange and externally enforced. | *RQ2, RQ3* |
| **T4**<br>Between necessity and experiment: two stories about why people eat insects | *3.4.1. Necessity: survival, poverty, and the primitive elsewhere* | Insect consumption was perceived as primal/necessary, situated outside Europe in non-Western contexts of deprivation. It was framed as a response to poverty, survival, or lack of alternatives. | *RQ1, RQ2* |
| | *3.4.2 Modern curiosity: novelty, choice, and the wealthy Western eater* | Insect consumption in Western contexts was seen as voluntary experimentation or a lifestyle choice, with novelty, health, and ethics as its drivers. | *RQ1, RQ2* |
| | *3.4.3 Where does the insect consumer live? Geographical primitivism and eccentricity divide* | Environment sorting task; three place-types spatialise the necessity/curiosity binary. The imagined location of the insect consumer shaped whether the practice was seen as a primitive necessity or a modern eccentricity. | *RQ2* |
| | *3.4.4 The combination of the two narratives as a unified perspective* | Across the interviews, two opposing motivational frames were seen: necessity/survival (non-Western, poverty-driven) vs. modern experimentation (novelty, health consciousness, culinary eccentricity); often by the same participants, like both perspectives could coexist in one account. | *RQ1, RQ2* |

**Note.** RQ = Research Question. T = Theme.

## 3.1. Theme 1. Between revulsion and acceptance: how form mediates the disgust boundary

Across the nineteen interviews, participants did not uniformly reject or accept insect consumption. Acceptance of entomophagy was found to be strongly linked by interviewees to the physical form in which insects are served, eliciting a visceral, immediate disgust response that participants described as automatic and beyond rational control. Whole, recognisable insects were described by participants as viscerally disgusting and unacceptable as food; processed, masked, or unrecognisable forms were treated as a different category of food altogether. Theme 1 reports this contrast, beginning with the visceral rejection of recognisable insect anatomy (3.1.1) and turning to the conditions under which willingness to try was offered (3.1.2).

### 3.1.1. Parasites, dirt, and wriggling larvae: the visceral rejection of insects as food (disgust, contamination) [RQ3]

Disgust was the most frequently expressed primary association with entomophagy across the collected data, with the majority of participants linking insects to unhygienic conditions and describing the idea of consumption as highly repulsive.

Participants captured the visceral disgust and used expressions to describe insects as *"something that [I] simply run away from, that I wrap up, that I treat as something unnecessary"*. When explaining their resistance, participants repeatedly associated insects with "*parasites*", "*dirt*" and "*poor hygiene*", and surfaces that "[insects] *are not associated with cleanliness*", suggesting that insects were seen as contamination rather than as a separate food category. One participant recalled a field cricket entering her apartment and the immediate, automatic response: "*It disgusted me*". Several other participants described the same reaction in similar terms of avoidance, "*running away*," and "*resistance*".

> "*Bugs are very often responsible for the decomposition of something... It's accompanied by the fact that we are disgusted by the very act of taking out or touching garbage, and yet they live there...*" [tourism student, F, 22]
>
> "*To me, insects, all these larvae and so on, are associated with flies, with the transmission of germs, with the fact that they are parasites... they collect various toxins... they accumulate various heavy metals.*" [physician, F, 62]
>
> "*If I find walking... a large green earthworm in the lettuce... I won't eat that lettuce, because that earthworm would disgust me*" [landscape architect, F, 41]

The most frequently mentioned visual trigger among participants was the larval form. One of the participants described larvae as "*the worst*", picking out "*white, wriggling*" movement as the source of revulsion. Visual descriptions such as "*white wriggling larvae*" or "*antennae [that] were disgusting*" were key triggers of negative emotions. One interviewee located her disgust in specific anatomical features that pre-empted any further consideration of the food: "*those little legs, those antennae… when I imagine it in my mouth I can't*". One participant pushed this association further into a register of moral pollution, describing insects as "*associated with dirt… with something dirty, impure*".

Two other participants articulated the cognitive dissonance stemming from their disgust. One person described knowing, intellectually, that insects are an efficient protein source while continuing to feel disgust at the idea:

> "*My head understands it's a good protein source, but my stomach says otherwise*" [biologist, F, 31]

Another interviewee proposed an evolutionary explanation to account for the same dissonance:

> "*It's evolutionary… the brain protects us from potential threat*" [PhD candidate, F, 26]

In these examples, participants described the feeling of disgust as something they could not talk themselves out of. Even when they could recognise rationally that insects are nutritious and safe to eat, the bodily reaction of revulsion did not weaken.

This reaction of disgust was not limited to the meal. In several interviews, the vocabulary of contamination was transferred from the insect to the insect-eater. Two participants described insect-eaters as "*dehumanised*", by which they appeared to mean that, in their expressions, eating insects pushed a person outside the boundary of ordinary humanity and closer to an animal or sub-human category. The same words that organised the rejection of the food seemed to be also used to organise the social positioning of the person who would eat it.

#### 3.1.2. If I can't see it, I can eat it: invisibility as the price of acceptance (visibility/form) [RQ1, RQ4]

When asked under what conditions they might try eating insects, participants' responses aligned with a single principle that dominated the narrative in most cases. The insect had to become unrecognisable, as one of them stated:

> "*If it were in bread and I couldn't see it then ok… the problem is with appearance*" [currently unemployed, recent graduate, F, 24]

Across the sample, willingness was conditional on the removal of legible anatomical features such as legs, antennae, wings, and larval shape. Willingness to try insects increased when the form was described as processed, masked, or unrecognisable, thereby eliminating the visual trigger for disgust. It was crucial to avoid these elements, as one participant noted that food would have to be, for example, in a similar form to traditional food, without shells. The food had to resemble something else before it could be eaten. Highly processed forms, such as flour, powders, or chips, were significantly more acceptable. Participants tended to choose three forms in particular: flour, powder, and chips. One participant recommended flour as a market-entry format and explained the visual logic underlying the recommendation in terms that, in the shape of insects she would feel resistance, but:

> "*In the form of a chip… it already looks more familiar and that way the brain sort of doesn't reject it at the start*" [food biotechnologist, F, 37]

Several participants expanded on the visibility principle into a more general claim about marketing and promotion. One described a "*psychological block against eating them in a more natural form*" and suggested insects as an additive in "*protein mixes*". Another pointed to the *carmine dye* example as evidence that invisible insect consumption is already established. She stated, "*People don't know that carmine dye is from insects*". The participant who raised the carmine example was not endorsing this practice; in her own diet, she avoided products containing carmine. The point she was making, and that several other participants echoed, was that the obstacle to eating insects is the visual cue itself rather than

the food: once the insect is no longer recognisable as an insect, the rejection disappears, which is why an industry that wants to introduce insects has typically done so by hiding them.
However, one voice complicated the strict visibility logic, which is worth considering. One interviewee proposed that aesthetic presentation, rather than attempting to conceal it, could lead to acceptance: "*if it were nicely served in a restaurant… with sauce, on a nice plate… maybe*". This formulation did not require invisibility but rather a proper culinary framing. As she implied, a visible insect form in the right context became conceivable as food.
Participants reacted with strong disgust when discussing eating insects in a visible form, and their reactions softened when the conversation shifted to insects in a hidden or processed form. The disgust did not disappear because participants had changed their minds about insects; it weakened because the food they were now being asked to imagine no longer looked or felt like insects to them. This pattern is consistent with the broader observation that acceptance of meat in contemporary food cultures depends on visual and processing distance from the live animal of origin, which is discussed in the Discussion.

### 3.2. Theme 2. Who eats bugs? Constructing the insect consumer as a social category

When the interviews moved from insects as food to people who eat insects, a second layer of the analysis emerged. Participants did not have a single, consistent perception of insect consumers. They seemed to hold two contrasting images, which could appear even within the same interview. In one image, the insect-eaters were found to be admirable; open-minded, ecologically aware and willing to experiment. In the other, they were more prone to being depicted as being poor, primitive, mentally ill or otherwise politically compromised. These two evaluations did not remain separate; participants frequently mapped them onto a political divide between a stereotypical "*progressive*" and a "*traditional*" Pole, and reproduced the same dual structure when given an adjective task. The sections below describe the positive image (3.2.1), the stigmatised image (3.2.2), the political alignment that organised the contrast between them (3.2.3), and the way both images survived the challenges posed by the adjective sorting task (3.2.4).

#### 3.2.1. Brave, curious, and green: the idealised insect-eater (positive identity) [RQ2]

Despite the strong stigma, people who incorporate insects into their diets were described as possessing traits valued in modern, innovative societies, particularly among people with a neutral or favourable attitude towards the concept. When asked to describe the kind of person who would eat insects, participants identified a selection of positive traits. Individuals who consumed insects were frequently characterised by terms such as intelligence and capability. They were often described with positive characteristics associated with innovation and responsibility, characterised as "*brave*", "*open-minded*", willing to "*try new things*", and interested in new solutions or technological advancements. They were also seen as people who are not afraid of new challenges. One participant described the insect consumer as being driven by "*intellectual curiosity*".

> "*These are more environmentally aware people, probably with better knowledge, more educated... non-conformist for sure... knowledge, I think, is key*" [horse riding instructor/psychologist/art therapist, F, 60]

Furthermore, those who integrate insects into their diet may be categorised as progressive non-conformists. In discussions of ethical consumption, adopting entomophagy was often presented as a moral decision or a means to reduce animal suffering in industrial livestock systems. For several

participants, the most compelling argument in favour of insect eating was the ecological one. Insects' consumers were often idealised as being "*more environmentally aware*," motivated by a conscientious effort to mitigate the ecological footprint of traditional cattle farming. This social category seemed to align with modernity and the active pursuit of sustainable alternatives.

> "*At the moment, it seems to me that it's mostly eaten by those who are more aware and who are moving towards a more modern diet... yes, definitely associated with the rise of civilisation*" [horse riding instructor/psychologist/art therapist, F, 60]

A landscape architect linked the ecological perspective to her daily work: "*I work with nature daily... I understand the ecological argument for insects*". In these narratives, the insect-eater was not described as eccentric, but as correctly informed.

A second pattern involved linking the positive image to travel and cosmopolitan exposure. One participant especially linked his openness to having tried crickets "*in Thailand*" and to a more general claim that "*when you travel, you open up to new tastes*". These descriptions presented willingness to eat insects as an example of broader openness to novel experiences, with food being just one aspect.

Across these voices, the positive image of the insect-eater was built on three domains: science (protein, sustainability); ethics (planet, animal welfare); and biographical markers (travel, openness to new experiences). Notably, none of these referred to the insect itself. The positive image of the insect consumer was built almost entirely from social and moral content, as if to praise a familiar set of progressive, environmentally conscious, well-travelled qualities, which were then attached to insect consumption as another expression of that lifestyle.

#### 3.2.2. Different, crazy, poor, or primitive: the stigmatised insect-eater (stigma) [RQ2, RQ3]

However, the same participants produced a contrasting negative image, sometimes within the same paragraph of conversation. Insect eaters were also associated with "*low economic status*" and "*food of inferior kind*". These comments were further reinforced by the emergence of derogatory labels, and insect consumers are characterised as "*crazy*" or "*mentally not well*". In their view, a person who incorporated insects into their diet was someone whose dietary choice reflected a lack of resources, taste, or cognitive capacity.

> "*I think it's a poor, sick person... It's some kind of brain defect in our culture... simply a disease, like a disorder. If someone eats insects,"* [physician, F, 62]

The criticism was sometimes mild, framed as eccentricity, but in other voices it was sharper, framed as economic distress or mental disturbance. One participant recalled her grandfather's unfiltered response to the topic:

> "*Grandpa said it's for starving [the name of inhabitants from regions stereotypically associated with poverty*" [student, M, 21]

In several interviews, derogatory rhetoric gave way to an insulting tone. The insect eater was described as a "*madman*", "*not fit to live in society*", or as someone who was "*carrying some kind of brain*

*impairment*". One participant recounted that he had tried insects during an exotic trip, and his companions reacted negatively: "*Most reactions were like, if not all: 'No, no, get away from me with that*!' and '*you are crazy!"*". This was an individual who reported being the target of the aforementioned stigma ("venom" of disease); in his testimony, the person who consumes it was the object of criticism, not food.
These evaluations (described in points 3.2.1 and 3.2.2) picture the divided perception of the same figure. Several participants used both evaluations within a single interview. The same speaker who described the insect consumer as "*more aware and educated*" later described the same figure as a "*madman*" or a "*sick person*". The two evaluations did not replace one another; they coexisted, and which one came forward seemed to depend on which kind of imaginary insect-eater the question called to mind.

#### 3.2.3. Soy lattes and blue hair: the political anatomy of the entomophage (political anatomy) [RQ2, RQ3]

Across most of the interviews, a pattern was observed in which the two evaluations were organised along a politically charged divide. The social construction of the entomophage has centred on a stereotypical profile that contrasts with traditional values. When asked to imagine a typical Polish insect-eater, several participants offered a near-identical characterisation: someone who is progressive, urban and young, and marked by a small set of consumer signs:

> *"A stereotypical person living in Warsaw who drinks soy lattes, has left-wing views… may have coloured hair, may have some piercings, may engage socially"* [currently unemployed, recent graduate, F, 24]

A young male described how the political factors shaped the public perception of an entomophage and provided examples of the described connotations:

> "*If you say you eat insects, you're immediately a leftist… blue hair and soy latte*" [youth worker, M, 25]

Those who consume insects frequently fell within "*left-wing circles*", and were associated with "*left-wing views*", sometimes being categorised alongside "*feminists, LGBT people, people who like to experiment*". Interviews also showed that the perceived identity of an insect consumer was being linked to "*modern technologies*" and progressive innovation. They are stereotyped as a "*group of young people" (young, definitely), closely associated with "modern technologies*".
Adversaries of insect consumption, by contrast, were described as "*conservative*", "*traditionalist*", and attached to "*typical Polish food*".
Once the entomophage had been placed on the progressive side of the cultural-political spectrum, the positive and negative images stopped looking like contradictions within one person and began to look like two readings of the same figure from opposite political positions. Based on the participants' statements, the entomophage was read as a positive example of openness and ecological awareness from a self-identified progressive position. From a self-identified traditional position, the same figure was read as a deviation from accepted norms.

#### 3.2.4. The adjective sorting task: the attribution of traits to a single food choice [RQ2]

The adjective sorting task produced two key findings that reinforce and refine the previously identified sociocultural patterns. Most participants completed the adjective sorting task without difficulty, which suggests that the same trait clusters they had produced spontaneously in conversation were still available to them when the choice was constrained to a fixed list of sixteen adjectives. The people associated with insect consumption were most often labelled as brave, open-minded, curious, eccentric, and educated, whereas the contrasting figure was labelled conservative, settled, and rooted in tradition. The fact that the same dual image survived the move from open-ended interview talk to a sorting task (where they need to choose adjectives from the closed set) suggests that the positive and stigmatised images of the person who incorporates insects into their diet are not produced on the spot in the interview, but draw on stable cultural schemas that participants can access regardless of the format in which they are asked.

One participant declined to complete the sorting task, stating that the people shown in the photographs were all similar, as they are humans, and she did not want to characterise them on the basis of their appearance. She continued the interview after this refusal. This refusal serves as a counter-narrative to the categorisation work carried out by the other participants. Some of them initially hesitated but performed the task.

Taken together, the sub-themes describe an image of the social representation of the typical insect consumer that participants had built up during the interview along positive, negative and politically coded lines. This figure remained fluid across the interviews. The perception of the person who incorporates insects into their diet was constructed with very little initial guidance and used remarkably consistent vocabulary across this sorting task. At the same time, the construction of that figure was internally divided, with the same speaker often issuing both an idealising and a stigmatising evaluation of the same figure within a single conversation.

### 3.3. Theme 3. The social cost of eating differently: tradition, ostracism, and political contamination

Across the interviews, participants repeatedly returned to a further set of concerns that did not fit into either of those themes: what would happen socially if a Polish person started eating insects, and what eating insects already means in the current Polish public conversation. The third theme groups these concerns. The analysis revealed four obstacles that, in their view, stood between insects and the Polish diet which was the absence of a culinary tradition that would make insect dishes recognisable as food (3.3.1), the expectation that eating insects would attract social judgement from family, neighbours, or colleagues (3.3.2), and the recent uptake of the topic in political and media discourse, which in their accounts had turned insect-eating from a food question into a marker of cultural identity (3.3.3), and the role of media in amplifying these reactions (3.3.4).

#### 3.3.1. We have cows, why would we need bugs? Tradition against change [RQ1, RQ3]

In the present interviews, participants described insect consumption as a traditional and culturally embedded culinary practice in Asian, African, and South American regions. Several of these same participants added that, in their view, the practice in those regions was sometimes a survival response to a lack of other food. When participants talked about insect consumption in a European setting, they typically reframed it as a voluntary "*experiment"*, an "*exotic"* choice, or a modern "*culinary eccentricity"* associated with novelty and tourism. Of all the reasons given by participants for not eating insects, the

most common was the absence of a Polish tradition of doing so. This argument was not related to taste, safety or cost. It was framed in terms of cultural heritage.

> "*We have our traditional food; why would we need insects?*" [horse riding instructor/psychologist/art therapist, female, 60]

As a typical Polish dish, in contrast to foreign cuisine, the example of pork schnitzel (in Polish "*schabowy*") was frequently mentioned. This meat dish was described as more appropriate for Polish customers as it aligns with national tradition. The role of this example was also to emphasise the difference between the nutritious meat dish with a rich taste and one containing unappealing insects.

> "*It's so Polish to say no because no... we don't need it... We have our schabowy [schnitzel]*" [student, M, 21]

The lack of the entomophagy tradition was more than a neutral fact about the Polish diet. It seems that it was also part of how they understood their own social position. The food choice was linked to social status, with insect consumption being seen as a form of "regression". Although status and tradition exist as distinct concepts, participants' testimonies suggest that they reinforce each other. Some participants explicitly articulated this link in terms of class, stating that if a person had achieved a certain level of social standing, meat was considered more appropriate than insects ("*higher social status, we will eat cows*". Consequently, adopting insects into one's diet "*would be a challenge to [current identity and lifestyle]*" and may evoke complex "*ethical issues*". In extreme cases, entomophagy may be perceived as "*something that regresses humans*", effectively reducing the eater to the level of "*primitive humans*". In these accounts, the tradition of not eating insects was also a tradition of not behaving outside of the cultural context.

It was also mentioned that, because of the novelty and the unfavourable characteristics stereotypically associated with insects, it would be especially difficult for elderly and less educated people to accept this kind of food in their diets.

#### 3.3.2. What will people think? The secret eater and the fear of judgement [RQ3, RQ4]

The data reveal that participants conceptualised dietary decisions as potent indicators of group membership and social standing. One interviewee articulated this dynamic by noting that *"food choices, particularly unconventional ones, affect how we are perceived by others"*. Across the dataset, the fear of social exposure and the anticipation of negative evaluation from peers or family served as a reputational scaffolding, leading individuals to either reject entomophagy entirely or retreat into secret, invisible modes of consumption.

> "*If I brought a dish with insects to Christmas Eve dinner, my family would laugh at me*" [currently unemployed, recent graduate, F, 24]

Consequently, entomophagy was framed not merely as a private nutritional act, but as a site of social identity work performed before a public audience. This suggests that the individual eater was situated

within cultural schemas that categorise behaviour along a spectrum ranging from normative acceptance to culinary eccentricity to outright moral deviance.
Participants who expressed a willingness to try insects also often mentioned the social conditions under which they would do so. These conditions were private:

> "*Even if I tried it, I wouldn't tell anyone*" [banking/insurance, F, 41]

If tasting occurred at all, participants said they would keep it hidden from others. Two reasons for this secrecy emerged: the anticipation of mockery from those close to them and the fear of being judged for stepping outside the boundaries of what their family or community recognised as food. Several participants specifically mentioned family gatherings as the setting in which these anticipated judgements would occur.
An interviewee who had actually tasted crickets reported the response he received:

> "*When I told my friends that I had eaten crickets, they said that I was weird*" [student, M, 21]

In the present interviews, anticipated judgment seemed to be treated as a factor in any decision to try food, alongside availability and price.

#### 3.3.3. Political polarisation: bugs, Brussels, and "the culture war" - when food becomes politics [RQ3]

Respondents framed entomophagy as a component of contemporary political discourse and the political interpretation of food. Within the Polish context, the subject has been integrated into broader debates, often serving as a tool to provoke opposition toward the European Union. Those interviewed highlighted that insect consumption has become a "*highly political issue*" locally. Interviewees characterised the media actions as being defined by "*fear-mongering*" and a "*polarisation similar to that surrounding electric cars*". In these narratives, eating insects symbolised deeper fears about perceived risks that environmental rules were being imposed on Poland from outside, that Brussels was overriding Polish food preferences in the name of sustainability, and that Polish dietary tradition was under threat from regulations the participants had not chosen and did not endorse. Several participants described how, in Polish public discourse, entomophagy had moved from the food sphere to the political sphere. A lawyer summarised this shift:

> "*It became political... People started screaming that the EU is forcing us to eat insects*" [lawyer, F, 38]

One interviewee described the politicisation of the debate on eating insects as a deliberate operation:

> "*It was used perfectly by [name of the right-wing Polish party]... Brussels is making us eat insects... people were scared*" [youth worker, M, 25].

The political dimension was depicted as reframing the debate in the context of familiar disputes about Brussels and Polish freedom of choice over what kind of products are put on a plate. Participants positioned themselves in different ways relative to this political framing. One group accepted the framing

and situated insect regulation within a wider narrative of perceived lost sovereignty, in which Brussels was steadily encroaching on Polish life across domains ranging from light bulbs to food; the same participant who articulated this position also voiced a conspiratorial reading of insect-based food as a tool of social control. Another group rejected the political framing as overblown. Two participants dismissed it directly, treating insect-eating solely as a food question rather than a political one and finding the left-right alignment of the topic inaccurate:

> "*It's food, not politics... people worry too much*" [film industry/personal trainer, M, 44]

A third pattern emerged among participants who, while not necessarily endorsing the political narrative, acknowledged its presence as an unavoidable feature of current discourse. This perspective was most clearly articulated by one participant, who conceptualised insect consumption as an explicit identity statement situating the consumer within a specific cultural-political field. He further illustrated this dynamic by describing how his own dietary and lifestyle preferences were interpreted within his household as a form of "*Western decadence*":

> "*Eating insects is a statement... You're saying who you are politically*" [youth worker, M, 25]

Other respondents interpreted this politicisation as a strategic construction by external actors; for instance, one interviewee framed the narrative as a product of right-wing media entities seeking to generate "*scandal*". However, another participant's words seem to challenge the underlying logic, maintaining that EU food regulations are derived from empirical research rather than "*Brussels' whim*". Her interpretation grounded the political debate in scientific legitimacy rather than ideological bias.

#### 3.3.4. How participants spoke about media coverage [RQ2, RQ3]

Across the interviews, national media coverage was seen as amplifying distorted, politically divided sources of bias. They indicated that this was a part of a political diversion at the time. Media coverage came up across several interviews when participants explained why people in Poland might find the idea of eating insects strange. Some participants portrayed the media as reinforcing the EU's "*forced and threatening*" narrative regarding edible insects. Mainstream coverage was described as emphasising the necessity of eating insects through negative portrayals that focused on compulsion, deception, or sensationalised health risks. Two participants pointed to media narratives of being "*forced to eat bugs*" as contributing to public scepticism and to the political polarisation documented separately in Theme 3, Section 3.4.3. A landscape architect made a similar point more calmly: in the media, insect consumption was usually presented as *"something strange"* rather than ordinary food. One participant traced her own initial impression back to television coverage in 2023 that linked the practice to poverty and distant places:

> "*On TV they showed people in Asia eating insects, and it was so strange*" [horse riding instructor/psychologist/art therapist, F, 60]

Notably, she attributed this framing to the images she had been shown (in media) rather than to her own beliefs. Younger participants spoke about social media differently. One person described TikTok content featuring people eating insects and claiming they taste good, in which such behaviour is normalised. Another participant in her twenties described Instagram videos where *"everyone comments 'ew'"*,

recalling the same medium as a place of amplified rejection. These testimonies suggest that the media did not introduce the contrast between necessity and curiosity from the outside, but rather reinforced participants' existing perceptions.

### 3.4. Theme 4. Between necessity and experiment: two stories about why people eat insects [RQ1, RQ2]

Across the interviews, two recurring ways of explaining insect consumption emerged. Insect consumption was either framed as primal and necessary, driven by survival, poverty, or the absence of alternatives, or as it was characterised as modern and voluntary, driven by novelty, health consciousness, ethical concerns, or culinary curiosity and experimentation. Consequently, the same physical practice was given two very different meanings depending on who the insect-eater was assumed to be, where they were assumed to live, and what economic position they were assumed to occupy. The fourth theme contains this contrast and the geographical pattern that anchors it.

#### 3.4.1. Necessity: survival, poverty, and the primitive elsewhere [RQ1, RQ2]

When participants described insect consumption as driven by necessity, they predominantly situated the practice outside Europe, in non-Western regions characterised by limited resources, with Asia and Africa most often named. One participant characterised the populations who consume insects in distinctly developmental terms:

> *"Primitive people who do not have access to food"* [physician, F, 62]

The same framing was evident in the narratives of two other participants, who perceived this practice as rooted in places of resource deprivation rather than choice. Several participants also depicted insects as a last resort food adopted "*out of necessity*" by individuals unable to develop and economically maintain more conventional protein sources.

A second variant drew on agricultural pragmatism rather than poverty and was observed by two participants, who stated that:

> *"It is easier to breed twenty thousand cicadas than one cow"* [currently unemployed, F, 32; programmer/musician, M, 30]

This statement suggests a shift in the understanding of necessity from a moral attribute of the eater to a functional aspect intrinsic to food systems in the context of resource scarcity. A male participant extended the necessity story into a survival setting, describing insect consumption as a "*basic survival skill*" in environments where one "*has to eat what one has*". Across these variants, the necessity narrative left the eater with no real choice and situated the practice at a distance from the everyday Polish kitchen.

#### 3.4.2. Modern curiosity: novelty, choice, and the wealthy Western eater [RQ1, RQ2]

When participants placed the same act of insect-eating in a developed Western context, the language changed. Participants subsequently reinterpreted the phenomenon as voluntary, curious, and identity-related. The insect-eater seemed to no longer be someone with no other option, but someone choosing to try insects out of interest, fashion, or environmental concern. Several commented directly on

the language of curiosity, speaking of "*trying something new*" or "*being open*". The consumption of insects in Europe has been described as an "*experiment*", motivated by "*curiosity*" and "*exploration*", or by an explicit attitudinal stance, "*I like to experiment*", articulated by two further participants. For participants describing wealthier or more progressive consumers, the practice took on additional connotations such as "*culinary eccentricity*" or "*a new fashion*". One participant tied the curiosity narrative to a specific consumer experience in a particular Western city:

> "*In Berlin I bought cricket crisps... they were OK, not great but OK*" [youth worker, M, 25]

This recollection situated the practice in a specific location and transaction, rather than in an abstract concept of progressive "elsewhere".
The other participant presented a particularly interesting point of view:

> *"Why is it called primitive? Two billion people [eat insects]; our culture is a strange one"* [PhD candidate, F, 26]

It seems to question the labelling itself (why is it called primitive) rather than the practice; to point to the numerical mismatch between a global majority of insect-eaters and a non-eating European minority; and to relocate the marker of strangeness from the eater to the ingroup's culture. This was the only participant who explicitly performed this reversal.

#### 3.4.3. Where does the entomophage live? Geographical primitivism and eccentricity divide

Participants not only described who the insect-eater might be, but also where that person was imagined to live. The photographs that participants associated with insect-eaters in the environment sorting task, together with the geographical references they made in the interview, organised insect consumption into three distinct kinds of places. The first were poorer regions of Asia, Africa, and Central or South America, where insect consumption was generally described as a response to a lack of other food. The second were large progressive Western cities (e.g. Berlin, Amsterdam, or a generic "Western European capital"), where insect consumption was described as a deliberate lifestyle choice tied to sustainability and openness. The third was the Polish or Central European countryside, where insect consumption was described as something that simply would not happen and would not be remarked on if it did.
One participant explained that in a highly developed country, individuals tend to be selective in their dietary choices and avoid foods that they consider unpleasant or inedible, whereas in a less developed country, individuals may be more willing to eat whatever is available regardless of personal preference. The aforementioned statement was exemplified by South Sudan, Bangladesh, and Congo. A second participant put the same reasoning more directly:

> "*In Asia, maybe they just don't have a choice and eat it because of poverty. Yes, it stems from poverty*" [programmer/musician, M, 30]

Another participant extended this framing further, using racially derogatory language to contrast African insect-eaters with Europeans, whom she described as occupying "*a higher social status*" and as therefore eating meat rather than insects.

In progressive Western urban settings (e.g. the participants mentioned Amsterdam, Copenhagen, Warsaw's city centre), the identical act was reframed as a voluntary, intellectualised identity statement. Some located the Western insect-eater in cities "*associated with young people and innovations*"; Another participant described the same figure as someone who tries insects "*on the principle of curiosity, as some culinary eccentricity, because when you have the resources and information, you try it*". The third kind of places, Polish or Central European countryside and small towns, across participants who mentioned this topic, got its own characteristics. In short, it could be depicted as neither poor enough to require insects as food, nor cosmopolitan enough to seek them out as a lifestyle choice. When participants who chose these photographs in the environment sorting task were asked to comment on their choice, they described small towns as "quite conservative" places where, as one participant put it, residents would simply not encounter the practice. Another participant added a class dimension, suggesting that established upper-class Europeans ("Old Money") would reject insects precisely because they associated them with "*food for poor people*"; in this account, the same association with poverty that participants attached to the Global South was reactivated within Europe as a fear of social regression.

#### 3.4.4. 3.5.4 The combination of the two narratives as a unified perspective [RQ1, RQ2]

Interestingly, the necessity narrative and the curiosity narrative sometimes seemed not to behave as two independent narratives held by different people. Five participants made this dual co-construction visible by shifting between the two stories within a single interview when asked to describe different hypothetical insect-eaters, based on their surrounding environment. This narrative presents how necessity and curiosity can co-exist.

One voice complicates this picture. One participant framed insect consumption as a matter of inevitability rather than of choice:

> "*It is not a question of if, but when. Humanity has no other choice*" [food biotechnologist, F, 37]

The survival narrative was situated by this participant not in a distant "elsewhere" but in a near future of contemporary Polish culinary practices. Her professional background may explain why she alone seemed to overcome the geographical distance that was present in the other cases.

## 4. Discussion

This study examined the attitudes of Polish adults towards entomophagy and those who practise it. Four themes emerged from the interviews. Across the themes, one pattern was hard to miss: the rejection of insect foods in this sample was not due to a lack of knowledge. Some participants could accurately describe the nutritional or ecological benefits of insects, yet still rejected the idea of eating them. The interviews suggest that disgust, social judgement, identity threat, anticipated social sanction, and political meanings worked alongside. This departs from the dominant narrative in the literature on entomophagy (e.g., Kröger et al., 2022; Mina, Peira & Bonadonna, 2023), which focuses on spreading science-based educational awareness of the benefits of insect-based foods.

### 4.1. From oral to moral, revisited: disgust as a multi-layered boundary mechanism

Participants reacted with revulsion to visible insect features such as legs, antennae, and wings. They were more open to processed, masked or invisible forms. This is consistent with quantitative studies on Polish

samples, which have found that visible insect cues and labelling reduce willingness to taste or consume insect-based foods (Modlinska et al., 2020; Adamczyk et al., 2023). It also fits the broader Western pattern in which acceptance of meat depends on visual and psychological distance from the original animal (Fiddes, 1991). The conventional meat industry hides biological origins behind packaging and processing. The interviews showed a similar condition for accepting insects, their form should disappear first and beyond consideration. The observed tendency for disgust to be elicited by apparent biological signals but mitigated through food processing aligns with the theory of disgust as a phylogenetically preserved mechanism for pathogen avoidance. This system of behavioural defence has been extensively recorded throughout various mammalian species Curtis, de Barra & Aunger, 2011; Oaten, Stevenson & Case, 2009).

In the same narratives, the language of contamination transferred from the insect to the person consuming it. The entomophage was described as "contaminated" by association, vulnerable to losing "human characteristics" and to "dehumanisation". Rozin, Haidt and Fincher (2009) described this shift in their work "From Oral to Moral", in which disgust is presented as an oral defence against contamination, a function that was culturally extended to regulate social and moral behaviour. This fits a broader view of emotions as socially functional (beyond signalling threat). They help mark group boundaries and define who belongs, and disgust towards an out-group can sharpen those boundaries (Keltner & Haidt, 1999). Another work has identified moral disgust as a distinct domain, empirically separable from pathogen-related disgust (Tybur, Lieberman & Griskevicius, 2009). For the purposes of this study, however, the continuity between the two is more analytically relevant than their distinctiveness.

Dual-process theory explains why rational counterarguments may not affect an individual's disgust response. According to this view, thought processes can be divided into two types: a fast, automatic, emotional mode, called System 1, and a slower, more deliberate mode, called System 2. In the case of food rejection, System 1 can function as an alarm response at a gut level. It reacts before a person has time to consider nutritional or ecological factors. Once a food is flagged as threatening or contaminating, this initial reaction can supersede subsequent reasoning (Evans & Stanovich, 2013). The interviews showed this split clearly. Some participants could explain the nutritional and ecological logic of entomophagy, but their visceral refusal remained intact. One person summarised it directly: "*My head understands it, but my stomach says otherwise*".

The interviews provide an additional perspective on this issue. Acceptance was only possible once the insect form had been hidden, powdered, or otherwise processed. In this sense, acceptance was the primary condition that enabled the evaluation process to begin with. Disgust played a role at three distinct levels throughout the narratives. Initially, it was visceral, manifested as gut-level revulsion, and appeared in the used language, such as "*parasites*", "*dirt*", and "*larvae*", as well as in strong reactions to the visibility of insect morphology (Rozin & Fallon, 1987). Following the initial reaction, this aversion became categorical, shifting focus from the food product to the individual consuming it. This shift serves to define who might be considered an appropriate social peer or companion and who might not be. Lastly, the response progressed into a moral domain, where disapproval was expressed through labels such as "*unnatural"*, "*perverse*", and "*unfit for society*". These stages demonstrate how a visceral distaste can evolve into a mechanism for regulating social and moral norms. This evolution can be interpreted as stages in the process by which a non-moral biological preference (such as food avoidance or distaste) was treated as a moral judgement (Rozin, Markwith & Stoess, 1997).

The data reveal an attitude–intention gap regarding entomophagy (Fiebelkorn et al. 2019), in which participants intellectually endorse the practice yet remain reluctant to consume insects. Thus, one can

suggest that the resistance is not due to a lack of information, as participants displayed high levels of knowledge; rather, it may be driven by the moralisation of disgust, which links the food stimulus to the consumer's social identity. This psychological barrier is maintained by attitudinal ambivalence (dual perception of the entomophage), anticipated social sanctions leading to secretive consumption, and an identity threat arising from the perceived conflict between one's dietary self-concept and the cultural prototype of an entomophage.

### 4.2. The entomophage as a moral actor: double construction and the spoiled identity

The analysis of the second theme revealed that perceptions of the entomophage were far from uniform. Instead, participants constructed two competing images that often coexisted within the same narrative. In one representation, the insect consumer was depicted as an admirable figure, described as courageous, inquisitive, progressive, and ecologically responsible. The second, less favourable construction portrayed the entomophage as eccentric, primitive, or a social deviant, a figure associated with lower economic status. This dual perception was further complicated by political dimensions, dividing the entomophage within a broader cultural divide between “soy latte progressive” and those defending Polishness and cultural tradition.

The idealised image identified in the interviews aligns with the experimental research by Hartmann and colleagues (2018), who found that Swiss participants attributed various positive traits to hypothetical insect consumers, such as being environmentally friendly, health-conscious, imaginative, brave and knowledgeable. These participants rated insect consumers more highly than meat eaters, but similarly to vegetarians. The consistency between the two studies suggests that the stereotype may be more universal than Switzerland-specific, but more studies in an international context are needed. However, these findings remain largely speculative, as the original study relied on hypothetical scenarios rather than real-world interviews.

The conditional nature of acceptance shown in the current study also resonates with findings on the power of social influence. Berger and colleagues (2019) demonstrated that both peer and expert opinions significantly influence consumers' evaluation of edible insects, and Berger and Wyss (2020) found that social norms are stronger predictors of willingness to try insects than individual disgust sensitivity. These findings suggest that the boundary of disgust acts as a socially monitored threshold that may shift whenever the cultural context signals that such a dietary violation is permissible.

The present study's findings also reveal that individuals can hold both favourable and pejorative views within the same individual's narrative. Several participants expressed that insect-eaters were both “*more aware and educated*” and “*some kind of madmen*”, and therefore seen as deviant, sometimes delivering these evaluations within minutes of each other. This fluctuation may indicate that the entomophage serves as a projection onto which contradictory cultural and social influences can be interwoven, such as tradition and modernity, ecomodernism and eccentricity, and the development of novel food sources alongside cultural taboos that prevent certain topics from being publicly discussed. This negative, stigmatising perception can be approached through Goffman's (1963) concept of “spoiled identity”, whereby an individual, in the current context, with different food preferences, is judged not only for their personal choices but also for their perceived compromised social status. While Goffman described stigma as a downward unidirectional pressure exerted by the majority on the minority, the current study suggests that certain groups may evoke significantly different perceptions. An insectivore seems to be admired and to carry a spoiled identity at the same time, which, according to other interpretations, might be contradictory. Thus, a sociocultural perception of an insect consumer identity may present a paradox.

Becker's (1963) research provides further clarity, noting that the label “deviance” is applied by those with the power to define social norms. Within this framing, evaluating the person who incorporates insects into their diet served to determine whether an individual belonged to a familiar moral group. Therefore, denying certain foods could be used as part of a social evaluation process (Haidt et al., 1997; Rozin et al., 1997) to determine who could be considered a socially acceptable companion or member of the national community. Food rejection became a way of evaluating others. The strength of this stereotype may also reflect how rarely insect-eaters are actually encountered in Poland. When a group is small and seldom meets in person, it tends to attract distinctive, often negative, attributes, even without strong personal prejudice (Alves, Koch & Unkelbach, 2018).

### 4.3. The moral politics of food: collective narcissism and the defence of Polishness

Interviews provided further perspective on entomophagy within a broader political context. Seven participants connected insect-based foods to a Polish "culture war" and opposition to the European Union. One participant characterised entomophagy as a “*highly political issue*” in Poland, while another compared the public debate to the polarisation surrounding electric cars, both of which were also associated with EU regulations and opposition. Participants described a media environment dominated by “fear-mongering” narratives, in which insect consumption served as a symbol of broader concerns, such as “Brussels-imposed regulations”, perceived restrictions on freedom of choice, and the erosion of traditional Polish dietary identity. Given this political context, it is understandable why standard social-norm intervention strategies (Berger & Wyss, 2020; Stone et al., 2021) may encounter difficulties in Poland. When dietary decisions become a source of conflict over cultural identity, information about the practices of an ostracised group, specifically, urban ecological progressives, may be perceived as a threat. In this case, the insectivorous group was often imagined as urban, ecological, and progressive. For people strongly attached to traditional Polish dietary norms, this framing may increase resistance rather than reduce it.

In order to describe this political layer, the analysis is based on the following two sources. Firstly, research has shown that national collective narcissism, defined as an unrealistic belief in the exceptional greatness of one's own nation, combined with heightened sensitivity to perceived disrespect of the in-group, predicts support for populist movements in Poland and elsewhere (Marchlewska et al., 2018). It is also linked to weaker support for liberal democracy (Marchlewska et al., 2022). It differs from secure national identification, which tends to become active in response to perceived in-group threat (Golec de Zavala & Keenan, 2021).

The symbolic pattern in the interviews was similar to this logic. First of all, Polish food emerged as a source of pride that risked being spoiled by the incorporation of insects. Pork schnitzel was used as a familiar symbol of Polish identity. Individuals who consume insects were occasionally portrayed as agents of foreign or elite-driven cultural intrusion. Nevertheless, this does not mean that collective narcissism was measured in the study. The interviews show a cultural pattern that future research could test more directly. Secondly, the concept of “*gastronationalism*” (DeSoucey, 2010; Ichijo, 2020) refers to the ways in which food production, distribution, and consumption come to symbolise national identity, and how nationalist sentiment can affect food markets. DeSoucey's (2010) analysis of “*foie gras*” in France is particularly relevant to the present case, as it demonstrates how food can become a subject of moral polarisation across national boundaries. More recent studies have demonstrated that gastronationalism does not require centralised governmental policy, but can also emerge through everyday conversations and media discourse (Ichijo, 2020; Wright & Annes, 2013). Polish dishes such as

"*schabowy"*, "*bigos*" and "*pierogi*" are widely recognised as symbols of national culinary heritage (Filipiak-Florkiewicz, Topolska & Florkiewicz, 2021; Suszko, 2025). In a gastronationalist interpretation, the insect was rejected not only as an unpleasant food but also as a symbolic intrusion into a category of food that participants considered integral to group identity. The presence of both contamination-related vocabulary and conservative political framing in the current study is consistent with the broader literature on disgust and conservatism (Inbar, Pizarro & Bloom, 2009; Inbar, Pizarro, Iyer & Haidt, 2012; Terrizzi, Shook & McDaniel, 2013). As this study did not measure dispositional disgust sensitivity or political ideology, it cannot make that claim about this sample. These reactions can also be read through identity process theory, which describes how a threat to the continuity and unique characteristics of a valued identity can trigger a defensive response (Breakwell, 1986). Shared food may also work as a marker of group membership. Eating the same things has been described as a low-cost way of signalling who belongs, especially in groups too large to maintain through close personal bonds (Dunbar, 1998). This idea has recently been extended to food culture, although it has not yet been tested in relation to food acceptance (Roberts & Roberts, 2026). Read this way, rejecting an unfamiliar food may function less as a taste judgement and more as a way of holding on to a shared dietary identity. For example, when insects were presented as an external imposition on Polish cuisine, defending the traditional diet became a means of safeguarding a sense of familiarity and continuity (Giddens, 1991).

### 4.4. Theoretical synthesis - an integrative interpretation: from food disgust to social meaning

The results of our study suggest that insect-based food carries multiple meanings simultaneously. One was visceral disgust. It came up when the participants talked about insects whose bodies were still recognisable, with legs, eyes, and wings, and it softened when they talked about insects that were ground, baked, or hidden inside a familiar product (Rozin & Fallon, 1987; Gmuer et al., 2016). A second meaning was social. Disgust was transferred from the food to the insect eater, who was perceived as strange, primitive, brave, or progressive. The judgment extended beyond the food, affected the individual, and carried a moral element. This connects to two strands of research. Goffman (1963) described how a negative label can attach to a person's perceived characteristics and affect how others view them, a process he termed "*spoiled identity*". Haidt (2007) argued that moral judgements are often driven by fast, intuitive reactions, such as disgust, rather than reasoning alone. Together, they help explain why disgust at a food could turn into a judgment about a kind of person. This is consistent with social categorisation theory (Tajfel & Turner, 1979), which describes how people categorise others into groups, and with evidence that social norms can influence the willingness to try insects alongside disgust sensitivity and other factors (Berger & Wyss, 2020). A third meaning was specifically Polish. Insect eating was filtered through national cuisine, ecological politics, suspicion of EU influence, and anxieties about cultural change. These meanings were not always split between different people. The same speaker could move between them, sometimes within one conversation.

Research on entomophagy has shown that informational interventions targeting nutritional or sensory concerns do not always produce lasting changes in attitudes (Gumussoy et al., 2021; Mina, Peira & Bonadonna, 2023), and disgust remains the main barrier even when people know that insects are safe and nutritious (Kröger et al., 2022). People are exposed to information about protein, sustainability and safety without it changing what they are willing to eat. In the interviews, resistance was rarely about the food itself, but also about how the person incorporating insects into their diet would be seen by others. Several interviewees recognised the benefits of becoming an insectivore and still could not picture the practice for

themselves (one summarised it as "*my head understands it, but my stomach says otherwise*"). This gap between thinking and feeling showed up in three kinds of behaviour. Some refused outright, some said they would only eat insects in secret, and some allowed experimentation on the condition that the insect was invisible, processed, or presented as safe.

Figure 1 brings these three layers together in a simple visual form. It is not a causal model and does not propose a fixed order. It shows the layers as interconnected meanings that emerged together in the interviews, and it lists the behavioural responses that followed: refusal, secrecy, and conditional experimentation. The figure should be read as a qualitative interpretation, not as a tested sequence. The proposed behavioural outcomes, including refusal, secrecy, and conditional experimentation, may therefore be understood as different attempts to resolve the tension of knowing cognitively that something is worthwhile but affectively refusing to engage further.

**Figure 1.** Disgust, social norms, and behavioural outcomes in responses to insect consumption.

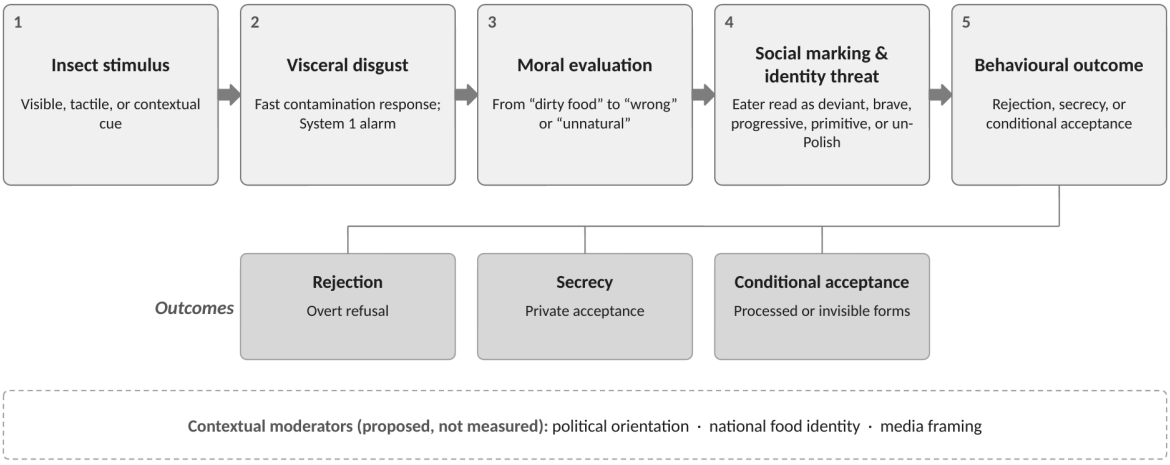


Table 1 summarises the theoretical approaches employed in the analysis and the core mechanisms that were identified, indicating where each approach is anchored in the data. Primarily, it is constructed through qualitative inquiry rather than being constrained by pre-established scales. While frameworks such as dual-attitude models and value-belief-norm theories have been effectively utilised to study the acceptance of insect-based foods, they generally position individual predictors, including food disgust, neophobia, and perceived benefits, as the central explanatory structure.

**Table 1.** Theoretical foundations, core mechanisms, and empirical grounding

| Level of analysis | Theoretical framework | Core mechanism | Empirical grounding in present data |
|---|---|---|---|
| *Neurobiological* | Pathogen disgust (Rozin & Fallon, 1987); amygdala-insula; System 1 processing (Kahneman, 2011; Evans & Stanovich, 2013) | Automatic threat appraisal precedes deliberate evaluation; contaminant logic applied to insect stimuli. | Participants described a gut-level revulsion prior to conscious reasoning; disgust triggered by visual cues (legs, larvae, antennae), independent of stated knowledge/rational views. |
| *Moral normative* | Moral Foundations Theory (Haidt, 2007); the sanctity/degradation domain; the Three-Domain Disgust Scale (Tybur, Lieberman & Griskevicius, | Purity norm violation transforms sensory aversion into normative condemnation. | Entomophagy was described as "*unnatural"* "*a brain defect*", "*not what psychologically healthy people do*"; disgust extended from food to the consumer. |

| | | | |
|---|---|---|---|
| | 2009); the three-function model of disgust (pathogen, sexual and moral) (Tybur, Lieberman, Kurzban & DeScioli, 2013). | | |
| *Social identity* | Social Identity Theory (Tajfel & Turner, 1979); Goffman's stigma framework (1963); Labelling theory of deviance (Becker, 1963); social functions of emotion (Keltner & Haidt, 1999) | Dietary acts and practices become an in-group/out-group signal; a bidirectional perception of the insect-eater's identity. | The insect-eater was perceived in two ways at once: admired and stigmatised; food rejection served as a way of judging who belonged. Research indicated that being depicted as an insect-eater has consequences for social attitudes, influencing perceptions both ways. |
| *Cognitive - ecological* | Attribute-Frequency Model (Alves, Koch & Unkelbach, 2018) | Rarely encountered groups tend to be disproportionately associated with distinctive, often negative attributes, regardless of actual prejudice. | Insect consumers are a rarely encountered group in Poland, and the negative attributed traits (e.g. crazy, primitive, politically deviant) formed a coherent stereotype. |
| *Cultural identity* | Identity Process Theory (Breakwell, 1986); ontological security (Giddens, 1991) | Threat to continuity and self-distinctiveness activates defensive resistance. | *Schabowy* served as a symbol of Polish identity under threat; EU/Green Deal framings were interpreted as attempts to impose an identity. |
| *Evolutionary - social* | Social Brain Hypothesis (Dunbar, 1998); food culture as a bonding mechanism (Roberts & Roberts, 2026). *Roberts & Roberts (2026) propose this mechanism for primate groups (including humans); the model has not yet been empirically tested in a human food-acceptance context.* | Dietary similarity functions as a low-cost social signal in groups too large for grooming-based bonding; rejection of dietary deviance protects group coherence. | Participants' emotional responses to dietary norm violations were consistent with the evolutionary function of food as an identity marker. Political polarisation around entomophagy reflects the high cost to group coherence of crossing dietary boundaries. |
| *Political/national identity* | Collective narcissism (Marchlewska et al., 2018); gastronationalism (DeSoucey, 2010; Ichijo, 2020) | National in-group sensitivity and food-based nationalism turn a novel food into a symbolic threat to the nation. | Insect eating was tied to a Polish "culture war", anti-EU narratives, and the defence of traditional cuisine. |
| *Behavioural* | Theory of Planned Behaviour (Ajzen, 1991); diffusion of innovations (Rogers, 2003); intention–behaviour gap (Sheeran & Webb, 2016) | Social norms can override individual attitudes. Early adopters carry social risk. | Conditional acceptance was restricted to invisible forms; safe tasting contexts increase openness; entomophage recognised as a social taster function (early adapters could carry social risk). |
| *Cognitive architecture* | Dual-process theory (Evans & Stanovich, 2013; Kahneman, 2011) | System 1 affective response operates independently of System 2 rational endorsement and can override it. | Some participants endorsed insects intellectually and rejected them behaviourally; rational arguments failed to override the disgust response. |

**Note.** Theoretical frameworks are cited in their primary sources. The rows are grouped by level of analysis, from more automatic and bodily mechanisms to social, cultural, political, and behavioural ones. This grouping is only a way of organising a large set of frameworks. It is not a tested sequence, and it does not claim that one mechanism comes before or causes another. The qualitative design cannot establish the order in which these mechanisms operate.

## 5. Limitations

This study had some limitations. Most participants were women (15 out of 19) who lived in a big city and had a higher level of education. This profile under-represents older adults, participants from rural areas,

working-class communities, and people from smaller cities. These groups may have different attitudes towards traditional food identity, perceived political influence, and perceived culinary innovation. The gender distribution also limits what can be said about gendered patterns. The study design did not treat gender as a main analytical dimension. If future qualitative work aims to examine whether disgust, identity and political meanings operate differently across genders, targeted recruitment should be used. The sample was also shaped by recruitment conditions. The project had no budget for financial compensation or large-scale promotional activities. This likely limited the number and range of participants. It may also have increased self-selection, because people willing to talk about entomophagy may already have had some interest in the topic.

These limits mean that the study findings cannot be generalised to the wider population. The findings present interpretations from a sample that primarily comprises young, urban, educated adults from a big city. They should be interpreted as theoretically significant rather than empirically representative (Creswell & Poth, 2018). This relatively homogeneous group is also characterised by significant observation. Rejection appeared among people who might otherwise be expected to be open to sustainable food innovations. This suggests that education and urban residence do not automatically remove the moral and political barriers around entomophagy.

## 6. Implications and future directions

The main implication is that entomophagy cannot be normalised through information alone. Nutritional and ecological arguments matter, but they do not necessarily reach the level where rejection is organised. In this study, rejection was traced back to feelings of disgust, social judgment, national food identity and political interpretations. Public communication should therefore avoid presenting insect foods solely as rational sustainability solutions. In the Polish context, strongly ecological or progressive framing may reinforce the perception that insects are part of an urban, elite or externally imposed agenda. For some audiences, this could lead to identity-protective resistance.

Product design also matters. The data support a practical strategy already visible in the literature, which involves reducing visible insect cues. Processed or masked forms of insects do not entirely eliminate disgust, but they can facilitate the initial encounter. This aligns with the sarcophagic logic outlined by Vialles (1994), which suggests that disgust is often managed by controlling appearance rather than addressing the underlying relationship with the animal body.

Future interventions should pay more attention to social transmission, as this is a key factor in the spread of ideas and behaviours. Close interpersonal contexts may matter more than mass media campaigns, especially when a food is morally or politically marked. Familiar people, shared tasting contexts, and trusted local settings may reduce the social cost of experimental behaviour. While this point is consistent with research into social norms and food choice (Berger & Wyss, 2020; Stone et al., 2021), it requires further empirical testing. Future research should also distinguish among the various mechanisms discussed here. Quantitative studies could investigate whether factors such as disgust sensitivity, political ideology, national collective narcissism, food neophobia and perceived social sanction independently predict acceptance of insect-based foods. Qualitative studies could compare urban and rural settings, different age groups, and individuals with varying levels of attachment to traditional Polish cuisine. Experimental work could test whether different framings of insect food reduce or intensify resistance.

## 7. Conclusions

The objective of this study was to provide insights into the perception of individuals who incorporate insects into their diets. The interviews suggest that rejection of insect food is not only a matter of taste or knowledge. The results support the view that they also serve to establish boundaries between what is considered clean and contaminated, normal and deviant, Polish and foreign, and ordinary and politically marked. When the insect was hidden or processed, participants could more easily imagine acceptance. Thus, visibility often determines whether an evaluation can begin at all. At the social level, the person who incorporates insects into their diet was perceived in two ways at once. The figure was admired as brave, aware, logical, and open-minded. The same figure was also stigmatised as strange, primitive, deviant, or politically suspect. This double construction suggests that insect eating can become a test of moral and cultural belonging. At the political level, insect food was sometimes interpreted through anxieties about Brussels (Polishness threatened by the EU), concerns about sustainability, and the loss of a familiar Polish culinary identity. The insect became more than just a novel ingredient. It became a symbol through which participants discussed social change, national cuisine and cultural threats. The study's key contribution is demonstrating how swiftly an unfamiliar food can become the subject of moral evaluation. The core issue identified in this study was not just a lack of public knowledge about entomophagy. Participants in the study were able to identify the core information. Rather, it concerned the fundamental question of whether consuming insects could be integrated into a respected, culturally established identity as an individual, a member of society, and a participant in Polish culinary traditions.

**Authorship contribution statement**

**Author Contributions:** K.G.: Conceptualisation, Data curation, Formal analysis, Investigation, Methodology, Project administration, Gratification for the participants of the study in the form of a photoshoot and pictures delivered after post-production, Visualisation, Writing—original draft, Writing—review & editing. K.M.: Conceptualisation, Methodology, Formal analysis, Supervision, Writing—original draft, Writing—review & editing. W.P.: Supervision, review & editing.

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**Informed Consent Statement:** Informed consent was obtained from all participants involved in the study.

**Data Availability Statement:** The dataset used is currently not publicly available to protect participant privacy and to prevent the dissemination of information that could identify participants and violate privacy regulations and ethical standards governing the protection of personal data.

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