

# **INSECTS AS FOOD. CONSUMERS' ATTITUDE BETWEEN PERCEIVED TASTE, HEALTHINESS AND FOOD NEOPHOBIA**

Luceri Beatrice<sup>1</sup>, Vergura Donata Tania<sup>2</sup>, Zerbini Cristina<sup>3</sup>, Ziccarelli Settimio<sup>4</sup>

## **ABSTRACT**

The aim of the study is to enhance the existing body of knowledge regarding consumer acceptance and interest in insect-based foods. Insect farming represents a sustainable and nutritionally valuable alternative to traditional livestock farming, which has a detrimental impact on the Earth's natural resources and contributes significantly to greenhouse gas emissions. In order to understand which factors drive positive attitudes towards entomophagy and which psychological barriers exert the greatest influence on customer choices a total of 755 responses were collected from Italian consumers. Results revealed that expected taste is the main driver of the increase in desire to eat and intention to purchase the product. Conversely, perceived risk acts as a deterrent to purchase and is negatively influenced by product perceived quality. Finally, food neophobia represents a relevant barrier to experimenting with insect-based products. The results will benefit both marketers and companies, providing insights into the positive and negative factors that may shape consumers' food choices.

## **KEYWORDS**

Insect-based food, sustainability, food neophobia, expected taste, desire to eat

## **INTRODUCTION**

In recent years, the consumption of insects by humans has emerged as a significant topic within discussions on the future of the global food system. This growing interest is fueled by the need for sustainable food production methods that can support the needs of an increasing global population. Insect farming presents an environmentally friendly and nutritionally rich alternative to traditional livestock farming which has a significant environmental footprint. It requires extensive land and water resources and is a major contributor to greenhouse gas emissions, deforestation and loss of biodiversity (Abbasi & Abbasi, 2016; Henchion et al., 2017; Van Huis & Oonincx, 2017). In contrast, insects require less land and water and produce fewer greenhouse gases compared to other livestock (Van Huis, 2020; Van Huis & Oonincx, 2017). For instance, producing one gram of cricket protein requires approximately 23 liters of water, compared to the 112 liters needed for the same amount of beef protein (Miglietta et al., 2015). This stark contrast highlights the potential for insect farming to mitigate some of the environmental effects associated with conventional meat production. According to Van Huis et al. (2013), incorporating

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<sup>1</sup> Dipartimento di Scienze Economiche e Aziendali, Università di Parma. Indirizzo e-mail: [beatrice.luceri@unipr.it](mailto:beatrice.luceri@unipr.it)

<sup>2</sup> Dipartimento di Scienze Economiche e Aziendali, Università di Parma. Indirizzo e-mail: [donatatania.vergura@unipr.it](mailto:donatatania.vergura@unipr.it)

<sup>3</sup> Dipartimento di Scienze Economiche e Aziendali, Università di Parma. Indirizzo e-mail: [cristina.zerbini@unipr.it](mailto:cristina.zerbini@unipr.it)

<sup>4</sup> Dipartimento di Scienze Economiche e Aziendali, Università di Parma. Indirizzo e-mail: [settimio.ziccarelli@unipr.it](mailto:settimio.ziccarelli@unipr.it)

insects into the human diet worldwide, could mitigate many of the environmental problems associated with conventional animal agriculture.

Insect consumption is a common practice for at least 2 billion people across 128 countries globally (Omuse et al., 2024; Tang et al., 2019). In developing countries, edible insects consumption offer significant nutritional, economic, and ecological benefits as compared to that of meat. The crude protein content of edible insects ranges from 40% to 75% (Omuse et al., 2024; Tang et al., 2019), greatly exceeding that of animal (Pereira & Vicente, 2013) and plant sources (Hasnan et al., 2023). It is well documented that 80% of an insect's body weight is edible, which is twice the consumable amount of cattle (Nakagaki & Defoliart, 1991). Additionally, insects are a rich source of essential amino acids, omega-3 and omega-6 fatty acids, iron, zinc, and dietary fiber (Nowakowski et al., 2022). Given their nutritional profile and lower environmental impact, insects represent a viable alternative to meat, promoting the adoption of processes aimed at reducing the environmental impact and enhancing the social and economic well-being of communities.

Although their versatility and nutritional benefits make them a promising component of sustainable diets, the widespread acceptance of insects as food is still limited by cultural perceptions and psychological barriers. Therefore, it is crucial to understand which factors drive positive attitudes towards entomophagy and which psychological barriers like neophobia and disgust mostly impact customer choices. To address these issues, a structured questionnaire was employed to assess the Italian customers' attitude towards insect-based pasta. Participants were asked to observe a product package and to rate the perceived quality, healthiness and expected taste as well as their attitude towards novel foods. This allowed us to evaluate both positive and negative factors which could influence participants perceived product risk and their desire to eat it while assessing how these latter could finally influence their purchase intention.

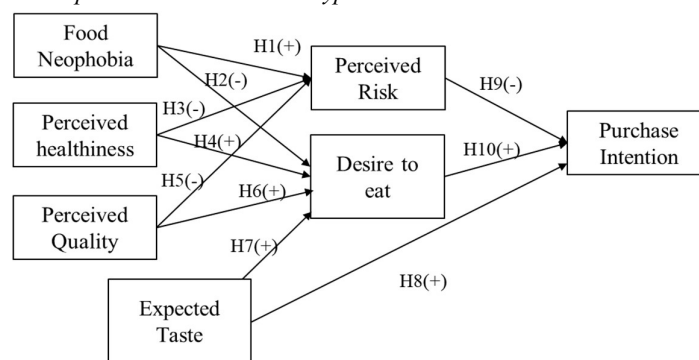
## LITERATURE REVIEW

A recent meta-analysis by Van Dijk and colleagues (2021) indicates that the total global food demand is expected to increase by 35% to 56% between 2010 and 2050. This expected increase poses a significant global challenge, as the resources historically employed for food production are becoming both insufficient and environmentally unsustainable. Conventional farming methods, which heavily rely on significant water and fossil energy consumption (Woods et al., 2010) are responsible for the depletion of the planet's resources on a yearly basis (Carlsen, 2024). This well-known phenomenon is contributing to several environmental issues, including deforestation, water and air pollution, and a decline in soil health (Foley et al., 2011; Tilman et al., 2001). A substantial body of research has consistently demonstrated the long-term unsustainability of continuing with the ongoing farming practices and highlighted the urgent need for more sustainable alternatives to our current methods (Garrett et al., 2013; Searchinger et al., 2019; Steffen et al., 2015). One potential solution to this global challenge could be represented by insect farming. Due to their high reproductive rates, rapid growth cycles, and the possibility to rear them in both urban and rural settings, insects provide a sustainable source of protein that can help diversify and stabilize food supplies, especially in regions vulnerable to food insecurity (Specht et al., 2019; Verner et al., 2021).

The consumption of insects in Europe is not traditionally part of people's diets but it began to increase recently although it is not yet widespread (Mancini et al., 2022; Papastavropoulou et al., 2023). The European Food Safety Authority (EFSA) approved the selling and consumption of

some insect species labeled as “novel food” which were defined on May 15, 1997, by the EU parliament as all food products with no significant history of consumption as of that date in EU and whose safety must be assessed before they can be sold to consumers. This aims to protect consumer health while encouraging innovation in the food sector. Insects are incredibly versatile and can be prepared in numerous ways, such as frying, boiling, or drying and can also be processed into powders or pastes making them suitable for incorporation into a wide variety of foods, from snacks and protein bars to more traditional dishes (Melgar-Lalanne et al., 2019). The present study aims to deepen the existing knowledge on the acceptance and interest of Italian consumers towards edible insects. To this end, an empirical research was conducted to evaluate both positive and negative factors which could influence consumers’ desire to eat and purchase intention towards insect-based products. The conceptual model and related hypotheses (Figure 1) are based on three areas of interest of food consumption: food neophobia, product evaluation, and behavioral intentions. From a structural point of view, the research model is based on a path of causal relations including seven main constructs derived from the relevant literature. The selection was made according to their relevance and expected validity for the purpose of the study. *Food neophobia* is defined as a reluctance to eat unfamiliar foods (Demattè, et al., 2014; Dovey et al., 2008), which causes individuals to instinctively protect themselves from potentially poisonous foods, thus limiting their willingness to experiment with new foods. It is a crucial determinant of food choices, which have great impact on the quality and variety of the individual diet (e.g., Cooke et al., 2003; Galloway et al., 2003; Lafraire et al., 2016; Siegrist et al., 2013). Consumer attitude and evaluation were measured in terms of four key factors: *perceived healthiness*, defined as “an individual’s perception that a specific food product will positively contribute to one’s health” (Iles et al., 2018); *perceived quality*, intended as the consumer’s judgment about a product’s overall excellence or superiority (Anselmsson et al., 2007); *expected taste*, described as a sensory attribute on which people base their product expectation (Furst et al., 1996; Piqueras-Fiszman & Spence, 2015) and as one of the most important factors in affecting willingness to eat insect-based food (Halonen, et al., 2022; Kane & Dermiki, 2021); and *perceived risk*, intended as the subjectively-determined expectation of loss (Mitchell, 1999) and representing the perception of health risks associated with insect consumption (Barbera, et al., 2018; Padulo, et al., 2022). Finally, behavioral intention has been operationalized as the *desire to eat* the insect-based product and the *intention to purchase* it.

Figure 1. Conceptual model and research hypotheses



## METHOD

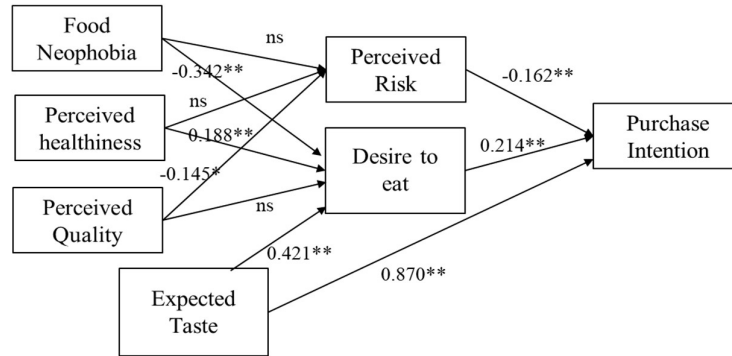
The empirical analysis is based on a structured questionnaire conducted among Italian consumers who do not adhere to a vegan or vegetarian diet. The survey was created using the Google Forms platform and launched in May 2024. The questionnaire was designed around a set of psychometric measures and was distributed via social networks using a snowball sampling technique.

A total of 755 consumers were reached (62% female, 38% male; mean age = 32). Participants were first shown a package of pasta with a claim indicating that the product is made with insect flour. Subsequently, they were asked to answer the questions by referring to the product observed. The seven latent variables were measured using scales that have been well validated in the literature and have been partially adapted to align with the objectives of the study. All statements were presented on a 7-point anchored scale. Specifically, Pliner & Hobden's (1992) scale was used to measure food neophobia. For detecting perceived healthiness and perceived quality the scales developed by Steptoe et al. (1995) and Kulikovski & Agolli (2012), respectively, were employed. Perceived risk was measured through the scale developed by Keh & Pang (2012), while desire to eat through the scale of La Barbera et al. (2020). Finally, expected taste and purchase intention were investigated using the items proposed by Raghunathan et al. (2006) and Van Rompay et al. (2013), respectively. The reliability of the scales was evaluated through the application of the Cronbach's Alpha index, which yielded a value exceeding the minimum threshold of 0.70 for all measured variables. For the analysis of the conceptual model, structural equation modelling (SEM) was performed using the LISREL software (release 8.80).

## RESULTS

The analysis showed that the structural model fits the data well (Satorra-Bentler  $\chi^2=3937.812$ ,  $df=448$ ; RMSEA=0.10,  $p < 0.001$ ; NFI=0.950; NNFI=0.951; CFI= 0.955). Results from path coefficients (Fig. 2) and t-values indicated that perceived healthiness ( $\beta = 0.188$ ,  $p < 0.01$ ) and expected taste ( $\beta = 0.421$ ,  $p < 0.01$ ) are significant drivers of desire to eat insect-based pasta. The latter also exerts a significant influence on purchase intention ( $\beta = 0.870$ ,  $p < 0.01$ ). On the contrary, food neophobia, although it does not increase the risk perception, causes individuals to decrease their interest in eating the product ( $\beta = -0.342$ ,  $p < 0.01$ ). The judgment about the product's overall quality can reduce the perception of health risks associated with insect consumption ( $\beta = -0.145$ ,  $p < 0.05$ ), which in turn negatively affects purchase intention ( $\beta = -0.162$ ,  $p < 0.01$ ). Finally, a direct positive relationship emerged between desire to eat and purchase intention ( $\beta = 0.214$ ,  $p < 0.01$ ). Mediation analysis showed that desire to eat mediates the relationship between expected taste and purchase intention, thereby increasing it (indirect effect: 0.092, CI [0.0596, 0.125]).

Figure 2. Structural model with standardized coefficients



## DISCUSSION

The study aims to contribute to the existing body of research on the cultural and psychological barriers, as well as the drivers that encourage the consumption of insect-based foods. The results showed that expected taste is the main driver of increased desire to eat and purchase intention. Conversely, the perceived risk and food neophobia are relevant barriers to the experimentation with insect-based products.

The findings provide valuable theoretical and managerial insights into potential pathways for further research, highlighting the positive and negative factors that may influence consumer eating choices. Taste expectations play a key role in consumer choice. Communication and launch strategies must, therefore, emphasise the product's characteristics and, above all, exploit taste expectations, possibly by proposing combinations with other dishes/ingredients that are widely accepted and appreciated in the cultural context in question. At the same time, marketing communication can be an effective tool for providing consumers with information that elucidates the characteristics of these products, the absence of health risks and their nutritional benefits. In order to facilitate acceptance and trial, it is therefore necessary to enhance the perception of quality and healthiness in order to increase the desire to eat the product and to mitigate the perception of risk associated with consumption. This applies both to the development of advertising and institutional campaigns (which could take advantage of both nutritional and environmental benefits) and to communication strategies at the point of sale, particularly through packaging, which can convey positive or negative implicit meanings about the product to consumers at the time they are actually deciding in the store (Silayoi and Speece, 2007).

Food neophobia acts as a disincentive to purchase. This is a trait observed in some consumers who are reluctant to experiment with novel or unconventional foods, such as insect-based cuisine in certain cultural contexts. This consumer segment, typified by the term "laggards", may only begin to approach the product under the condition that it is widely available on the market. Conversely, early adopters, who are inclined to experiment, can be the initial recipients of marketing strategies, as well as a crucial channel for word-of-mouth communication and a vital means of expanding market penetration.

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