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The influence of product preparation, familiarity and individual traits on the consumer acceptance of insects as food

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ABSTRACT

Insects are highly valued as food in many cultures but have only recently gained interest in the West as a sustainable alternative to reduce the environmental impact of meat production. Despite the growing consumer interest in insect consumption, there is still a great disparity between curious trying and actual acceptance. The aim of this study was to examine how the product preparation, familiarity and individual traits (e.g. food neophobia) influence the consumer acceptance of insects as food. Dutch consumers (n = 976) evaluated 8 mealworm product images on 4 acceptability measures (product appropriateness, expected sensory-liking, willingness to buy, willingness to try). Product images varied according to mealworm visibility (visible/invisible), carrier flavour (savoury/sweet) and carrier origin (Western/Asian). High product acceptability was not simply achieved by adding mealworms to familiar foods. Acceptability depended very much on the perceived appropriateness of mealworms as food and the perceived appropriateness of the product combination. However, mealworm products were always expected to be inferior to the carrier products, even when visually identical. Familiarity with mealworms and individual traits played a relatively minor role, and influenced the willingness to try more than the other acceptability measures. We conclude that appropriate product design is important but insufficient to achieve consumer acceptance of insects as food in the West. Additional incentives are required to encourage acceptance beyond the mere willingness to try. We discuss the complexities underlying the consumer acceptance of insects as food and reflect on how acceptance might be increased in the future.

1. Introduction

Rapid population growth and rising meat consumption have spurred efforts to improve current food production systems and to develop more sustainable food alternatives (Boland et al., 2012). For this reason, edible insects have gained much attention for their high nutritional value and environmental advantages over meat production (Van-Huis et al., 2013). Their short life cycles, low space requirements, efficient nutrient conversion rates and lower greenhouse gas production render insects to be, in principle, an excellent alternative to meat (van Huis, 2013). Yet even though a large variety of insects are valued as tasty delicacies in many cultures around the world (Bukkens, 1997; Hanboonsong, 2010; Luo, 1997), the vast majority of Western consumers reacts with disgust at the prospect of ingesting creatures that are more familiar as pests than as food (Harris, 1985; Looy, Dunkel, & Wood, 2014). At the moment, many cultural and psychological barriers stand in the way of consumer acceptance of insects as food in Western cultures (Lensvelt & Steenbekkers, 2014; Looy et al., 2014).

Efforts to overcome the disgust towards insect consumption have so far focussed on reasoning away the prejudices. Yet marketing foods on a rational basis usually has limited success. Ethical arguments have proven to be ineffective in persuading consumers to fully accept more sustainable meat alternatives (de Boer, Schösler, & Boersema, 2012). Consumers are generally unwilling to sacrifice the immediate pleasures of the food experience for uncertain and delayed benefits that are not necessarily accrued to the self (Griskevicius, Cantú, & Vugt, 2012; van Trijp & Fischer, 2011). While these arguments have contributed to an increase in interest in insects as food, few Western consumers are actually ready to adopt insects as a food as part of their regular diet (Looy et al., 2014; Tan et al., 2015; Tucker, 2014). The lack of acceptance has often been attributed to the low sensory appeal and unfamiliarity with insects as food (Deroy, Reade, & Spence, 2015;

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Shelomi, 2015; Tan et al., 2015; Tucker, 2014). This highlights the importance of first overcoming existing negative perceptions regarding insect-based foods if consumer acceptance in Western cultures is to be achieved (Looy et al., 2014; Shelomi, 2015). Creating appealing products could thus play a critical role in the acceptance of insects as food (Deroy et al., 2015; Tan et al., 2015).

The starting point for consumer-oriented product development is an understanding of consumer expectations and preferences (van Trijp & Steenkamp, 2005). However, the unfamiliarity with insects as food in Western cultures may pose difficulties for product development, as prior taste experiences are required in order for preferences to be formed (Birch, 1999). Consumers from insect-eating cultures have distinct expectations regarding how insects are appropriately prepared (Chakravorty, Ghosh, & Meyer-Rochow, 2011; Obopile & Seeletso, 2013; Tan et al., 2015). Such expectations are less distinct in cultures where insect consumption is not common (Tan et al., 2015). Several studies have shown that the product preparation affects the willingness to eat insects (Caparros Megido et al., 2014; Hartmann, Shi, Giusto, & Siegrist, 2015; Tan et al., 2015). But to date, consumer expectations and preferences towards different aspects of the product preparation have not been investigated. This study aims to provide actionable insights for the development of insect-based foods by examining how product preparation influences different dimensions of acceptability.

Using familiar preparations has been shown to effectively increase the liking and willingness to eat novel foods (Pelchat & Pliner, 1995; Tuorila, Andersson, Martikainen, & Salovaara, 1998; Wansink, 2002). However, exceptions arise when the combination of ingredients is perceived to be inappropriate (Stallberg-White & Pliner, 1999). This means that ingredients could be liked separately but disliked in combination (Cardello, Schutz, Snow, & Lesher, 2000; Schutz & Martens, 2001). For instance, a qualitative study involving Dutch consumers (Tan et al., 2015) showed that grasshoppers were perceived to be appropriately flavoured with chilli and salt, but inappropriately flavoured with chocolate due to perceived mismatch of sensory properties or mismatch with expectations of insects to be used as meat substitutes. This subsequently impacted the willingness to try and buy the insect-based foods. Apart from the type of preparation, presenting insects invisibly within familiar foods could improve acceptance (Tan et al., 2015), as it has the advantage that the products would not look different from regular foods (Shelomi, 2015). However, in the case of insects, the mere idea of its presence within the food could be perceived as a contamination of the original food and lead to rejection (Rozin & Fallon, 1987). Apart from a previous study that compared insect-based burgers to standard beef burgers (Tan, Fischer, van Trijp, & Stieger, 2016), no other studies have compared the acceptability of insect-based foods to the corresponding insect-free foods. Hence, this study not only examines the influence of appropriateness of the product preparations on acceptability, but also compares the evaluations of insect products to the original products in order to assess their potential alongside existing products on the market.

An individual's familiarity with a food and level of food neophobia are known to be key determinants of acceptance or rejection of various novel foods (Fenko, Backhaus, & van Hoof, 2015; Raudenbush & Frank, 1999; Tuorila, Lähteenmäki, Pohjalainen, & Lotti, 2001) including insects (Hartmann et al., 2015; Verbeke, 2015). Absence of taste experience and higher levels of food neophobia have been consistently linked to lower hedonic ratings and consumption intentions (Raudenbush & Frank, 1999; Tuorila et al., 2001). This may be attributed to the uncertainty and fear of unknown foods (Rozin & Vollmecke, 1986; Tuorila, Meiselman, Bell, Cardello, & Johnson, 1994), as well as misconceived notions about the expected sensory experience when taste experience is absent (Alba & Hutchinson, 1987). In the case of insects, strong negative associations with the origins and nature of the insects tend to be brought up when Western consumers are confronted with insect-based foods (Tan et al., 2015). In addition, socio-demographic characteristics could play a role in consumer acceptance, where younger males have been shown to be more open to unusual foods like insects (de Boer et al., 2012; Hartmann et al., 2015; Verbeke, 2015). Yet consumers who are keen on tasting and have previously tasted insects still express difficulties in accepting insects as food (Tan et al., 2015; Tucker, 2014). Little is known about the importance of these individual-related factors in determining the consumer acceptance of insect-based foods. Hence, this study examines the influence of taste familiarity, food neophobia, and socio-demographic characteristics on various acceptability measures in relation to the product-related factors.

The mixed attitude of interest and disgust that Western consumers exhibit towards insect consumption further adds a layer of complexity to the study of consumer acceptance of insects as food. Many consumers are willing to try despite their negativity, but are unwilling to adopt insects as food even if they recognized their functional benefits and good taste (Tan et al., 2015; Tucker, 2014). Clearly, there is a distance between curious trying and actual acceptance of insects as a regular part of the diet. While this has been highlighted in previous studies (Tan et al., 2015, 2016), the difference between curious trying and product acceptance has not yet been measured. This study thus explores the consumer acceptance of insect-based foods using four different measures of acceptability—(1) perceived appropriateness of the product combination, (2) expected sensory-liking, (3) willingness to buy, and (4) willingness to try. We hypothesize that the perceived appropriateness of the product combination (i.e. insect + carrier product) influences the expected-sensory liking of the insect-based product (Cardello et al., 2000), and these sensory-affective expectations are likely to subsequently affect intentions to consume a food (Mela, 2001). Willingness to buy is often measured when investigating the introduction of novel food products (Solheim & Lawless, 1996) as an indication of how much a consumer values a product (Beneke, Flynn, Greig, & Mukaiwa, 2013), therefore we included it to provide a view of consumer acceptance that goes beyond the mere willingness to try.

This study aims to provide new insights into consumer acceptance of insects as food by examining the role of various product- and individual-related factors on various measures of acceptability. Choosing for a species that is more familiar in the local context and incorporating it in familiar products might be a good way to introduce insects as food in Western cultures (Shelomi, 2015; Tan et al., 2016). Mealworms (*Tenebrio molitor* larvae), which are available for human consumption in Dutch supermarkets, were incorporated in whole and ground forms within carrier products that are also available in Dutch supermarkets, and product images were evaluated.

2. Materials and methods

2.1. Participants

Participants were recruited from a Wageningen University research database (6161 people). A total of 1173 subjects responded to an email asking for Dutch consumers of at least 18 years of age to participate in a consumer study regarding new food products. The survey was completed by 1057 participants, of which 81 vegetarians were excluded from the analysis as some vegetarians may categorically reject meat-based carriers and mealworms based on their meal practices. The remaining 976 participants ranged from 18 to 94 years (M = 44.8 years,