



## Profiling consumers who are ready to adopt insects as a meat substitute in a Western society



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### ABSTRACT

This study investigates the readiness of consumers in a Western society, where traditional meat consumption prevails, to adopt insects as a substitute for meat. Using cross-sectional data ( $n = 368$ ) and binary logistic regression modeling, the study identifies gender, age, familiarity, food neophobia, convenience and environmental food choice motives, as well as meat-related attitudes and future meat consumption intentions as significant predictors. The predicted likelihood of adopting insects as a substitute for meat is 12.8% [95% CI: 6.1–19.4%] for males and 6.3% [95% CI: 2.8–9.9%] for females, other predictor variables held constant at their mean value. People who claim to be familiar with the idea of eating insects have a 2.6 times higher likelihood, and consumers who intend to reduce fresh meat intake are up to 4.5 times more likely to adopt insects. Food neophobia makes the largest contribution to consumers' readiness to adopt insects: a one-unit increase in the food neophobia score is associated with a 84% decrease in the predicted odds of being ready to adopt insects. A stronger convenience orientation in food choice and a higher interest in the environmental impact of food choice increase the likelihood of adopting insects by 75% and 71% per unit increase in these predictors' scores, respectively. By contrast, a one-unit stronger belief that meat is nutritious and healthy, and a one-unit higher importance attached to taste for meat lower the predicted odds by 64% and 61%, respectively. This study reveals that the most likely early adopters of insects as a novel and more sustainable protein source in Western societies are younger males with a weak attachment to meat, who are more open to trying novel foods and interested in the environmental impact of their food choice.

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### Introduction

Entomophagy or the eating of insects has recently received a growing deal of attention as a promising way to cope with some of the major food and nutrition challenges facing the world. A recent report by the Food and Agriculture Organization of the United Nations (FAO) used multiple perspectives – including cultural, economic, ecological, technological, nutritional and legislative ones – to explore the potential of insects in addressing issues of food and feed security (van Huis, 2013; van Huis et al., 2013). The report details the advantages of consuming insects (or insect protein) compared to protein from livestock production and found insects compared favorably in terms of feed conversion efficiency, greenhouse gas and ammonia emissions, water use, animal welfare and zoonotic infection risk. However, the report acknowledges that “despite these benefits, consumer acceptance remains one of the

largest barriers to the adoption of insects as viable sources of protein in many Western countries” (van Huis et al., 2013: 59).

The objective of the present study is to profile consumers who claim to be ready or willing to eat insects. The study was conducted in Flanders, Belgium: a ‘typical’ Western society where traditional meat consumption prevails and the adoption of insects as a foodstuff is regarded with a great degree of skepticism and disgust (Vanhonacker, Van Loo, Gellynck, & Verbeke, 2013). A few years ago, Verkerk, Tramper, van Trijp, and Martens (2007) highlighted the lack of consumer acceptance of insect protein, especially in the Western or industrialized world, as a major issue that needed to be investigated in order to successfully bring this novel protein source to the market and prevent initial rejection by consumers. While discussing the sources of Westerners' negative attitudes, their aversion toward terrestrial invertebrates and its consequences for global food availability, sustainability and cross-cultural relationships, Looy, Dunkel, and Wood (2014) called for more social sciences research about insect eating. A couple of recent studies reported that in cultures where insects are traditionally eaten consumption is now in decline, e.g. in Botswana (Obopile

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& Seeletso, 2013), in India (Chakravorty, Ghosh, & Meyer-Rochow, 2013; Meyer-Rochow & Chakravorty, 2013), or in Cameroon (Sneyd, 2013). Among the reasons identified for this decline are an increasing westernization of local diets in traditional communities (Chakravorty et al., 2013), dietary change towards cheaper imported and refined foods (Sneyd, 2013), and the long-standing image of insect-eating as a “primitive peoples’ practice” (Costa-Neto, 2003). Hence, any study into Western consumers’ attitudes and intentions towards entomophagy has implications that extend beyond the potential for developing alternative protein food markets in Western countries (DeFoliart, 1999).

As yet, little data are available about the eating of insects in Europe (Rumpold & Schlüter, 2013) and there have been few studies that address consumers’ perception of and readiness to adopt insects in their diet. Schösler, de Boer, and Boersema (2012) investigated consumer readiness to adopt several types of meat substitutes in the Netherlands, including dishes with fried mealworms or locusts and fictive pizza containing protein derived from insects. Meat substitutes with visible insects were rated much more negatively compared to other options in terms of their attractiveness and likelihood of preparing them. The pizza with processed insect protein was rated somewhat more positively, especially by younger people (Schösler et al., 2012). Vanhonacker et al. (2013) reported that consumers in Flanders (Belgium) demonstrated a very low willingness to consume insects and concluded that adopting insect protein was generally perceived as a rather unrealistic, unacceptable and ineffective way to improve dietary sustainability. Consumers who, due to their self-reported awareness of, and readiness to reduce their ecological footprint, might have been assumed to be more amenable to consuming insects, were just as averse as the wider population when asked about their readiness to eat insects. In another study, de Boer, Schösler, and Boersema (2013) found that of snacks based on environmentally-friendly proteins, such as hybrid meat, lentils, beans, and seaweed, the insect-based snack (made from locusts) was the least popular. The idea of an insect-based snack was preferred by only 4% of the study participants (in the Netherlands), while 79% of them flagged it as the snack they would least like to taste. By contrast, the sensory study by Megido et al. (2014) showed that insect tasting was well accepted among consumers with an a priori interest in insects in Belgium.

Despite most of these findings which show a clear reluctance among Western consumers to include insects in their diet, there are indications of the presence of a nucleus of some kind of market for insects or insect protein in Western countries (United Nations News Centre, 2013). For example, an increasing number of restaurants now serve insects as a delicacy and more insect cookery books become available (Verkerk et al., 2007). Equally, insect-based recipes are being featured more regularly on late night television shows and there are dedicated insect food festivals (Cunningham & Marcason, 2001). The findings of Schösler et al. (2012) about consumer reactions towards chocolate-coated locusts and pizza with insect protein suggest that there may be opportunities to present insects as a delicacy or as an ingredient in convenience foods. In the study of Vanhonacker et al. (2013), about 13% of participants claimed to be neutral towards the idea of consuming insects, while 5% said that they were willing or very willing to eat insects. In advance of a clear standpoint and harmonization at European level of the status of insects (which are expected to fall under the European Union (EU) novel foods Regulation (EC) 258/97 as foods not consumed to a significant degree in the EU before 15 May 1997), the Belgian Food Safety Authority (FAVV-AFSCA) authorized the production and trade of ten insect species for human consumption from the end of December 2013, as confirmed in its circular published in May 2014 (FAVV., 2014). While such a development officially paves the way for the industrial mass

production and consumption of insects, a great deal of work remains to be done in order to improve consumer acceptance (Rumpold & Schlüter, 2013). Profiling consumers who are ready (or not) to adopt insects in their diet might be a first step towards a better understanding of consumers’ reactions towards eating insects and their future marketplace acceptance.

The present study frames the readiness to eat insects in relation to meat, since insects or insect proteins are generally positioned as an alternative to meat as the traditional animal based protein source in Western countries. ‘Excessive’ meat production and consumption have been increasingly criticized for their potential negative impact on the natural environment (de Vries & de Boer, 2010; Odegard & van der Voet, 2014) and human health (Micha, Michas, Lajous, & Mozaffarian, 2013), as exemplified in the recent Meat Atlas published by Friends of the Earth Europe (2014). Compared to meat, insects are referred to as a more resource-efficient food source (Odegard & van der Voet, 2014) and as a foodstuff that qualifies much more favorably in terms of diverse sustainability rankings (Vinnari & Tapio, 2012). Nevertheless, meat is still highly valued by consumers for its nutritional value (Van Wezemael, Caputo, Nayga, Chryssochoidis, & Verbeke, 2014), taste and other sensory aspects (Verbeke, Perez-Cueto, de Barcellos, Krystallis, & Grunert, 2010). Meat is viewed as a nutritious and healthy food that is part of a varied diet (McAfee et al., 2010; Pereira & Vicente, 2013) and an important component of the traditional Western meal (Scholderer, Kügler, Olsen, & Verbeke, 2013). In line with this we can expect that the likelihood of adopting insects as a substitute for meat will be higher among people with higher levels of importance attached to the environmental impact of their food choice, health orientation in food choice and, in line with de Boer et al. (2013) among people who are more oriented towards convenience food. By contrast, the likelihood of adopting insects as a foodstuff is expected to be lower among those who have a stronger focus on the taste or sensory satisfaction acquired from meat consumption and those with a stronger belief that meat is nutritious and healthy. In addition, food neophobia (aversion to new foods) and, maybe to a lesser extent food technology neophobia are expected to lower the likelihood of being ready to adopt insects (Megido et al., 2014). Both attitudes are personal traits that relate to the extent to which consumers accept new or unusual products (Pliner & Hobden, 1992) or products produced using unfamiliar or unknown technologies (Cox & Evans, 2008), which is clearly the case for insects in Western societies. Furthermore, familiarity with the idea of eating insects and the intention to reduce meat consumption are both expected to increase the likelihood of adopting insects as a meat substitute. Familiarity has frequently been shown to be an important driver of food choice in general, and a significant determinant of the decision to replace meat by meat substitutes in particular (Hoek et al., 2011).

No specific hypotheses are set forth with respect to possible effects of socio-demographics such as gender, age and education. Some of these factors have been shown to be associated with food neophobia (e.g. Siegrist, Hartmann, & Keller, 2013), meat consumption (Verbeke et al., 2010) or readiness to adopt meat substitutes in general (Hoek et al., 2011) and insects in particular (Schösler et al., 2012), so the effects of these factors are controlled for during the analysis.

## Materials and methods

### Data collection and sample

Cross-sectional data were collected from a representative sample of 368 meat consumers in Flanders, Belgium during December

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