



Combining product attributes with recommendation and shopping location attributes to assess consumer preferences for insect-based food products



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ABSTRACT

Because edible insects provide nutritional and environmental benefits, there is a focus on establishing and optimizing the insect production sector and developing the value chain. However, little is known about consumers' reactions to insects as food. This paper provides a first insight into consumers' preferences for termite-based food products (TBFPs) using data from a choice experiment survey in Kenya. A novel feature of this paper is that it investigates the combined effects of product-related and contextual attributes, as well as consumer attitudes on preferences for TBFPs. In addition, the paper focuses on the extent to which preferences may be affected depending on the meal formats, i.e. whether the termites are introduced either as whole insects or as a processed component in a typical daily meal. The results suggest that consumers prefer TBFPs with high nutritional value and especially when they are recommended by officials. Results further indicate that affirmative recommendations are particularly important for the processed TBFP, and consumers prefer to buy this type of product in kiosks or supermarkets than at local marketplaces. Despite a considerable degree of preference heterogeneity, most consumers react positively to whole as well as processed termites. Therefore, the introduction of TBFPs is likely to succeed regardless of whether the termites are processed or not, although introducing the processed product may require further information and quality assurances to alleviate perceived food risks.

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1. Introduction

Despite edible insects have only recently been embraced as a potentially valuable future source of food (FAO, 2013), they are traditionally eaten in some cultures mainly in developing countries (Food, 2010; Ramos-Elorduy, 1997). For instance, insect species such as Lake flies, termites, black ants, and grasshoppers have traditionally been consumed in western Kenya, (Ayieko, Ndong'a, & Tamale, 2010; Ayieko & Oriaro, 2008; Christensen et al., 2006; Kinyuru, Kenji, Muhoho, & Ayieko, 2011). A large body of literature (see FAO, 2013) has documented that edible insects contain

important nutrients such as protein, vitamins and minerals which are essential for human consumption (DeFoliart, 1989; van Huis, 2013). Notwithstanding the decline in consumption of edible insects as people move to urban areas, the insects consumed in western Kenya contribute to the nutritional requirement of the rural communities (Ayieko et al., 2010; Kinyuru, Kenji, Njoroge, & Ayieko, 2009). However, the insects are typically collected from harvesting in the wild (Ayieko, 2013; van Huis, 2013) and they are eaten either raw or sun-dried and fried once their wings are removed (Kinyuru, Kenji, & Njoroge, 2009). These practices are traditional and the insects are not part of the conventional food chain. As a result, little is known about their role in terms of their contribution as food (van Huis, 2003).

In line with this, little is known about consumer responses to insects as food. Consumers' views on food acceptance and preferences for their specific attributes are crucial as a successful food product development depends on consumers' judgment (Brown & Eisenhardt, 1995; van Kleef, van Trijp, & Luning, 2005). Few studies focusing on the acceptance of insects as food have emerged

Abbreviations: AIC, Akaike's Information Criteria; ASC, Alternative Specific Constant; BIC, Bayesian Information Criteria; CAIC, corrected-AIC; CE, choice experiment; FNS, Food Neophobia Scale; KShs, Kenyan Shillings; LCM, latent class model; LL, log-likelihood; MNL, multinomial logit; PCA, principal component analysis; RPL, random parameter logit; RUT, random utility theory; TBFPs, termite-based food products; TP, termite powder; WTFS, whole termites fried and salted.

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(Hartmann, Shi, Giusto, & Siegrist, 2015; Megido et al., 2014; Tan, Fischer, van Trijp, & Stieger, 2016; Tan et al., 2015; Verbeke, 2015). However, these studies focused mainly on meal formulations and sensory liking rather than on consumer preferences for specific product characteristics. Focusing specifically on this aspect, this paper strives to give a first insight into the consumer preferences for TBFPs based on a study conducted in Kenya. The focus on termites was partly motivated by focus group discussions which indicated that termites are relatively popular among participants. And these insects contain protein and other important nutrients that can help reduce nutritional deficiency if they are directly consumed as food or if they are used to enrich low protein foods such as maize and sorghum (Kinyuru et al., 2013). As a result, gathering information regarding consumer behavioral responses in relation to termites as food would guide future policy interventions aimed at developing consumer-driven products.

Information on consumer preferences for food products can be collected using various approaches ranging from survey-based to experimental-based approaches. The choice experiment (CE) method is a widely applied approach (see e.g. Jaeger & Rose, 2008; Rousseau, 2015), which is often used for development of new products. We thus use this method to investigate the importance of specific attributes in determining consumer choices of the TBFPs. This is in line with the fact that the CE method is specifically suited for empirically investigating the effects of the various product characteristics of a good on consumer choice behavior related to that good.

This study has three main contributions to the consumer and food preferences research. First, in the CE design we include *recommendation* and *shopping location* attributes in addition to product-related attributes, i.e. nutritional value and food safety. This is to acknowledge the fact that food choice is determined not only by factors related to a product but also by other contextual factors (Jaeger, 2006; Jaeger & Rose, 2008; King, Weber, Meiselman, & Lv, 2004; Köster, 2009; Stroebele & De Castro, 2004). The *recommendation* attribute is included since consumers often seek advice and recommendations from others when looking for information about new products. Thus, recommendations are likely to influence consumers' responses to novel food products. Although previous works investigated the impact of providing verbal information on acceptance of unfamiliar foods (e.g. Tuorila, Meiselman, Cardello, & Leshner, 1998), the aspect of recommendation is not explored in novel food research except in the marketing discipline (e.g. Chen, Wang, & Xie, 2011; Trusov, Bucklin, & Pauwels, 2009) even if it is not treated as an attribute in a CE setting. Therefore, in this paper, we aim to contribute to the novel food consumer research by investigating the relative importance of recommendation in determining preferences for TBFPs. The inclusion of the *shopping location* attribute is guided by the fact that there are currently no TBFPs available in Kenyan shops and supermarkets. These outlets are however relevant to consider in relation to a possible wide-scale introduction and commercialization of TBFPs in Kenya. And since shopping location has previously been found to impact food choices (Grunert, 1997; Martínez, Mollá-Bauzá, Gomis, & Poveda, 2006; Ubilava & Foster, 2009), this attribute is considered potentially important in the current setting as well.

Previous studies found that meal formats (Elzerman, Hoek, van Boekel, & Luning, 2011; Schösler, Boer, & Boersema, 2012) and familiarity with food products (Hartmann et al., 2015; Tuorila, Lähteenmäki, Pohjalainen, & Lotti, 2001) influence preferences for novel food products. For instance, Schösler et al. (2012) found that respondents rated pizza with processed insect protein better than the visible chocolate coated locusts suggesting that the way the insect-based products are presented would influence consumer preferences. However, evidence is scanty in terms of relating these aspects to consumer preferences for specific attributes of the food

in question. To shed light on this, the second main contribution of this paper is to investigate how the termites could be presented and introduced in a typical daily meal to increase consumer acceptance in an African context. Therefore, we identified two TBFPs and used photo representations to display them to respondents. One product was whole termites, fried and salted (WTFS) and the other product was termite powder (TP). Both TBFPs were presented with Ugali (stiff porridge) which is a staple food in Kenya and is made from either maize or sorghum. The TP was presented as mixed into the Ugali while the WTFS was served on the side of it. While these products are new and not currently part of the food chain in Kenya, our focus group discussions revealed that most people had tasted whole termites when they were young. This suggested that respondents would not be totally unfamiliar with the TBFPs, though the TP product would be completely new to them. This would likely reduce the level of uncertainty related to the new food products which, according to Hoeffler (2003), should thereby enable consumers to better relate the attributes of the TBFPs to their preferences.

Given that edible insects are not currently part of the conventional food chain in Kenya and most other African countries, (re-) considering them as food will be new for most consumers. Thus, it is obviously necessary to address potential food neophobia if aiming to bring edible insects into the food chain. Several studies have explored the influence of consumers' attitudes and the traits of food neophobia on food choice in a western country context (e.g. Hartmann & Siegrist, 2016; Hartmann et al., 2015; King, Meiselman, & Henriques, 2008; Pliner & Hobden, 1992; Ruby, Rozin, & Chan, 2015; Tuorila et al., 2001; Verbeke, 2005). To our knowledge, this has not yet been investigated in an African context. The third main contribution of this paper is thus to investigate attitudinal statements regarding the use of edible insects as food while also addressing food neophobia through the use of a modified Food Neophobia Scale (FNS) (Pliner & Hobden, 1992). In line with Bechtold and Abdulai (2014), we furthermore contribute to the literature by combining the behavioral information obtained in the attitudinal and food neophobia questions with the preference information elicited through the CE.

2. Methods

2.1. Choice experiments

CEs are questionnaire based surveys, interviewing respondents to learn about their preferences for attributes (e.g. origin, brand, fat content, taste) of products such as food products. Specifically, respondents are asked to make choices between experimentally designed alternatives explained by attribute levels describing the food products. CEs are increasingly used to assess consumer choice behavior in food preference studies (see e.g. Denver & Jensen, 2014; Jaeger & Rose, 2008; Rousseau, 2015). This is tied to the fact that CEs have some desirable properties: 1) products are described in terms of their attribute characteristics (Lancaster, 1996) which enables estimation of preferences for each attribute, 2) choice scenarios can be presented in a way that resembles the decision-making settings in real markets (Adamowicz, Boxall, Williams, & Louviere, 1998), and 3) the random utility theory (RUT) (McFadden, 1986) provides a behaviorally plausible theoretical framework for modelling individuals' choices probabilistically based on observable as well as unobservable utility components.

While observations of actual market behavior are always preferable when investigating individuals' preferences, CEs are often employed to elicit preferences for product attributes since real market data is naturally unavailable for new products (Grisolía, López, & Ortúzar, 2012; Jaeger & Rose, 2008; Mark & Swait, 2004). Since suitable market data for TBFPs in Kenya is

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