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Effects of the degree of processing of insect ingredients in snacks on expected emotional experiences and willingness to eat

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ABSTRACT

This study explored willingness to eat and the negative and positive emotional expectations that people from a Western country may have toward the consumption of insect snacks. The snacks, which were presented as pictures in an online survey, differed in their degree of processing of the insect ingredient: tortilla chips made of cricket flour ("flour"), tortilla chips containing deep-fried cricket bits ("bits"), a snack consisting of tortilla chips and deep-fried crickets ("mix"), and deep-fried crickets ("crickets"). Swiss respondents (N = 428) made 39 emotional evaluations, rated willingness to eat and expected liking of the presented products. Each participant evaluated the same non-insect-containing snack (within-subjects design) and one of four insect-containing snacks (between-subjects design). Results showed that the insect snacks evoked various negative emotional expectations that went beyond expectations of disgust. Positive emotional expectations were less expected to occur. Furthermore, expectations related to *disgust/uneasiness*, *inertia/dissatisfaction*, and *positive emotional evaluations* were significant predictors of willingness to eat. The degree of processing of the insect ingredient partly influenced the ratings, with the "mix" product being assessed more negatively than the "flour" or "bits" products. The "cricket" product was rated more positive than expected.

The research indicates that in the development and marketing of insect food, efforts should be undertaken not only to eliminate initial negative expectations of disgust and dissatisfaction but also to generate positive emotional expectations. We suggest the marketing of snacks containing processed insect ingredients will be more promising, and selling whole insects alone is more preferable to selling a mixed snack. Regardless of the degree of processing of the insect ingredient, the results suggest that marketing activities must contend with a large emotional barrier.

1. Introduction

The idea of insects as food is growing because it promises several advantages for health, the environment, and people's livelihoods (van Huis et al., 2013). In several Western countries, products that contain insects are considered novel, and Westerners often respond to insects as food with disgust[1] (Looy & Wood, 2006; Tan et al., 2015; van Huis et al., 2013) and a low willingness to eat (WTE; Hartmann, Shi, Giusto, & Siegrist, 2015; Schösler, de Boer, & Boersema, 2012). Research on insect food has reported that more investigations on insect-containing products are needed to identify those products that have a higher acceptance (Tan et al., 2015). The burgeoning research on emotional reactions to food has, however, revealed that assessing a large number of emotional responses may be more informative than assessing acceptance alone (King & Meiselman, 2010; Ng, Chaya, & Hort, 2013a; Spinelli, Masi, Dinnella, Zoboli, & Monteleone, 2014). In addition, researchers on food-related emotions have emphasized the additional value of considering emotional assessments in new product development and marketing (Jiang, King, & Prinyawiwatkul, 2014; King & Meiselman, 2010). Because existing studies on insect food restricted emotional assessments to a small number of emotions (e.g. Looy & Wood, 2006), the present study thoroughly explored the emotional expectations that people from a Western country may have towards

Abbreviations: G-FEE-List, German Food-related Emotional Evaluation List; ANOVA, analysis of variance; MANOVA, multivariate analysis of variance; WTE, willingness to eat.

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[1] Because there are two meanings of the English term *disgust* (Disgust, 2015), note that, in the present article, we use the term *disgust/disgusted* interchangeably with *sickened* or *grossed out* rather than to signify a feeling of annoyance and anger.

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the consumption of insect snacks varying in the degree of processing of the insect ingredient. In addition, we explored the influence of emotional expectations on WTE and compared the ratings of the insect snacks to a well-established snack to estimate market success.

1.1. Insects as human food and Western consumers' reactions

The eating of insects is called "entomophagy" (van Huis et al., 2013). Human entomophagy is practiced by an estimated 2 billion people around the globe (van Huis et al., 2013), such as in Africa, Asia, and America (Ramos-Elorduy, 1997; van Huis et al., 2013). Delicacies range from ants, bees, beetles, and butterflies to grasshoppers and crickets (Ramos-Elorduy, 1997; Tan et al., 2015) and are prepared in various ways (Chen, Feng, & Chen, 2009; Tan et al., 2015). Due to present and future challenges in food sustainability, insects as food and feed have been discussed and promoted among scientists for several decades (Belluco et al., 2013; Deroy, Reade, & Spence, 2015; Ramos-Elorduy, 1997; van Huis et al., 2013; Vane-Wright, 1991; Verkerk, Tramper, van Trijp, & Martens, 2007; Yen, 2009). More recently, insects as food are also a common topic in the media.[2] It is estimated that the global population will increase to 9.1 billion by 2050. This population increase will be accompanied by urbanization and rising incomes that require changes in the food supply, such as a massive increase of an estimated 200 million tons in meat production (Food and Agriculture Organization of the United Nations, 2009). Therefore, interest in alternative protein sources such as insects (Verkerk et al., 2007) is high. However, Westerners regard eating insects as primitive behavior (Hartmann et al., 2015; Ramos-Elorduy, 1997; Vane-Wright, 1991), and the conscious consumption of insects as part of a daily diet is not yet well established in Western societies (Deroy et al., 2015; Pascucci & de-Magistris, 2013; van Huis et al., 2013).

Westerners' reactions toward insect food and the factors that influence such reactions have been probed within diverse disciplines, especially in the last few years, revealing that Western consumers have a rather negative perception of insect products. Several authors have specifically explored Westerners' assessments of insect products as a meat/protein substitute or in comparison to their ratings for alternatives (de Boer, Schösler, & Boersema, 2013; Schösler et al., 2012; Vanhonacker, Van Loo, Gellynck, & Verbeke, 2013; Verbeke, 2015). WTE insect-containing products, either as meat substitutes or in general, was rather low (Hartmann et al., 2015; Vanhonacker et al., 2013; Verbeke, 2015). However, Westerners' evaluations were shown to be strongly dependent on the visibility of the insect ingredient (Hartmann et al., 2015; Schösler et al., 2012; Tan et al., 2015). Compared to products that contain unprocessed, more visible insect ingredients (e.g., a snack made of deep-fried crickets), WTE and the reported attractiveness of insect products were higher if the insect ingredient was highly processed and therefore less visible (e.g., cookies containing cricket flour; Hartmann et al., 2015; Schösler et al., 2012). Further studies on different types of insect products are necessary to identify those products that improve acceptance amongst potentially new consumers (Tan et al., 2015). Because the survival rate of general new products is small (Stewart-Knox & Mitchell, 2003; Thomson, 2010) and new alternatives to traditional market success predictors such as acceptance (liking) ratings are needed (Thomson, 2010), research on insect food-related emotional experiences may be useful to guide product development.

1.2. Emotions in food research

Research on emotions is relatively new in the sensory science field. Although emotion research in general has a long history (Kroeber-Riel, Weinberg, & Gröppel-Klein, 2009), there is no consensus on the definition of the term "emotion" (Brandstätter, Schüler, Puca, & Lozo, 2013; Kleinginna & Kleinginna, 1981; Scherer, 2005). The applied emotion theory is one determinant out of many that influences the characterization of an emotion (Coppin & Sander, 2016). In a recent overview, Coppin and Sander (2016) describe three main theories of emotions. First, the basic emotion theory was especially developed from an evolutionary viewpoint and assumes that there exists a small number of basic emotions (Coppin & Sander, 2016). An emotion that is identified by several authors as a basic emotion is disgust (Ortony & Turner, 1990). Basic emotions contribute to the survival and well-being of human beings (Matsumoto & Ekman, 2009). According to Ekman (1994), emotions can be identified as basic if they exhibit several specific characteristics, including a brief duration or the presence in other primates (see also Coppin & Sander, 2016). Second, dimensional theories assume that feelings can be represented by several underlying dimensions (Coppin & Sander, 2016). As a prominent example, Russell (1980) presented a bidimensional model that proposes a circumplex organization of emotions with two underlying dimensions. These dimensions were named sleepiness/arousal and displeasure/pleasure (see also Coppin & Sander, 2016). Appraisal theories assume that the evaluation of an event is required to evoke an emotion (Scherer, 2005) and that the number of emotions is not restricted to a small number of "basic" emotions (Coppin & Sander, 2016). These three main theories have in common that they all agree on characterizing emotions as a multicomponent phenomenon (Coppin & Sander, 2016). The multicomponent approach is widely accepted among researchers (Scherer, 2005). According to Scherer's (2005) description, an emotion is composed of the following elements: 1) cognitive component (appraisal); 2) motivational component (action tendencies); 3) neurophysiological component (bodily symptoms); 4) motor expression component (facial and vocal expression); and 5) subjective feeling component (emotional experience). Along with the multicomponent nature of an emotion, emotions can be assessed by various instruments of measurement that can be categorized at a superordinate level as verbal or non-verbal assessment tools (see Desmet, 2003, for a further reading).

In sensory science, new knowledge has been generated in the last few years, especially through the use of food- and odor-specific verbal instruments (Bhumiratana, Adhikari, & Chambers, 2014; Chrea et al., 2009; Ferrarini et al., 2010; King & Meiselman, 2010; Ng et al., 2013a; Rousset, Deiss, Juillard, Schlich, & Droit-Volet, 2005; Spinelli et al., 2014; Thomson, Crocker, & Marketo, 2010) that contain a relatively large number of emotional terms (for an overview, see Gmuer, Nuessli Guth, Runte, & Siegrist, 2015, Table 1). By presenting actual samples or food names, it has been revealed that food and odor stimuli evoke differentiated and multifaceted emotional states (e.g., Cardello et al., 2012; Chrea et al., 2009; Gutjar et al., 2015b; King & Meiselman, 2010; Ng et al., 2013a; Spinelli et al., 2014). The evoked emotional states often had a relatively low (i.e., not above moderate) intensity (Cardello et al., 2012; Desmet & Schifferstein, 2008; King & Meiselman, 2010; Ng et al., 2013a; Spinelli et al., 2014), which may be explained by the fact that the contribution of food-related emotions to life goals in Western cultures is usually

[2] E.g. *BBC*: http://www.bbc.com/future/story/20141014-time-to-put-bugs-on-the-menu. Retrieved on 8 August 2015; *Die Welt:* http://www.welt.de/regionales/hamburg/article142797530/Heuschrecken-schmecken-nussig-Grillen-wie-Haehnchen.html. Retrieved on 8 August 2015; *Financial Times:* http://www.ft.com/cms/s/2/bc0e4526-ab8d-11e4-b05a-00144feab7de.html#slide0. Retrieved on 8 August 2015; *Tagesanzeiger:* http://www.tagesanzeiger.ch/wirtschaft/unternehmen-und-konjunktur/Insekten-und-Wuermer-im-Supermarkt/story/15795619. Retrieved on 8 August 2015; *The Sun*: http://www.thesun.co.uk/sol/homepage/woman/health/health/5955954/Insects-food-of-the-future.html. Retrieved on 8 August 2015.