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How Might We Overcome 'Western' Resistance to Eating Insects?

Harry McDade and C. Matilda Collins

Abstract

Entomophagy, the consumption of insects as a food source, occurs at a global scale with over 2 billion people seeing it as traditional. This practice does not extend into mainstream Western culture where its introduction is often met by a range of barriers, leaving entomophagy often seen as a taboo. The 'disgust response' of food neophobia and a lack of social and cultural contexts that reduce adoption may be overcome by strategic application of tools arising from innovation diffusion theory: relative advantage; compatibility; low complexity; trialability and observability. This chapter accessibly reviews known barriers to uptake and outlines the potential application of these concepts in promoting the wider acceptance of entomophagy.

Keywords: neophobia, taboo, acceptance, innovation, experience

1. Introduction

The growth potential of entomophagy is currently attracting much interest [1, 2]. Currently, this practice is declining in many traditional markets and does not extend into mainstream western culture where its introduction is often met by a range of barriers, leaving insect consumption often seen as a taboo [3–5]. Insect protein has great potential to be used as reliable alternative or supplement to vertebrate 'meat' consumption and offers relative advantages over traditional animal protein sources if entry barriers can be overcome. One advantage is the lower environmental impact of mass rearing insects in terms of greenhouse gasses and ammonia [6]. Furthermore, insects are highly nutritious and have been found to be healthier than some meat alternatives [7].

This chapter accessibly reviews known barriers to uptake and uses Rogers *Diffusion of innovation* theory (**Figure 1**) to outline possible strategies to overcome these [8].

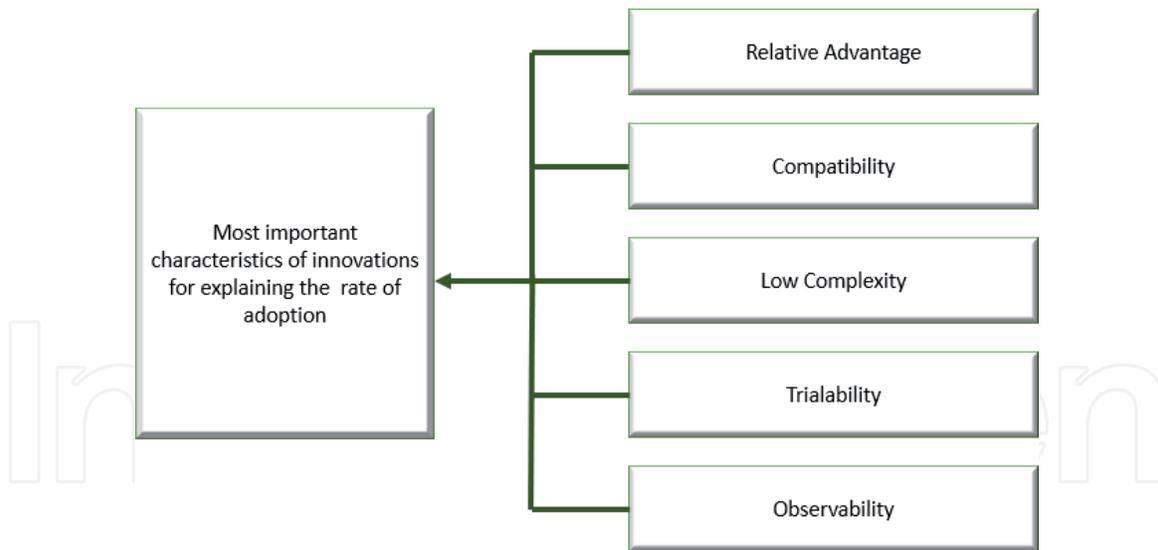


Figure 1.

Perceived characteristics of an innovation considered to determine the level of penetration into a target audience: relative advantage—the level to which the innovation is perceived to be better than existing alternatives; compatibility—the degree to which the innovation is perceived to be in keeping with values and experiences of the target population; complexity—the level to which an innovation is perceived as difficult to utilise and understand; trialability—the level that a new innovation can be experimented with; observability—the level to which the outcomes of an innovation is viewable by the target population [8].

2. Disgust and food neophobia

Insects can trigger a disgust response for a number of reasons. Disgust is different to an innate distaste reaction, which is a response to the bitterness of many biologically toxic compounds [9]. Rather than being a reflex action, a disgust reaction comes from a cognitive process when assessing foods and explains why differences are seen in cultural perception of entomophagy [10]. Disgust can arise with perceived or real associations of insects to objects of core disgust, which include pathogens and pathogen-related stimuli such as faecal matter and vomit [11]. Scaled disgust ratings can predict participants' willingness to attend an event with insect-based cuisine; this demonstrated clearly that disgust is a barrier to introduction of entomophagy into western diets [12].

Separate from the disgust response is the effect of food neophobia which also contributes to an unwillingness to try entomophagy. Food neophobia is simply the tendency to avoid the consumption of novel foods and the degree of novelty correlates strongly with willingness to try unfamiliar foods [13, 14].

2.1 Disgust and the 'law of contamination'

The law of contamination states that a disgust reaction will be elicited not only by objects of core disgust but through any objects that have been contacted. Rozin's elegant demonstration of this with fruit juice and sterile cockroaches indicates that this barrier to entomophagy is often based on irrational thought. Participants knew their reaction was irrational due to the cockroach having been sterilised [15, 16]. If the reaction does occur even with the knowledge that the organism is safe, then providing information on safety is likely to have little effect on uptake.

Overcoming this barrier to introduction may involve new brands initially selling insect-related products to focus primarily on gaining consumer trust or using established and 'trusted' brands to reduce the perceived risk of novel products [17]. Discovering and adopting shared values with consumers may permit entomophagy

to become more compatible with western consumption while reducing negative attitudes [18]. Although, for this strategy to find success, individual brands must avoid perceived or real negative impacts on any group of consumers as these would likely impact the entomophagy industry as a whole by reducing trust [19]. For such trust to grow, a foundation of legislation is developing to provide advice and standards in appropriate methodology for hygienic insect handling and storage [20, 21].

2.2 Disgust response to 'identifiable insects'

Disgust also arises when consumers are reminded that they are eating an animal or are made aware of the animals' origins [11, 12]. When whole insects are found within a food product, this is considered an extended example of the law of contamination, as it occurs due to an association with dead animals and decay [11]. Many studies have pointed to invisibility of insects (such as in cookies) leading to increased willingness compared to their unprocessed counterparts (such as mealworms and crickets) [7, 10, 22]. These support the idea that, for easier implementation, innovators should focus on products without visible insects and thus simplify the product's trajectory to western acceptability.

2.3 Food neophobia

Insect protein products are seen as novel, which influences consumer perception and thus their expected experience on trying it [23]. Increased familiarity reduces any anticipated negative assumptions of taste and experience before trying them [24] and incorporating novel food into familiar dishes will accelerate consumer acceptance. This plays into Rogers' concepts of **compatibility** with western society as well as that of **low complexity**. The latter in this case is achieved through individuals being familiar with how common dishes in their culture are created and consumed. Mimicking familiarity also plays a part and people are more willing to try an insect when it comes in the format of a familiar food item [25]. Expectation also plays a role, an expectation of good flavour was found to be an important indicator for willingness to eat for crickets and silkworms [10].

There are examples where food neophobia has been overcome effectively. Rationing of U.S food supplies during World War II promoted consumption of unfamiliar organ protein. A strategy of preparing and serving these novel ingredients in expected and visually familiar ways led to accelerated uptake [24]. This may, however, prove more difficult with insects as they are perceptually distinct from mainstream food products. In order to capitalise on **observability**, using novel foods in a side dish accompanying a highly favoured familiar main dish can reduce variation in specific perception and in overall evaluation of the meal [26]. Thus, introducing insect protein to side dishes with the 'delicious' main course could optimise their introduction to mainstream diets before incorporation into main dishes.

Making a dish familiar is not enough, it is still important for the product to actually be a strongly positive culinary experience in terms of taste and texture. An *a priori* negative perception may become justified if the dish displays textural characteristics that the consumer does not enjoy and then serve to reinforce or increase aversion to insect dishes [13, 27]. Investment in the gastronomic integrity of dishes as well as in enticing advertising messages will increase the success of insect trials and encourage repeat consumption leading to increased **observability** [16]. There is much positive feedback between brand and item in the context of gaining consumer trust.

3. Social context and current culture

3.1 Absence of social context

Western culture has little recent experience with entomophagy and this is a barrier to its introduction as diet aligns strongly with the social norms of immediately surrounding culture [28]. This lack of social context for entomophagy allows for a greater level of food neophobia as all insect-based cuisine is seen as a novel food. Harnessing social norms may prove to be a method of increasing insect consumption as almost one-third of participants in one study tried insects 'in company' having first stated they would not [29]. This study concluded that having positive social models could result in mitigation of the disgust response. Expanding entomophagy as a social norm through positive models for people to **observe** and **trial** for themselves would thus increase **compatibility**.

3.2 Receptivity and age

Introducing children to entomophagy may bring these social norms into the general populace. People who tried foods in early childhood, even on rare occasions, were more likely to enjoy those foods when they were older. Parental influence is a less reliable indicator of liking foods when older, though this can encourage initial consumption of insect protein [30]. Social influence can be incorporated into the strategy by having parents and teachers as a positive model; **observing** adult influencers consuming insect products may draw greater willingness to try from the children. The challenge is how to develop the adult model to suit the most receptive 'primary school' age range [7]. Introduction to children should incorporate both visual and taste exposure to insect products; however, the focus should be on providing taste exposure to children as this has been shown to increase preference for the food item to a greater extent [31].

3.3 Complexity through absence of social context

Lack of social norms and context also increases the complexity of accepting entomophagy as innovation. With little opportunity for observability, people are less aware of the options available for entomophagy, where to begin, or even if it is possible to adopt it into their lifestyle. Creating social context is vital in allowing individuals to observe entomophagy before trying, it shows them that such dietary options are possible and can be desirable. The approach sometimes taken is that of 'bug banquets', events that offer the chance for consumers to try insect products. This approach can be biased as those people who seek out these experiences are more likely to have more positive views on entomophagy or lower neophobia scores. Furthermore, while these often result in reduced aversion to entomophagy, there is little to no follow-up on whether there is long-term uptake [32].

An alternative strategy for creating social context is to use social media. Applications such as Instagram, which has a high presence of food-related content, can offer recipes as well as images of available dishes. These global platforms also allow more insect-experienced countries to encourage the adoption of entomophagy in western countries. The efficacy of this strategy is limited by the notion that sharing of entomophagy may be limited by the fear that it will generate a prejudice towards them [33]. Social media methods create enhanced **observability** by endorsements from established food pages or celebrities. Some do distrust information from these sources and these endorsements may only need to be reflective of

the possible lifestyle with limited focus on information distribution. Social media also allows for peer-group pressure to influence spending of certain age groups (such as teenagers) on insect proteins. This will be important as people are more likely to try an insect-containing product when it is offered by a friend than an unknown individual [7, 34, 35].

3.4 Relative advantage

A lack of necessity is a barrier to entomophagy uptake in westernised countries and countries with high meat production and consumption may perceive a lack of need for meat-based alternatives [36]. This highlights a barrier to the introduction strategy of insects as a meat-based alternative as consumers have a food gradient which they follow when selecting meat-based alternatives with initial choice being fish and eventual choices including tofu and similar products at the bottom. Although not a linear path, this gradient shows that consumers have a hierarchy of foods that they follow with novel foods often situated at the bottom [25]. One proposed strategy to overcome this lack of relative advantage would be to avoid promotion as meat alternative. Instead, comparison to nuts could prove more productive as they share similarities in texture, macronutrient content, flavour and size and will circumnavigate the problem that insects encounter when replacing dishes with larger portions of meat such as steaks [32]. In order to fully capitalise on a **relative advantage** over other products, the environmental benefits can be emphasised. Most current comparisons, however, are with meat and there is still debate surrounding this area with vegetarian diets becoming ever more popular in western countries [37, 38]. If the environmental benefit argument is to be made, using circular production gives some insect products **relative advantage** over other 'green' alternatives. A total of 1.3 billion tonnes of food produced for human consumption is wasted per year and valorisation can occur through the use of certain insect species to convert this wasted food into a high-protein product to be used for human or livestock consumption [39, 40].

Differences among western populations affect uptake of entomophagy as individual cultures place different values on factors when choosing their food. For example, the French place a higher value on the pleasures and the social aspects of food consumption whereas the English favour convenience, organic and ethical issues when choosing their food options [41]. With entomophagy, French respondents place less value on the relative advantages of insect products and the British have been found to be more repulsed by visible insects. Understanding this variation creates an opportunity to have adaptive introduction models in different countries. This approach will work to increase the **compatibility** of entomophagy and could also be used to adapt legislation within different legal jurisdictions [42].

4. Availability of product and information

4.1 Absence of available products

The lack of general availability of insect products creates greater complexity through reducing the ease of both **trialability** and enduring adoption. In some cases, demand may already exceed supply and the currently rising visibility will influence social norms causing an increase in demand [32]. As seen with sushi and lobster, greater observability and supply can change societal views and there is no reason this could not be the same for entomophagy [32, 43]. A great range of

Recipe type	Insect	Nut	Chicken	Vegetable	Biscuit
Number of 'hits' (millions)	68	176	991	1960	2550
Relative abundance (to insect)	1	2.6	15	29	38

Table 1.

The number and relative abundance to 'insect recipe' as reference, of 'hits' (search results) in response to the search terms 'insect recipe', 'nut recipe', 'chicken recipe', 'vegetable recipe' and 'biscuit recipe'. Searches conducted using Google Chrome, 21 June 2019.

well-presented products are now available and this very variety can increase acceptance and adoption by consumers [24]. In addition to this, having a wider variety available can reduce the stigma insects have with their strong associations to pests or to notably high-revulsion species such as cockroaches [16].

4.2 Absence of available information

The limited supply of appropriate resources for the sourcing and preparation of insect-containing dishes adds to **complexity**; people do not know where to find recipes, choice advice and cooking information [36]. Though this is now changing rapidly, there remains a substantial information deficit. In 2015, recipes using pine needles and whale meat were more common than insect recipes on the food website 'food.com' and there are currently almost 40 times more mentions of biscuit recipes than insect recipes in a goggle search (**Table 1**) [32].

Along with a knowledge deficit, there is also a confidence deficit contributing to complexity as many people would rather try insects for the first time in a restaurant setting than at home [25]. It is clear that to move towards **lower complexity**, there is a need for an increase in the availability of accessible and free resources. To reduce the need for extensive research, social media, online repositories and increased product information and recipes on packaging all have a part to play. These routes can encourage expansion of the range of dishes individuals will be willing to trial, and, through increasing **trialability** in this way, it can reduce the overall complexity associated with entomophagy.

5. Absence of relative advantage through high prices

Increasing the availability of insect products alone will not be sufficient to drive consumer acceptance for enduring entomophagy. Of those participating in a Dutch study, one-third found insect products to be 'prohibitively expensive' and although most people said price alone would not stop them from purchasing, the remaining two-thirds did recognise price as a factor in repeat purchase decisions [44]. In the 2019 online market place, insect protein powders are 3–10 times the price of vegetable and dairy comparators. Many things currently affect sale price and the increased production now happening across Europe and the North American continent will act to reduce this. Quality, reliability and cost effectiveness arising from increased automation and appropriate species selection will help to reduce price and mitigate the current absence of relative advantage [3].

6. Conclusion

Though interest and product availability are rising, western society has yet to adopt entomophagy as common practice. Entomophagy remains largely

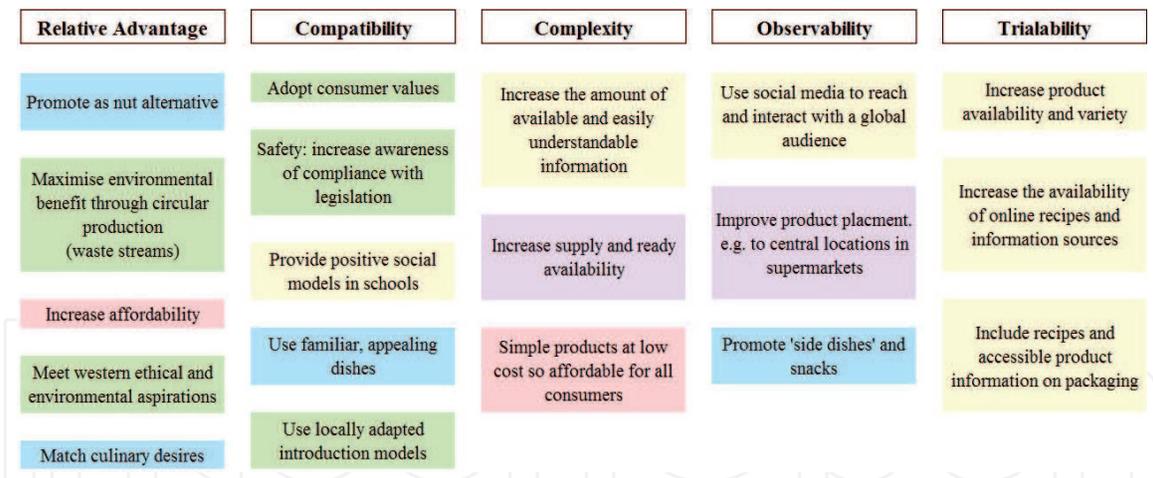


Figure 2.
 The relationships between potential strategies to overcome barriers to entomophagy. Boxes of the same colour indicate strategies that share an overarching theme or whose implementation can improve the ability of other strategies to meet their goal.

incompatible with western ideals, and most westerners exhibit a disgust response when faced with the prospect of eating an insect. A lack of social context and awareness increases the complexity of the innovation and is clearly indicated by consumers experiencing high levels of food neophobia or low awareness of purchase and preparation options.

This chapter has outlined a multitude of promising strategies to overcome such barriers and these strategies need to be developed concurrently (**Figure 2**). When combined, they may help ensure that entomophagy has each of the five characteristics outlined by Rogers as influential to product penetration (**Figure 1**) [8].

Though many recent studies reviewed here have found an increase in participant interest and willingness to adopt through the provision of experience with entomophagy, more research on long-term adoption is required. We need to understand what will embed long-term adoption after food neophobia and the disgust response have been attenuated.

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Conflict of interest

The authors declare no conflict of interest.

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References

- [1] Trends Tracker (Blueshift Research). Interest in Insect-Based Products Grows Slightly but Hovers Around One-Third of Respondents. The Other Two-Thirds are Awaiting Recommendations, Confirmation of Nutritious Value and Taste [Internet]. 2015. Available from: <http://blueshiftideas.com/content/june-2015-trends-tracker/>
- [2] Ahuja K, Deb S. Edible Insects Market Size By Product, By Application, Industry Analysis Report, Regional Outlook, Application Potential, Price Trends, Competitive Market Share & Forecast,. 2018. pp. 2018-2024
- [3] van Huis A. Potential of insects as food and feed in assuring food security. *Annual Review of Entomology*. 2013;**58**(1):563-583
- [4] Caparros Megido R, Sablon L, Geuens M, Brostaux Y, Alabi T, Blecker C, et al. Edible insects acceptance by Belgian consumers: Promising attitude for entomophagy development. *Journal of Sensory Studies*. 2014;**29**(1):14-20
- [5] Berenbaum MR. A consuming passion for entomophagy. *American Entomologist*. 2016;**62**:140-142
- [6] van Huis A, Oonincx DGAB. The environmental sustainability of insects as food and feed. A review. *Agronomy for Sustainable Development*. 2017;(1):37-43
- [7] Collins CM, Vaskou P, Kountouris Y. Insect food products in the Western world: Assessing the potential of a new 'green' market. *Annals of the Entomological Society of America*. 2019. Special Issue: Edible Insects 1-11
- [8] Rogers EM. *Diffusion of Innovations*. 5th ed. New York: Simon & Schuster; 2003
- [9] Chapman HA, Anderson AK. Understanding disgust. *Annals of the New York Academy of Sciences*. 2012;**1251**(1):62-76
- [10] Hartmann C, Shi J, Giusto A, Siegrist M. The psychology of eating insects: A cross-cultural comparison between Germany and China. *Food Quality and Preference*. 2015;**44**:148-156
- [11] Rozin P, Fallon AE. A perspective on disgust. *Psychological Review*. 1987;**94**(1):23-41
- [12] Hamerman EJ. Cooking and disgust sensitivity influence preference for attending insect-based food events. *Appetite*. 2016;**96**:319-326
- [13] La Barbera F, Verneau F, Amato M, Grunert K. Understanding Westerners' disgust for the eating of insects: The role of food neophobia and implicit associations. *Food Quality and Preference*. 2018;**64**:120-125
- [14] Tuorila H, Lähteenmäki L, Pohjalainen L, Lotti L. Food neophobia among the Finns and related responses to familiar and unfamiliar foods. *Food Quality and Preference*. 2001;**12**(1):29-37
- [15] Rozin P, Millman L, Nemeroff C. Operation of the laws of sympathetic magic in disgust and other domains. *Journal of Personality and Social Psychology*. 1986;**50**(4):703-712
- [16] Deroy O, Reade B, Spence C. The insectivore's dilemma, and how to take the west out of it. *Food Quality and Preference*. 2015;**44**:44-55
- [17] Siegrist M. Factors influencing public acceptance of innovative food technologies and products. *Trends in Food Science & Technology*. 2008;**19**(11):603-608
- [18] Earle T, Siegrist M. Trust, confidence and cooperation model:

A framework for understanding the relation between trust and risk perception. *International Journal of Global Environmental Issues*. 2008;**8**(1):17

[19] Siegrist M, Cousin ME, Kastenholtz H, Wiek A. Public acceptance of nanotechnology foods and food packaging: The influence of affect and trust. *Appetite*. 2007;**49**(4):459-466

[20] Belluco S, Losasso C, Maggioletti M, Alonzi CC, Paoletti MG, Ricci A. Edible insects in a food safety and nutritional perspective: A critical review. *Comprehensive Reviews in Food Science and Food Safety*. 2013;**12**(3):296-313

[21] Finke MD, Rojo S, Roos N, van Huis A, Yen AL. The European food safety authority scientific opinion on a risk profile related to production and consumption of insects as food and feed. *Journal of Insects as Food and Feed*. 2015;(1):245-247

[22] Gmuer A, Nuessli Guth J, Hartmann C, Siegrist M. Effects of the degree of processing of insect ingredients in snacks on expected emotional experiences and willingness to eat. *Food Quality and Preference*. 2016;**54**:117-127

[23] Pliner P, Pelchat M, Grabski M. Reduction of neophobia in humans by exposure to novel foods. *Appetite*. 1993;**20**(2):111-123

[24] Wansink B. Changing eating habits on the home front: Lost lessons from World War II research. *Journal of Public Policy & Marketing*. 2003;**21**(1):90-99

[25] Schösler H, de Boer J, Boersema JJ. Can we cut out the meat of the dish? Constructing consumer-oriented pathways towards meat substitution. *Appetite*. 2012;**72**:1592-1607

[26] Peryam DR, Polemis BW, Kamen JM, Eindhoven J, Pilgrim FJ. Food

Preferences of Men in the U. S. Armed Forces. *Surveys of Progress on Military Subsistence Problems*. Chicago: Quartermaster Food and Container Institute; 1960

[27] Martins Y, Pliner P. Human food choices: An examination of the factors underlying acceptance/rejection of novel and familiar animal and nonanimal foods. *Appetite*. 2005;**45**(3):214-224

[28] Higgs S, Thomas J. Social influences on eating. *Current Opinion in Behavioral Sciences*. 2016;**9**:1-6

[29] Jensen NH, Lieberoth A. We will eat disgusting foods together—Evidence of the normative basis of Western entomophagy-disgust from an insect tasting. *Food Quality and Preference*. 2019;**72**:109-115

[30] Wadhwa D, Capaldi Phillips ED, Wilkie LM, Boggess MM. Perceived recollection of frequent exposure to foods in childhood is associated with adulthood liking. *Appetite*. 2015;**89**:22-32

[31] Birch LL, Marlin DW. I don't like it; I never tried it: Effects of exposure on two-year-old children's food preferences. *Appetite*. 1982;**3**(4):353-360

[32] Shelomi M. Why we still don't eat insects: Assessing entomophagy promotion through a diffusion of innovations framework. *Trends in Food Science & Technology*. 2015;**45**:311-318

[33] Looy H, Dunkel FV, Wood JR. How then shall we eat? Insect-eating attitudes and sustainable foodways. *Agriculture and Human Values*. 2014;**31**(1):131-141

[34] Lensvelt EJS, Steenbekkers LPA. Exploring consumer acceptance of entomophagy: A survey and experiment in Australia and the Netherlands.

Ecology of Food and Nutrition.
2014;**53**(5):543-561

Academic and commercial implications.
Appetite. 2016;**107**:47-58

[35] Spero I, Stone M. Agents of change: How young consumers are changing the world of marketing. *Qualitative Market Research: An International Journal*. 2004;**7**(2):153-159

[36] Clarkson C, Miroso M, Birch J. Consumer acceptance of insects and ideal product attributes. *British Food Journal*. 2018;**120**(12):2898-2911

[37] Oonincx DGAB, de Boer IJM. Environmental impact of the production of mealworms as a protein source for humans—A life cycle assessment. *PLoS One*. 2012;**7**:12

[38] Shelomi M. The meat of affliction: Insects and the future of food as seen in expo 2015. *Trends in Food Science and Technology*. 2016;**56**:175-179

[39] Gustavsson J, Cederberg C, Sonesson U. *Global Food Losses and Food Waste—Extent. Causes and Prevention*. Rome, Italy: FAO; 2011

[40] van Huis A, Klunder JVIH, Merten E, Halloran A, Vantomme P. *Edible Insects. Future Prospects for Food and Feed Security*. Rome: Food and Agriculture Organization of the United Nations; 2013

[41] Pettinger C, Holdsworth M, Gerber M. Psycho-social influences on food choice in southern France and Central England. *Appetite*. 2004;**42**(3):307-316

[42] Halloran A, Muenke C, Vantomme P, van Huis A. Insects in the human food chain: Global status and opportunities. *Food Chain*. 2014;**4**(2):103-118

[43] Luzer D. How Lobster Got Fancy. *Pacific Standard* [Internet]. 2013. Available from: <https://psmag.com/>

[44] House J. Consumer acceptance of insect-based foods in the Netherlands: