ENTOMOPHAGY

Understanding New Zealand Consumers' Attitudes Toward Eating Insects

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Abstract

While the ecological, economic, and social benefits of entomophagy are well documented, adoption of this food source in many Western countries has been slow. Understanding consumers' attitudes towards entomophagy is important in determining if and how edible insects will be accepted as a food product in the future. This research determined the dominant discourses that exist towards entomophagy in New Zealand. Q methodology, which provides both a technique and philosophical principles for studying individuals' judgments, attitudes, and points of view about a topic, was used to identify dominant consumer discourses. The objective of the study was to describe representations of different dominant participant viewpoints. Thirty-four participants living in Dunedin sorted a set of statements about entomophagy. The comparison of sorts across participants in a factor analysis enabled the identification of statistically similar participant viewpoints, which were then interpreted using the rich qualitative data obtained in interviews after card-sorting. Five different discourses were identified: 'Enthusiastic adventurers', 'Benefit seekers', 'Disgusted disavowals', 'Tolerable but restrained', and 'Secure resolute'. In addition to practical insights about how insects could be positioned in the marketplace, the identification of these discourses adds to a limited literature on entomophagy attitudes. Future research that measures the prevalence of these discourses via a nation-wide representative survey would allow researchers to determine who holds these viewpoints, which would have useful implications for developing an insect industry.

Key Words

Entomophagy, Insects, Discourses, Consumers

Introduction

By 2050, the global population is estimated to reach nine billion people. Feeding a rapidly growing and more demanding population is estimated to increase the current food requirements by 70 per cent (Food and Agriculture Organization, 2009). This will require a massive increase in worldwide food production, including livestock. Meat demand is growing in both developing and developed countries (van Huis, 2013; Verbeke, 2015), and farming livestock requires large amounts of limited resources. Livestock alone takes up 70 per cent of agricultural land use and requires significant quantities of feed and water to produce one kilogram of meat (van Huis, 2013). The anticipated increase in food demand and feed sources has prompted a search for alternative protein sources. Insects present a potentially sustainable protein source for humans because of their high nutritive value, high environmental safety, and economic livelihood benefits (Caparros Megido et al., 2014; Rumpold and Schlüter, 2013; van Huis, 2013; Yen, 2009). Insects are among the most diverse group of animals on the planet today; there are more than one million described species, more than half of all known living organisms (van Huis, 2013). Consumption of edible insects is known as human entomophagy (Cunningham and Marcason, 2001; Shockley and Dossey, 2014). Historically, eating insects was common in most cultures all over the world, dating back over a thousand years (Shockley and Dossey, 2014). Nowadays, insects are a regular part of the diet for over two billion people worldwide (van Huis et al., 2014). Insects are believed to have the potential to improve people's diet by contributing protein, minerals, and vitamins, which will lead to a decrease in common deficiencies (Rumpold and Schlüter, 2013).

Entomophagy also has many beneficial effects on the environment compared to the production of other more traditional protein sources such as beef. Rearing insects requires much less land, water, and feed than livestock. Most insects can be farmed vertically, utilising a fraction of the land space. As they are cold blooded, they require less energy and can obtain moisture through their food, reducing water and feed requirements. Short lifecycles and the ability to breed rapidly and in large numbers mean they are very efficient

to rear (van Huis et al., 2014). The greenhouse gas emissions from most edible insects compare favourably to alternative protein sources. Methane, for instance, is only produced by a few insect groups, such as termites and cockroaches (van Huis et al., 2014). Insects also have the ability to lower net human greenhouse gas emissions by lowering the amount of food waste created. Insects can feed on bio-waste and transform it into a high-quality protein that can be used for animal feed or human food (Katayama et al., 2008).

In recent years, entomophagy has been receiving a great deal of attention as a promising way to cope with some of the major food and nutrition challenges facing the world (Verbeke, 2015). This study was carried out to discover what the dominant consumer discourses about entomophagy are in New Zealand. Given the relative newness of the topic, establishing the different dominant discourses about entomophagy is an important first step in the process of understanding likely consumer acceptance. Before describing the study methods used to elicit the dominant discourses, the following section identifies reported barriers to entomophagy, details the niche status of entomophagy currently, and summarises the key literature on consumer attitudes to entomophagy.

Although entomophagy is common in tropical countries, in Western countries it is infrequent or even culturally inappropriate. The main barriers to entomophagy are (1) a phobia of eating insects in Western societies, and (2) the globalisation that has seen the adoption of a universal culture largely based on Western values, habits, and customs, including changes in food customs (Schiefenhövel and Blum, 2009; Vane-Wright, 1991; Yen, 2009). There is a major attitudinal barrier to the practice of entomophagy in Western societies (Yen, 2009). The belief that insects are dirty, disgusting, and dangerous is deeply embedded in the Western psyche (Looy et al., 2014; Looy and Wood, 2006; Rozin and Fallon, 1987; van Huis et al., 2014; Yen, 2009). Despite these negative feelings towards insects and a clear reluctance amongst Westerners to include insects in their diets, there are indications of some kind of market for insects in Western countries (Verbeke, 2015). For example, an increasing number of restaurants are serving insects as a delicacy, more insect cookbooks are being released, and exclusive insect-based food festivals are happening. Some Western tourists also enjoy the novelty of trying whole insects in food stalls in foreign countries such as Thailand, China, and Mexico, where eating insects is part of the culture (Caparros Megido et al., 2014; Verkerk et al., 2007; Cunningham and Marcason, 2001; Ramos-Elorduy, 1998).

While such initiatives pave the way for large-scale insect consumption, Western consumption of insects still remains part of a niche food sector or novelty food product, and a great deal of work needs to be done to improve consumer acceptance. The concept of novel food is guiding the development of insects as human food (van Huis et al., 2014).

To date, there are only two studies explicitly concerned Westerners' attitudes towards entomophagy (Looy and Wood, 2006; Caparros Megido et al., 2014). The study by Looy and Wood (2006) found two extreme attitudes about entomophagy: interest or disgust. Caparros Megido et al. (2014) determined Belgian consumer attitudes based on pre-determined attitude categories, and their results showed that if consumers could associate the insects with familiar tastes and flavours, they would be more ready to cook and eat the products. Importantly, both studies usefully demonstrate how tasting insects affected consumers' attitudes towards insects as a possible food source. In addition, the studies provide understandings of how ready consumers are to adopt insects and how the presentation of insects affects peoples' attitudes. The limitation of both studies was that they were specifically focussed on how sensory liking/disliking affected attitudes, rather than peoples' attitudes about insects in a more holistic manner. Furthermore, the studies examined the attitudes of consumers in different geographical areas than that of the current study (New Zealand). New Zealand is an interesting case country in which to examine attitudes about entomophagy for two reasons. First, while entomophagy is commonly promoted as a way to overcome global food security issues, New Zealand, with 70 per cent of the country's total exports being primary products and just under half of the available land area used for farming (StatisticsNZ, 2008), is considered to be a very food-secure nation. Second, New Zealanders are notoriously big meat eaters (Ferguson, 2002).

Given the limitations of the current literature on entomophagy, what is needed is a deeper understanding of consumer attitudes towards entomophagy to more accurately understand how likely consumer acceptance is, under what circumstances consumers would choose to eat insects, and why this is the case. To obtain such an understanding requires an in-depth methodology that is able to capture the dominant attitudes that exist amongst a given population. Q methodology is used in social science to measure human attitudes, beliefs, and viewpoints towards a topic. Q is an effective way to identify the shared perspectives that people hold towards a given topic. The resulting rich description of the dominant

discourses towards entomophagy in New Zealand is the focus and main contribution of this study. Obtaining this information will allow other researchers to more confidently conduct further quantitative market segmentation research in the future.

Methods and materials: Q methodology

Q is a social science method that was developed from factor analytic theory in 1930s by physician and psychologist William Stephenson to provide a systematic means to study human subjectivity (Stephenson, 1935; Stephenson, 1953). Q refers to the distinction between procedures that collate and facilitate traits (Stenner et al., 2003). Q provides both a technique and philosophical principles for studying individuals' judgments, attitudes, and points of view about virtually any given topic. Two main features characterize all Q studies: (1) the collection of data in the form of Q-sorts, and (2) the subsequent intercorrelation and by-person factor analysis of those Q-sorts. A Q-sort is a collection of items based on the research question that is sorted by a participant according to subjective dimensions, such as 'most like me/least like me' or 'agreement/disagreement'. Through the sorting of items, the participant provides a representation of his or her viewpoint on the issue that is being studied (Stenner et al., 2003). The Q-sorts of different participants are subsequently compared and contrasted through factor analysis, thus allowing any shared forms of understanding to be detected (Stenner et al., 2003). Q data collection and analysis usually includes five steps as described in Stenner et al. (2003). These are (1) identifying a concourse, (2) constructing the Q-sample (the Q-set), (3) selecting the participant sample (the P-set), (4) completing the Q-sort activity, and (5) analysing the data. Each step is now presented in turn.

Step 1: Identifying a concourse

A concourse that adequately reflects the issue under investigation is the first step towards completing a Q study. This step involves an attempt to survey, as far as possible, the field of what is declarable about the issue of the study. The hypothetical field of declare-ability is known in Q study as the concourse (Stenner et al., 2000). This requires familiarity with the theme in question, which can be gained in numerous ways, such as focus groups interviews, discussions and debates, and so on (Stenner et al., 2000). Given the novelty of the topic, two focus groups were used to gather initial preliminary data from which to build the concourse.

The focus groups were held at the University of Otago campus in the Gregory Building. The focus groups consisted of 10 people per focus group and lasted approximately 60 to 90 minutes. The focus groups were audio recorded for data analysis. Upon completion of the focus group, participants were given a $10 voucher to compensate for travel costs incurred in attending the session. Insects were on display to generate discussion, but insects were not eaten during the research study. The insects were not consumed because the study focused on the discourses towards entomophagy, not consumers' sensory like or dislike of insects. The insects were on display in different forms, from highly visible (raw product) to hidden (muesli bar made with cricket flour). From the focus groups, a series of statements about entomophagy were gathered. Alongside this information, a comprehensive review of previous literature and social media (e.g., blogs) was conducted to add depth to the concourse. All of the opinions and statements were then combined to produce a pool of approximately 100 statements, which was when saturation was reached, and no new information was being added to the set (Stenner et al., 2000). The aim of the pool of statements was to be as inclusive as possible to capture all possible discourses on the topic of entomophagy.

Step 2: Constructing the Q-sample (the Q-set)

The main aim of a Q-set is to generate a set of items that provide an excellent coverage surrounding the research question. After gathering the 100 opinion statements in the concourse sample, researchers (the authors) selected a sample of 49. The concourse was condensed using a structured systematic approach through the use of conceptual categories on entomophagy (n=14). The category labels were habit, right/wrong, social norms, appearance, convenience, taste, knowledge, food security, economic, curiosity, safety, health, fear, and environmental. The final Q statements were selected by taking three or four statements from each category. The statements selected were as different as possible.

Step 3: Selecting the participant sample (the P-set)

Posters were displayed in and around the University of Otago on notice boards and throughout Dunedin New World community boards. An email was also circulated around the University of Otago. An information sheet regarding the project and session times was sent to all participants. A simple questionnaire regarding demographic information such as age, gender, income, occupation, and ethnicity accompanied the consent form for

participants to complete before they started the Q-sort activity. The inclusion criterion for this study was that participants were older than 18 years of age. The study involved the recruitment of 34 participants. Ages ranged from 18 to 66, and incomes were between $0 and $124,999. The ethnicities of the participants were mostly NZ European, with some NZ Maori, Asian, and European participants. The participant selection resulted in mostly students and staff from the university. Q does not adjust for this; therefore, results need to be understood and interpreted within this context. Participants in a Q study are not regarded as subjects; this means that a relatively small number of participants can yield worthwhile results (Stenner et al., 2000).

Step 4: Completing the Q-sort activity

The participants were provided with 49 individually numbered cards, a felt distribution matrix, and a set of instructions. The instructions were verbally explained throughout the sorting process. The participants sorted 49 statements onto the felt quasi-normal distribution from 'strongly agree' (+6) to 'strongly disagree' (-6). The participants sorted the statements into three piles, including agree, disagree, and neutral. The participants then took the piles of items they definitely agreed with and spread them out so they could see them all at once. They then had to allocate each of these items a ranking position at the right-hand side (strongly agree) end of the distribution. The one item they found they most agreed with they gave a ranking of +6. The next two items they gave a ranking of +5 and so on, until all of their agreement items had been allocated an appropriate ranking. This was done again with the disagreement and neutral statements. On average, the Q-sort took approximately 25 minutes. Directly after the sorting activity, post-sort interviews identified why participants had sorted statements in the way they did. The main aim of the interviews was to explore each participant's wider understanding of entomophagy, to discover why they sorted the items as they did, and to get them to focus on the meaning and significance of particularly important statements. The interviews took on average an additional ten minutes to complete. Upon completion of Q-sort session, participants were given a $10 voucher to compensate for travel costs incurred for attending the session.

Step 5: Analysing the data

A dedicated free statistical program package, PQ program, (version 2.35) available from www.qmethod.org, was used to analyse the Q-sorts, which were entered into the program

as one file and analysed through the process of inter-correlation and subjected to by-person analysis. The PQ program identifies regularities or patterns of similarity in the configurations produced and hence the viewpoints the participants have; this is referred to as the factor. Factor extraction involved the identification and removal of distinct portions of common variance from the correlation matrix. The appropriate number of extracted factors was determined from a recommendation from Brown (1980). All factors that have two or more significant factor loadings are extracted (n=5). Using this extraction technique allows the inclusion of factors that are meaningful and significant, which may be lost using other techniques (Brown, 1980). Once the data was collaborated and the factors were determined, the interview data was used to allow for further theoretical interpretation of the factors. Interviews from participants that only associated with one factor were listened to, rather than transcribing every participant's interview. Opinions from these interviews that further interpreted or explained the factors were then transcribed verbatim. Selected quotes from these transcriptions are included in the Results section as additional explanation for the factors and to allow an in-depth explanation of the viewpoints that these factors expressed.

Results

Although there are five distinct groups represented, all of the groups agreed on several items in the Q-sort. The five different factors/groups identified included the 'Enthusiastic adventurers', 'Disgusted disavowals', 'Benefit seekers', 'Secure resolute', and 'Tolerable but restrained'. In the following section, each of the factors has been named and includes a summary statement as well as a description of the factor. The items statements have been italicised, with the item statement number and the specific factors rating have been included in the brackets. The ratings range from +6 (strongly agree) to -6 (strongly disagree).

Consensus statements

The consensus items resulting from this study indicate that the majority of participants agreed on several statements towards entomophagy. All factors agreed that farming insects is a good idea, as it would create new jobs for the population of New Zealand. In addition, they all felt neutral about whether the texture would determine if they would eat insects. At this general level, they all expressed varying levels of agreement.

Factor 1: 'Enthusiastic adventurers'

> *We are enthusiastic and positive towards the concept of entomophagy. We enjoy the experience and are not affected by the appearance of insects.*

Factor 1 had an eigenvalue of 11.75 and explains 22 per cent of the study variation. Fourteen participants—six men and eight women with a wide range of ages, incomes, jobs, and ethnicities—associated with this factor (with seven participants only loading on this factor). This factor was characterised by an unambiguously positive view towards entomophagy. Participants who adopted this enthusiasm for entomophagy exhibited a deeper interest in introducing insects into their lives because of the opportunities that they provide. For example, they agreed, *entomophagy would open up a whole new variety of tastes (7, +5)*.

'Enthusiastic adventurers' are not worried about the social acceptability of entomophagy or what other people think of their food choice, as this quotation from one of the interviews illustrates: "Being embarrassed because I was eating insects has never crossed my mind. In Mexico it can be a competition to see who can eat the most insects". They believe that entomophagy is an experience that should be made the most of; they do not believe that the consumption of insects needs to be hidden. Otherwise, the new experience is taken away, as one person remarked: "If the insects are hidden from view, the experience of eating insects is missing". This group likes to try new things and they often look for new experiences. Is it possible that this open-mindedness extends into the rest of their lives, making them more likely to trying new things, including new recipes, and to hunt for new and unusual experiences. The 'Enthusiastic adventurers' are not affected by the appearance of the insects; instead, they have curiosity towards them. For example, they strongly disagreed with the following statements: *I think insects are dirty and unhygienic (31, -4)*, and *Eating insects is gross and disgusting (46, -5)*.

The 'Enthusiastic adventurers' would consider introducing insects into their lives if they became more convenient. For example, they largely agreed with the item statement, *I would eat insects if they were way cheaper than meat alternatives (36, +3)*. They can also see the potential that insects can bring to New Zealand's economy, in terms of agricultural production, tourism opportunities, and economic advances, as the following quotes demonstrate: "Economics will always be a main driver. If insects were cheaper, that would be a motivator

to try them." Another participant remarked, "We have land for farming insects so why not? If insect farming could be developed to a point where it was a substitute for meat protein, then it could be a great industry. The fact we have lots of infrastructure for exporting products already, it could help us benefit from farming insects as we could send them all over the world".

Factor 2: 'Benefit seekers'

> *We are potential advocates towards the concept of entomophagy. We love the benefits associated with entomophagy and are not concerned with the appearance.*

Factor 2 had an eigenvalue of 1.61 and explains 14 per cent of the study variation. Thirteen participants—three men and ten women with a wide range of ages, incomes, jobs, and ethnicities—are significantly associated with this factor (with seven participants only loading on this factor). The factor is characterised by a positive view towards the benefits of entomophagy. Participants who are interested in the benefits of entomophagy exhibited an interest in introducing insects into their lives because of the individual health and environmental advantages. For example, participants largely agreed with the statements, *I would eat insects if they were produced in a green way (22, +4)*, and *I would eat insects because they are a healthy alternative (37, +5*). The following statement also highlights the 'Benefit seekers'' desire to consume insects for the benefit of the environment and rest of the world: "I am concerned about the environment long term and other methods of producing current protein having a large long-term impact compared with other insects".

'Benefit seekers' make sure that they are supplying their bodies with good nutrition. They are possibly healthy people whose biggest concerns are their own health and well-being, and they are interested in healthy foods. Although they are interested in entomophagy, they need guarantees that insects are safe to eat. For example, they agreed with the statement, *if there was a guarantee that insects were food grade I would eat them (18, +4)*, as this participant's remark also makes clear: "I know insects are clean creators but I still want to know they are OK to eat".

The 'Benefit seekers' are not affected by the appearance of the insects. Instead, they see the benefits associated with insects. For example, there was strong disagreement among them

with the statement, *I think eating insects is gross and disgusting (46, -4)*. As one participant explained, "I do not think insects are dirty or unhygienic, but I know a lot of people think of them as being dirty and unhygienic. It is the cultural perception behind it all". They may not often focus on what their food looks like when it is presented, but they care about its nutritional content. It is possible that they are advocates for social change and make purchases based on both personal well-being and the sustainability of food products.

Factor 3: 'Disgusted disavowals'

> *We have no interest in entomophagy and worry about the safety of entomophagy. We would prefer to become vegetarian than have to eat insects.*

Factor 3 had an eigenvalue of 4.22 and explains 10 per cent of the study variation. Seven participants—one men and six women with a wide range of ages, income, jobs, and ethnicities—were significantly associated with this factor (with six participants only loading on this factor). This factor is characterised by an unambiguously negative view towards entomophagy. Participants who experienced disgust toward entomophagy exhibited a negative view towards introducing insects into their lives because of the disgust they felt towards them. This was clear through the strong agreement of the item statement, *eating insects is gross and disgusting (17, +5)* and the participant quote, "I think insects are dirty and unhygienic because they live in the ground. Their surroundings are dirty which I associate with germs, bacteria, and illness. I most associate insects with being dirty and unhygienic and then relate that to illness".

The 'Disgusted disavowals' have no interest in introducing insects into their lives, even if it became a socially accepted practice. One participant stated, "I couldn't psychologically bring myself to eat insects. If other people were, that would be fine; I wouldn't be grossed out by [their] entomophagy. It is just the thought of insects going into my body I cannot handle". The 'Disgusted disavowals' are not affected by experience or curiosity. Instead, they worry about the by the safety of entomophagy. Their agreement with the item statements, *I worry that if I eat insects they will upset my stomach (44, +3)*, and *I would only eat insects if I knew where they were from (40, -1)* illustrates this. It is possible that they are largely influenced by what their parents and culture have taught them—namely, that most insects might be poisonous and should be avoided.

The 'Disgusted disavowals' are not interested in entomophagy, even if the insects were disguised or tasted similar to the foods they currently consume. They cannot get past the gross factor. Even if the insects were hidden, this group still cannot break the psychological barrier that stops them from consuming insects. Although they might often create disassociations between themselves and food, they cannot do that when they know that the food is insects, as the following quotation highlights: "The thought of eating insects grosses me out. I think a lot of it is texturally and psychologically. I think part of it is the shape, for example grasshoppers on a stick look like grasshoppers. We have become removed from our food; which is the main influence for me. Since I can visualize and see it in its whole form puts me off, I like to create complete dissociation between me and my food because of what my head tells me".

Factor 4: 'Tolerable but restrained'

> *We would consider introducing insects into our lives if they were disguised or tasted like something we were used to. However, we still prefer to eat current meat options.*

Factor 4 had an eigenvalue of 0.91 and explains 8 per cent of the study variation. Five participants—two men and three women, with a wide range of ages, jobs, incomes, and ethnicities—are significantly associated with this factor (with two participants only loading on this factor). This factor is characterised by a slightly positive view towards entomophagy. Participants who adopted this 'Tolerable but restrained' attitude exhibited a positive view towards introducing insects into their lives if they were disguised or hidden from their view. They generally agreed with the item statements, *I would eat insects if they were unrecognizable (34, +3)*, and *I would eat insects if they tasted like something I was used to eating (32, +5)*. The 'Tolerable but restrained' are focussed on the flavour of insects rather than their appearance: "If the insects tasted like chicken, which is a food I like, then I would be keener to try them". They do not believe that there is a gross factor surrounding insects; they believe that it is what others associate insects with, rather than their appearance, that makes them gross. As one participant explained, "Insects do not look yuck. It is more the concept of insects that people associate it with being yuck rather than their appearance".

The 'Tolerable but restrained' are not affected by the potential sustainability benefit of entomophagy: "I do not see sustainability as an issue with meat at the moment. Therefore, I

would continue to eat meat options over insects". These people are big meat eaters and prefer to consume and buy current meat, but they would consider entomophagy if the insects were hidden and if current meat was not available. It is possible that they would consider entomophagy when other meat alternatives became less available, and therefore, they would have to eat insects to get animal proteins that they desire so much. It is also possible that they want more education on the topic of entomophagy, given their uncertainty about the benefits of eating insects: "If insects had a better nutritional value or were farmed in a more humane way than current meat options, that would be attractive, but I have no knowledge on the topic, so I do not know if they do".

Factor 5: 'Secure resolute'

> *We do not think that people from developed countries should have to eat insects. They are dirty and will not add anything new.*

Factor 5 had an eigenvalue of 1.45 and explains 5 per cent of the study variation. Three participants—one men and two women, with an age range of 18 to 34 and with various incomes—are significantly associated with this factor (with two participants only loading on this factor). All three participants were students, one was European and the other two were Chinese. This factor is characterised by a negative view towards entomophagy. Participants who adopted this resolution against introducing insects into their lives exhibited a negative view towards entomophagy because of the disgust they felt towards insects. For example, they agreed with the item statement, *I think insects are dirty and unhygienic (31, +5).* As one participant put it, "They are gross because of the way they look. Insects are different to the normal; they have feelers and gross beady eyes and stuff like that".

It is possible that they do not focus on the nutritional value of the food but on the taste of it, as disagreement with the item statement, *I would eat insects for the nutritional value (11, -2)* and the following quotes suggest: "Unless there is substantial evidence to support the idea that insects are a healthy alternative I would not eat them because I do not think it is a healthy alternative," and "I think nutrition content of the insects would be less than meat, but I do not know. I think that you would eat a whole heap of the them, which I wouldn't want to do". It is possible that with more education they would understand the nutritional content of insects and may reconsider eating them for nutritional reasons.

The 'Secure resolute' believe that underdeveloped countries have a greater need for insects than developed countries: "The underdeveloped countries eat insects, maybe because they don't have education about insects". They have a stronger belief that people from developed countries should not have to eat insects because there are so many different alternatives available: "People from developed countries should not have to eat insects other than for curiosity". It is possible that they think that insects should be eaten only if other food is too expensive and therefore required nutrition is available only through insects.

Discussion and implications

The present study investigated New Zealand consumers' attitudes towards entomophagy. Five different discourses were identified; the largest portion of the total participants—'Enthusiastic adventurers', 'Benefit seekers', and 'Tolerable but restrained'—had positive views about consuming insects. The discourses ranged from 'interested in entomophagy for the benefits associated', to 'an experience', to 'having no interest in introducing insects into their lives at all'. This is similar to the study by Looy and Wood (2006), which found that people generally have two different attitudes towards insects as a possible food source: a general willingness to try a new food, or an increase in food neophobia, the reluctance to eat new foods. These two attitudes are similar to that of the groups 'Enthusiastic adventurers' and the 'Disgusted disavowals'. Food neophobia is often due to the unknown tastes, origins, or expected harmful consequences of consuming new foods (Rozin and Fallon, 1987) and is shown in the 'Secure resolute' and 'Disgusted disavowals'. This can be linked to the 'omnivore's dilemma', in which omnivores should be cautious of harmful foods but also need to explore novel options (Addessi et al., 2005). Food neophobia is common among omnivore species so poisonous foods are not ingested, but it can become a barrier to the uptake of novel foods, such as edible insects (Rozin and Fallon, 1987). 'Enthusiastic adventurers', however, are curious and are more willing eat novel foods with unknown tastes and consequences.

Previous studies have confirmed the importance of familiarity as a driver for food product usage. Caparros Megido et al. (2014), for example, found that if consumers could associate insects with familiar flavours, they would be ready to purchase and cook insects at home. The current study shows similarities with discourses ('Secure resolute' and 'Tolerable but

restrained') that directly rely on familiarity in determining their viewpoints. In the current study, familiarity was not measured directly but more indirectly through the Q-sorts and how they were arranged. Although similar findings were established, Caparros Megido et al. (2014) found that entomophagy was mainly well accepted by participants in their study, and consumers would be ready to buy and cook insects at home. This is in contrast to the results of the current study, which found a wider range of attitudes towards entomophagy. A possible explanation could be that Caparros Megido et al. (2014) surveyed participants who were already interested in insects, as the study was carried out in an insectarium. By comparison, the current study included individuals who had no previous knowledge or exposure to entomophagy, vegetarians, and those who had previously consumed insects.

Food security is a real and pressing issue, and different stakeholders in the world's food supply are approaching the problem in a multitude of ways. One of the findings from this current study was that food security was not one of the main drivers contributing to interest in consuming insects. Perhaps this is not surprising given that, despite worldwide talk of food security, the realities of global food shortages have not hit home in New Zealand, which is a successful exporting agricultural market. Although people are not (perhaps, not yet) willing to eat insects to alleviate hunger, there nonetheless appears to be a market for insects in New Zealand. Rather than driven by food security issues, the key current motivators for consuming these products are taste, culinary, experimental, health, and environmental related.

Understanding the five discourses or attitudes towards entomophagy enables the development of strategies to target these different groups of consumers. The following practical implications will be considered using the 4Ps framework in light of the five factors (McCarthy, 1960). The 4Ps—product, place, price, and promotion—are crucial for determining a product or service, and help describe the different choices that need to be made to bring a product to market. Only the key findings from the current study's results will be discusses according to the framework.

Product: Introducing insects to New Zealand according to the five factors can be done in a variety of ways, depending on the discourse. When targeting 'Enthusiastic adventurers', the insects should be obvious because "if insects are hidden from view than the experience of

entomophagy is missing". Deroy et al. (2015) suggest that openly serving insects is ideal, as hiding them may come across as dishonest and present new problems. However, the present study makes it clear that when targeting 'Benefit seekers', products that promote the health and environmental benefits should be used. When targeting the 'Tolerable but restrained', products where the insects are hidden would be the best approach. For instance, biscuits and muesli bars that include insects would be similar to products these individuals already know and consume. Currently edible insect products must comply with Food Standards Australia New Zealand novel food requirements code (Standard 1.5.1). A novel food is a non-traditional food that does not have a history of human consumption in Australia or New Zealand. These foods require an assessment of the public health and safety considerations, including potential adverse effects in humans, process of preparation, and composition of the food. Once the food has passed a pre-safety assessment procedure, it is added to the Food Standards and can be distributed and sold.

Price: If insects are going to be introduced at a price premium or have a bottom-line price, these prices need to be determined before edible insects are introduced into the market. When targeting the 'Enthusiastic adventurers', a price premium is an appropriate value, even though it is generally accepted that the more expensive a product, the less the product will be purchased. However, since 'Enthusiastic adventurers' are interested in new experiences (which are often costly), they will be willing to pay more for the latest experience. A price premium can also be used when targeting the 'Benefit seekers' as they are interested in the benefits associated with edible insects. They are mainly concerned with environmental concerns, specifically minimizing the negative impact that some processing methods may have on the environment, as well as the nutritional benefits of insects, including protein, iron, and zinc. They will, therefore, be prepared to pay more for food products that contain these benefits. Currently, production and price of insect products in New Zealand is high due the novelty. However, if insect products become more popular in the agricultural industry, associated costs may be lower than traditional livestock, reducing the price. As insects are cold blooded, they can efficiently convert feed into edible protein and other nutrients. Lower prices in the future may increase adoption by groups such as the 'Tolerable but restrained'.

Place: To be purchased, insects must be available for the potential customer. Once the product has passed the pre-safety assessment procedure (as outline in Standard 1.5.1), there is a range of outlets that could be used to sell insects (e.g., supermarkets, health shops, and weekend markets). Online markets are another possibility. Hence, there is a possibility for great diversity when it comes to distributing edible insects. Using the internet will reinforce that entomophagy is still a new, exciting experience that should be made the most of (also not yet publicized to everybody). Edible insects could also be a tourism opportunity for New Zealand. Local insect farmers could encourage adventurous tourists to try whole insects and other products that they sell. When targeting the 'Benefit seekers', insects should be sold in a health shop or supermarket. They need the reassurance that insects are safe to eat; selling them through respected retail outlets will give them their needed reassurance. They rely on reputation of the retail outlet to confirm the safety of entomophagy. Hence, the credibility of the organization selling the products are important to the marketing of insects to the 'Benefit seekers'.

Promotion: In general, it is appropriate to focus the promotion of edible insects on making the consumers aware of edible insects and providing reasons to purchase them. This is because the vast majority of customers do not have accurate knowledge about edible insects or benefits associated with them. When promoting the 'Enthusiastic adventurers', low-key promotion is suggested as they are venturesome and eager to try new things; therefore, low-key promotion will reinforce the originality of this experience. Using internet promotion is suggested as they have multiple information sources available to them and tend to be popular and respected amongst their peers (Rogers, 1976), which may determine future diffusion. When targeting the 'Benefit seekers', the promotion should still be low key but a bit more intense than when targeting the 'Enthusiastic adventurers'. By using the internet, benefits associated with entomophagy can be promoted in a way that informs and educates the 'Benefit seekers'. They have a strong interest in the environmental and nutritional benefits of entomophagy, which should therefore be the main focus of the online promotion. They need a guarantee that insects are safe to consume, so information on safety should be included with the benefits. When targeting the 'Tolerable but restrained', more intense promotion is needed as this group tends to adopt with caution and scepticism (Rogers, 1976). They need strong pressure from others who have already adopted before they will adopt. Word of mouth and public promotion should be used for this group. Billboards and

television commercials would be useful to convince them to adopt insects. They need to be reassured that others are doing it and that it is a social norm; public promotion is the best way to achieve this.

Conclusion

This study contributes to the current body of literature on entomophagy. Specifically, it builds on studies that have focussed on Western attitudes towards entomophagy. Its findings are similar to previous work, but, due to its unique methodology, this study encourages a more nuanced approach that results in a greater understanding of the discourses of entomophagy. The Q methodology allowed for the complexities and realities of the topic to be shown. The application of this methodology revealed five distinct discourses around the concept of entomophagy from a Western country's perspective: 'Enthusiastic adventurers'; 'Disgusted disavowals'; 'Benefit seekers'; 'Secure resolute'; and 'Tolerable but restrained'.

Q methodology has proven to be an effective way of determining the shared perspectives of entomophagy. However, the method does not offer findings that are representative of the whole population (this was outside the scope of the study). In the future, it would be beneficial to combine Q methodology with a survey that is more representative of the wider population, and to profile different groups of individuals with the five discourses, to understand the differing views towards entomophagy across society. Furthermore, given that it is unclear what price point would switch consumers to purchase insects over conventional livestock, future research could also look at how providing participants information about the benefits of entomophagy affects their attitudes and likelihood of adopting insects.

This study is also unique in that it has used a population that is not geographically bound—that is, participants have a different perspective toward food security than in other studies. It reveals that there is some interest and a potential market in entomophagy; however, none of the discourses indicate a willingness to substitute insects for current meat options.

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