

ORIGINAL ARTICLE

Willingness to eat an insect based product and impact on brand equity: A global perspective

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Abstract

Rapid population growth is creating the need to find new and sustainable food sources. Insect-based products could satisfy this high priority necessity while incorporating important nutrients in the human diet such as protein, vitamins, and minerals. This research provides a global overview of the willingness to try a new product that contains insect powder and determine the impact of adding insect-based products to a brands portfolio. An international survey was conducted in 13 different countries ($n = 630$ consumers per country, total 7,800 consumer) with consumers who represented diverse demographic backgrounds. Eight of the 13 countries could be classified as “disgust” countries where most respondents said they would not be willing to try a familiar product containing insect powder. Nine countries fell into the “impact” category where participants would be more likely to stop buying other products from this company knowing that they have used insect powder in another product from the same brand. The reasons why participants would not consider eating foods containing insect powder were religion, the perception that insects carry diseases and cause allergic reactions. Only the disease-carrying perception was significant in most of the countries.

Practical applications

The results from this study showed that most consumers from most countries studied are not willing to try insect-based products at this time. However, there was a segment of the population in each country that was willing to try such products. There is a great opportunity for companies to create new products for countries where the disgust factor was not a barrier and to test those new concepts and products. This could help provide information to educate consumers about all the benefits of insect protein and implement. It is key to remember that new brands probably are necessary for such products because of the potential damage to brand equity of introducing products containing insect powder.

1 | INTRODUCTION

Every primate is, to some degree, insectivorous (McGrew, 2014). Extensive literature has documented that edible insects contain important nutrients such as protein, vitamins, and minerals which are essential for human consumption (Van Huis et al., 2013). From the sustainability point, there is no other food source as efficient and effective as insects (Van Huis et al., 2013), the environmental impact is crucial and provides enough benefits to promote this novel food. Muller, Evans, Payne, and Roberts

(2016) challenge the overall concept as insects as a “quick-fix” for food systems, but foresees a potential long-term solution for meat alternatives.

By 2050, the global population of humans is predicted to grow to nine billion, and the demand for animal-derived protein is expected to increase at an even higher rate (Godfray et al., 2010). Humans already eat insects as part of their diet often without realizing it. For example, according to the US Food and Drug administration (USFDA) an average of 75 or more insect fragments per 50 g are allowed in wheat flour as a defect (AOAC 972.32).

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Currently insects are being studied by academic institutions and companies in different countries to develop edible food products for mass consumption, which comply with the basic sensory standards of a benchmark product, particularly taste and appearance. If insect based products can be marketed and commercialized properly, then insects could become a new source of protein. A challenge is the emotional disgust barrier toward insects and its associations (food neophobia, lack of information, etc.). At the same time consumers want products made from natural ingredients and Chambers, Chambers IV, and Castro (2018) found that insect powder was considered natural by only 7% of the US population in their survey. Further research (Chambers, Tran, & Chambers IV, 2019) found that US consumers either did not know what "Cricket Powder" was or found it disgusting.

The idea of insects as food is growing because it promises several advantages for health, the environment, and people's livelihoods (Henchion, Hayes, Mullen, Fenelon, & Tiwari, 2017; Van Huis et al., 2013). Several research studies have shown that insect based product are starting to gain acceptability in different populations across the world (Caparros Megido et al., 2014). In Belgium during a tasting session experiment conducted with insect based burgers, most (~70%) of the participants were convinced that we will eat insects in the future and were ready to include insects (principally minced or powder) in their diet (Caparros Megido et al., 2016). Moreover, House (2016) states "If insect-based foods are to be commercially successful they will need to be at a comparable price level, tastiness and availability to existing Western foods." Not only the sensory side of an insect based product is crucial but also the cultural factor plays an important role on consumer decision. Additionally, studies in African and Asian countries have reviewed and showed a culture of entomophagy (Ghosh, Lee, Jung, & Meyer-Rochow, 2017; Kelemu et al., 2015).

Familiarity and cultural aspects also plays an important role in acceptance of products (Choe & Hong, 2018; Gama, Adhikari, & Hoi-sington, 2018; Phan & Chambers, 2016). In addition disgust, particularly for things like insects in food can be an issue. Rozin and Fallon (1987) "Approaches disgust as a food-related emotion and define it as revulsion at the prospect of oral incorporation of offensive objects." Disgust about something is a cultural construction, which is socialized to most or all members of a group, and indicates clearly the physical or cultural threat related to some object or action (Herz, 2012). Disgust also can be easily generalized from one entity to others through contamination (Rozin & Fallon, 1987). In consequence, some insects could easily be clustered in a "decomposition and filthy" group which causes the psychological contamination of all insects, creating a disgust effect in the complete insect category. (Verneau et al., 2016). Chambers et al. (In review) found that cricket powder received the highest percentages of "disgust" from consumers of any ingredient tested.

Based on Zhang (2015), brand image is the driving force of brand equity, which involves the consumer's general perception and feeling about a brand and influences consumer behavior. "The power of the brand lies in the minds of consumers" (Leone et al., 2006). A brand's equity is comprised of knowledge (brand awareness), relevance (meeting customer needs), esteem (consumer regard), and differentiation (uniqueness) (Keller, 2008). Furthermore, product usage experiences enhance brand awareness; in simple words, the more people buy a

product, the higher the brand awareness for this specific product (Huang & Sarigollu, 2012). Applying these concepts, it is easy to see that if consumers learn information about when a consumer experiences an insect based product repeatedly and it is positive, brand awareness might increase with little negative effect on brand equity. As suggested and stated by van Doorn et al. (2010), "The concept of customer engagement behaviors is defined as customers' behavioral manifestation toward a brand or firm, beyond purchase, resulting from motivational drivers." Companies might be building the bridge between emotions and brand loyalty. According to Lassar, Mittal, and Sharma (1995), brand equity comes from the customers' confidence in a brand. The greater the confidence they place in the brand, the more likely they are willing to pay a high price. It is essential to protect brand image and study if novel products can deteriorate brand equity. This is a key starting point for new research and development projects among many large multinational companies and essential if future protein sources, such as insects, are to be introduced into their products.

The objectives of this study were to (a) investigate willingness to eat insect-based products and (b) to determine the impact of adding insect-based products on brand equity. The study was conducted in 13 different countries to provide a somewhat global perspective.

2 | MATERIALS AND METHODS

2.1 | Participant profile

Respondents ($n = 630$ per country) were recruited in each country by Qualtrics, an online survey company, or their partners in each country, from existing databases. One hundred participants of each gender (male, female) in each of three age groups: 18–34 years old; 35–54 years old; 55+ years old were targeted in each country with additional respondents included in case of incomplete data. The participants did not receive a financial incentive for completing the online survey, but Qualtrics database has a reward system in order to compensate the respondents for their time and collaboration.

The participants represented 13 different countries (United States [USA], Mexico, Peru, Brazil, United Kingdom [UK], Spain, Russia, India, China, Thailand, Japan, South Africa, and Australia) where differences in cultures, languages, traditions and religions make this reasonably broad-based as a multi cross-cultural international survey. One group that is lacking is a primarily Arab country. We attempted to conduct the survey in Egypt, but could not obtain sufficient older adult (55+) participants and that country was dropped from this analysis.

2.2 | Survey

The questions for this study were included in a larger survey studying multiple aspects of food beliefs. For the overall research, multiple questions covering various topics including socio-, psycho-, and physical demographics and food beliefs about various types of ingredients, incorporation of insects into products, reasons for not eating insects, and impact of products containing insects in a brand. The duration of the entire survey was targeted to be between 15 and 20 min to avoid respondent's fatigue.

For this specific research study two main questions related to the willingness to eat new products that contain insect powder and the impact on the company's brand equity, as well as three questions about reasons for not eating insect products are reported. Before the two main questions were asked, a brief statement was presented to the participants. It stated: "If a major worldwide company; e.g., Nestle, Coca-Cola, KFC, Starbucks, etc., introduces a new product similar to one you currently buy that contains insect powder." The two questions presented to the participants were: (a) How willing would you be to try this product? (b) How likely would you be to stop buying other products from this company knowing they have used insect powder in one product? Questions related to reasons were: (a) "Religion does not allow all or certain insects"; (b) "Insects carry diseases" and (c) "I have an actual allergic reaction to some insects". All responses were measured on seven-point Likert-type scales with the appropriate response type.

The survey was translated into nine languages (English, Spanish, Portuguese, Russian, Hindi, Mandarin Chinese, Thai, Japanese, and Afrikaans). Checking of the translations was either by back translation or multiple translation, both with discussion afterward by the translators to resolve any problems.

2.3 | Data analysis

Initially, data was simply categorized and described using percentages for each potential answer for each country. For additional analysis of the data, made scores for extremely unlikely, unlikely, and somewhat unlikely were combined into a category of "unlikely" and scores for extremely likely, likely, and somewhat likely were combined into a category of "likely for the questions on willingness to try and impact on brand.

Statistical tests were executed using SAS 9.4 and RStudio version 3.4.1. For every country, the frequency, expected value, total percent values, chi-square and Kendall's correlation coefficient scores (for nonparametric data) were calculated for each gender and age groups, the total percentages bar graphs were plotted using Excel™ software (Microsoft Office, version 2016). Multinomial logistic regression followed by ANOVA was applied to find significant differences between the gender and age groups for both questions independently. The same procedure was applied to the three additional reasons but ANOVA was not performed for this section.

The correlation was established between the willingness to eat an insect based product and the likeness to stop buying other products from an appointed company. A separately correlation was performed for the religion reason and the willingness question. Note that Kendall's correlation produces a *tau* value that typically is lower than traditional R^2 values, but even those lower values indicate reasonable correlation.

3 | RESULTS

3.1 | Global trends and outcomes

The overall results showed that the majority of the countries are not willing to try insect based products (Figure 1). Surprisingly, after

clustering the data by gender, a new trend is detected on the male segment. Figure 2 displays that males are more willing to try this product than females in most countries. All the countries followed this pattern except for China where women appeared more likely than men to eat a product containing products. Moreover, two age segments, 18–34 and 35–54 years old, are similar in their willingness to try insect based products. Both age groups were receptive and willing to the idea of this new product category, but the young age group (18–34) had slightly higher values than the 35–54 age group in most of the countries (Figure 3). The 55+ year old consumers often were not as responsive to this new product category concept except in South Africa where the older population had a slightly higher percentage of those willing to try than the 35–54 year olds.

South America is the only continent with more countries (Mexico, Peru, and Brazil) where the percentage of willingness to try is greater than the unwillingness. Asia had both Thailand and China that also were more willing to try products containing insect ingredients, but Asia also had countries such as India and Japan where willing to eat was low. Figure 4 provides a map showing a more global perspective of the willingness to try insect based products.

A linear regression line was plotted to understand the relationship between the unwillingness to try insect based products and the impact on the brand equity of a determined company. Basically, as the disgust factor increases, the impact on brand equity decreases, meaning consumers would be more likely to stop buying other products from this specific company, later the correlation analysis confirmed the initial findings; refer to Figure 5 for more details.

3.2 | Willingness to try a familiar product with insect power as an ingredient

Figure 1 shows that eight of 13 countries (United States, Australia, Spain, India, Russia, South Africa, United Kingdom, and Japan) could be classed as "disgust" countries where more respondents said they would not be willing to try a familiar product containing insect powder than said they would be willing to try such as product. "Acceptor" countries were Mexico, China, Brazil, Peru, and Thailand, where more respondents indicated they would try familiar products if they had insect powder added than said they would not (Figure 1). Those countries were more receptive to the idea of trying an insect based product.

Respondents in Russia (63.3%), Japan (61.9%), India (57.8%), and Spain (56.5%) were the least willing to try a familiar product that had insects as an ingredient. Consumers in Mexico (71.4%), Peru (57.6%), and Thailand (56.0%) were the most likely to try such products. Respondents in some countries, such Australia and China, showed levels of ambivalence (score = neither unlikely nor likely) nearly equal to any other score given, suggesting that there still is some level of uncertainty concerning insect-based products in some cultures. That could relate to unfamiliarity with such ingredients, which also impacts consumer beliefs for topics such as naturalness (Chambers et al., 2018). However, the "ambivalent" consumers had little impact overall considering the correlation between percentages of willingness and unwillingness to try was high ($tau = 0.94$). That shows a clear

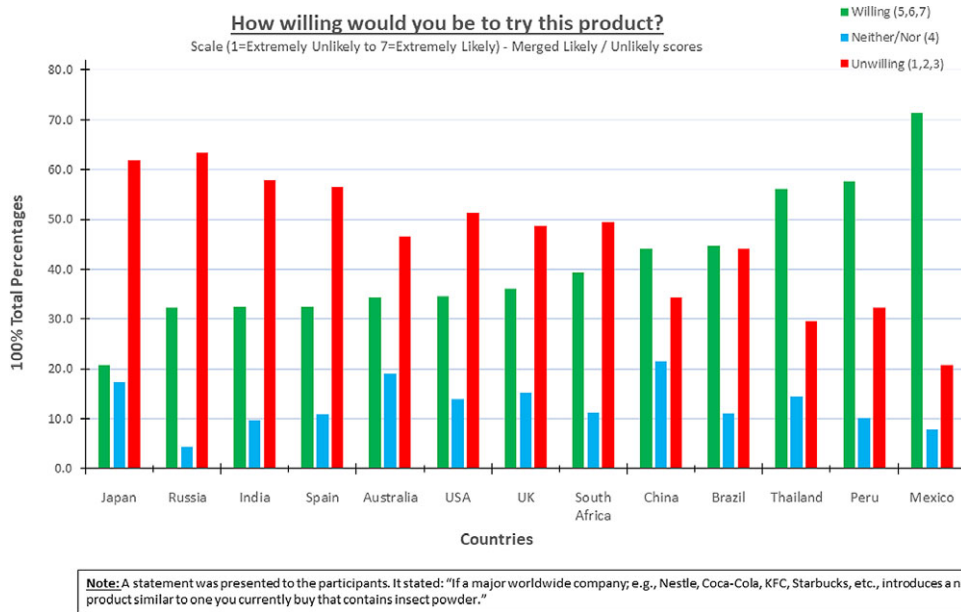


FIGURE 1 Percentages of the willingness, neutral, and unwillingness to try an insect based product

dichotomy of willingness to try between likely and unlikely in most countries.

3.3 | Effect on brand equity

The results from the question “How likely would you be to stop buying other products from this company” were classified into two categories; the “high impact” and “lower impact,” and on brand equity. Six of 13 countries (United States, Mexico, Australia, South Africa, United Kingdom, and Thailand) could be grouped as “lower impact” on brand equity where more participants mentioned that they would continue buying other products from this specific company. The “high impact on brand equity” countries were China, Spain, Brazil, India, Russia,

Japan, and Peru. It is important to highlight that the difference between the unlikeliness and likeliness to stop buying other products was less than 10% for 10 out of the 13 countries which shows an almost even split in tendency for impact or no impact on brand equity. Therefore, most countries have almost equal groups of people on whom the inclusion of insects in brands would affect purchases and others on whom it would have no effect. Davcik and Sharma (2015) showed that innovation, such as functional food ingredients, can be a strong driver of brand equity, but also indicate that the innovation must be considered positive by consumers. For those lower impact countries, this data suggests that there is opportunity to introduce and promote an insect based product, but perhaps not using a current

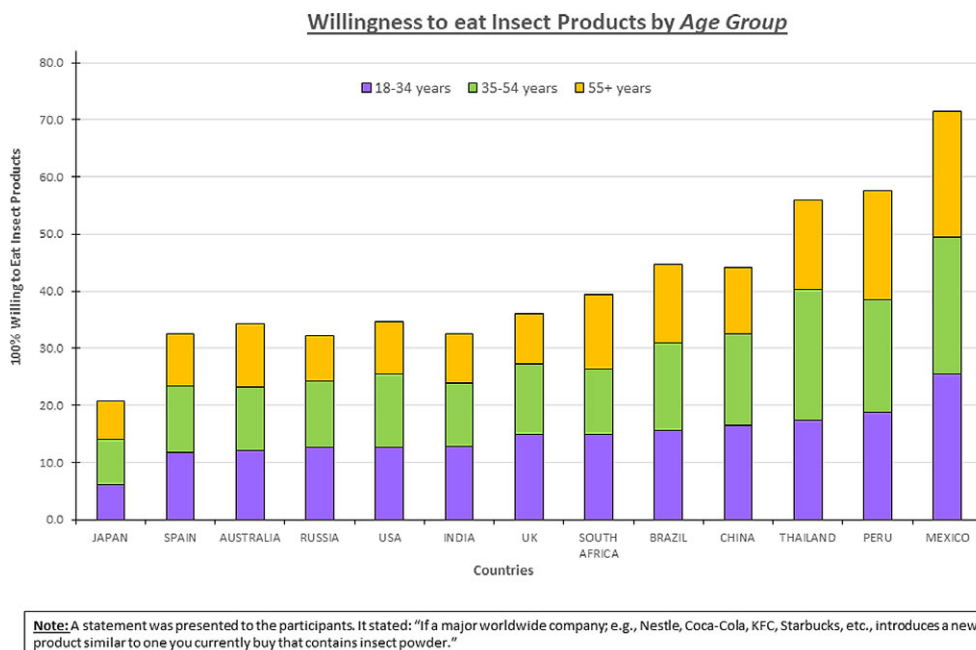


FIGURE 2 Percentages of the willingness to try an insect based product by age group

Willingness to eat Insect Products by Gender

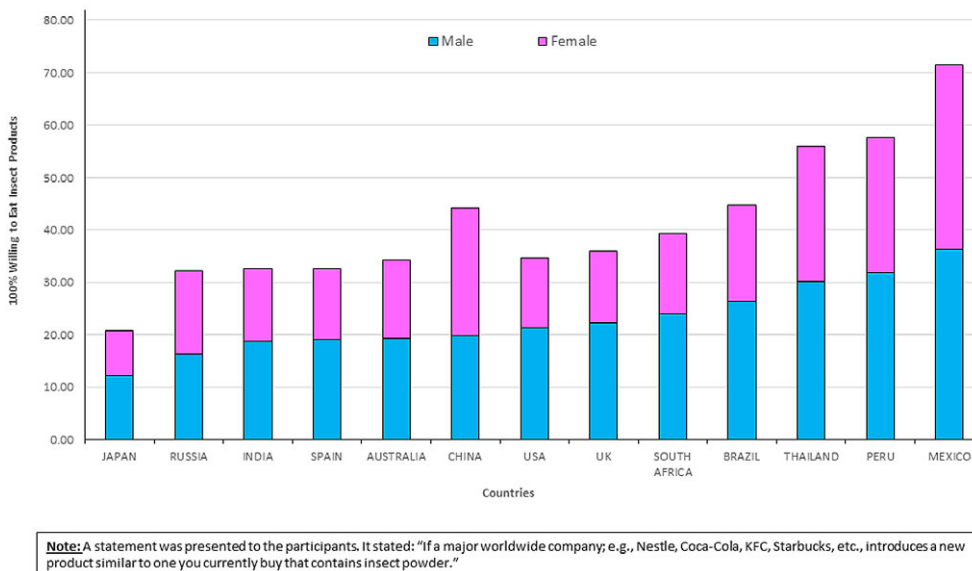


FIGURE 3 Percentages of the willingness to try an insect based product by gender

brand. A large portion of people in those 10 countries likely may stop buying other products in the brand if insects were used in some products within the brand. This is not surprising given the influence varying criteria on individual consumer and brand differences (Kumar, 2011).

The percentage of consumers unlikely to stop buying other products is led by Mexico with the highest percentage (49.8), followed by South Africa (43.3%), United States (42.5%) and United Kingdom (40.2%). Consumers in Russia (49.4%), Japan (48.3%), India (47.8%) and Brazil (47.3%) mentioned that they would stop buying other products from, which company that sold insect-containing

products (Figure 6). As expected, Mexico, which was most likely to eat insect products also was least likely to stop eating other products in a brand if insects were included as an ingredient in other products of that brand. However, 70% of Mexican consumers indicated they would try a product with insects, but only 50% said they would continue eating a product from a brand that included insects in other products. These findings highlight the contrast in potential consumer information. People may be willing to try or eat something, but may also reject changes in their “branded” products if there is an association with “new” or unusual ingredients that may not be trusted.

Global Willingness to Eat Insect based Products

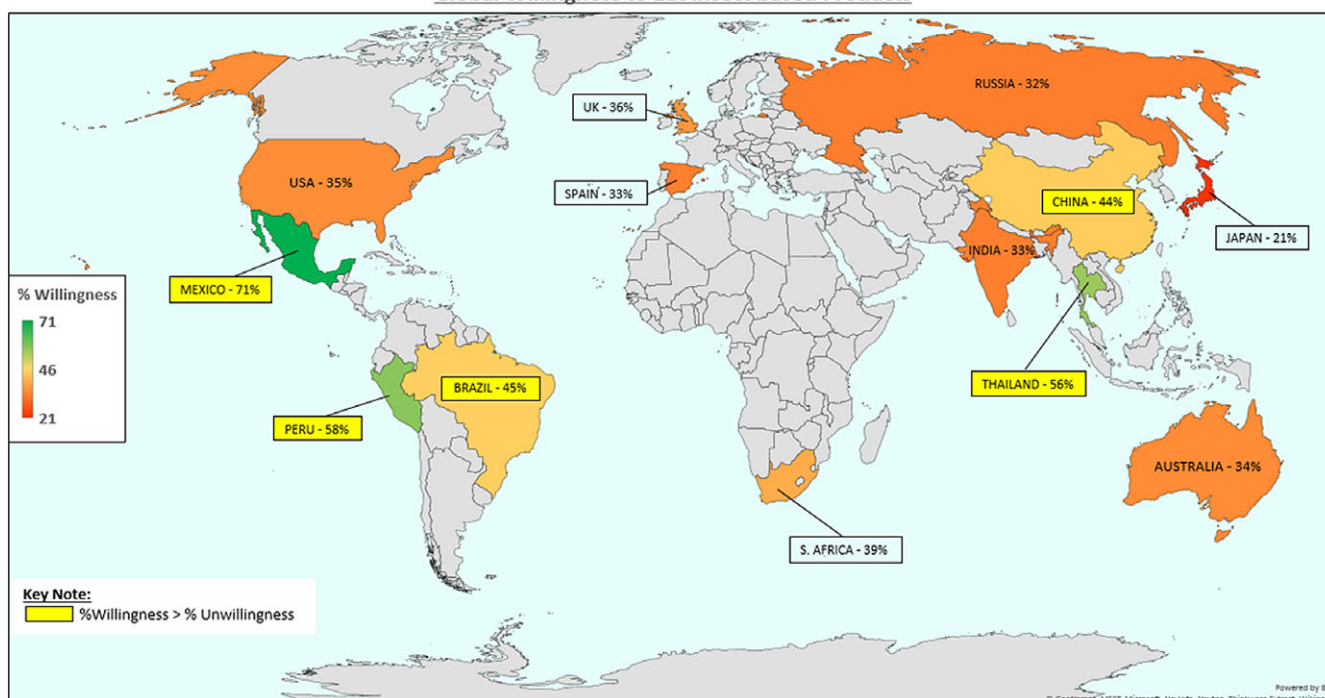


FIGURE 4 Map of the willingness to try insects products—by country

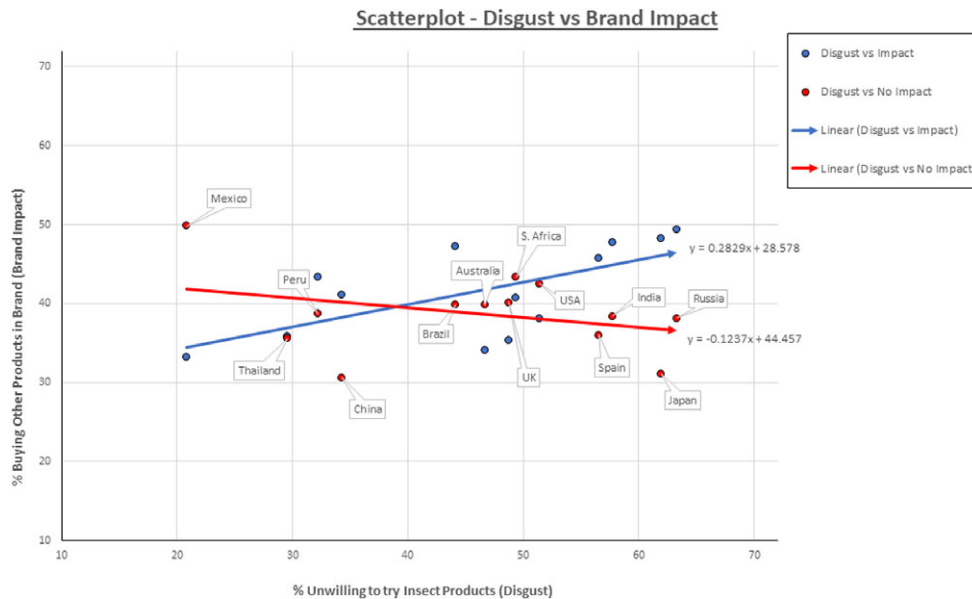


FIGURE 5 Scatterplot summary of the unwillingness to try insect based products and the impact on the brand equity

Based on this information, new brands may be necessary to prevent the dilution of brand equity. Morris, Beresford, and Hirst (2018) suggest that high quality products are one key to brand equity. It would appear from this data that the potential for insect-based products using “new” brands is the most way to introduce such products given the right strategies and the correct product positioning based on the country.

3.4 | Correlation between willingness and brand equity

For the correlated parameter of willingness to try an insect based product and the likelihood that a consumer would stop buying other products from this company if they introduced an insect based product to their brand, the analysis was performed for each country

independently. Four categories were created: (a) Disgust = Lower impact on brand equity; (b) Disgust = Impact on brand equity; (c) No Disgust = Lower impact on brand equity; (d) No Disgust = Impact on brand equity. If the correlation of willingness to try is low or positive with the likelihood of not buying products from that brand, then we can conclude there is lower or no systematic impact on brand equity. All correlations are included in Supporting Information 1 for gender and age. Only key ones are discussed below.

3.4.1 | United States of America

The disgust factor or the unwillingness to try a product that contains insect powder in the United States is over 50%, but the correlation with the brand equity question is low for gender and most of the age groups. Moreover, males and females between 18 and 34 years old

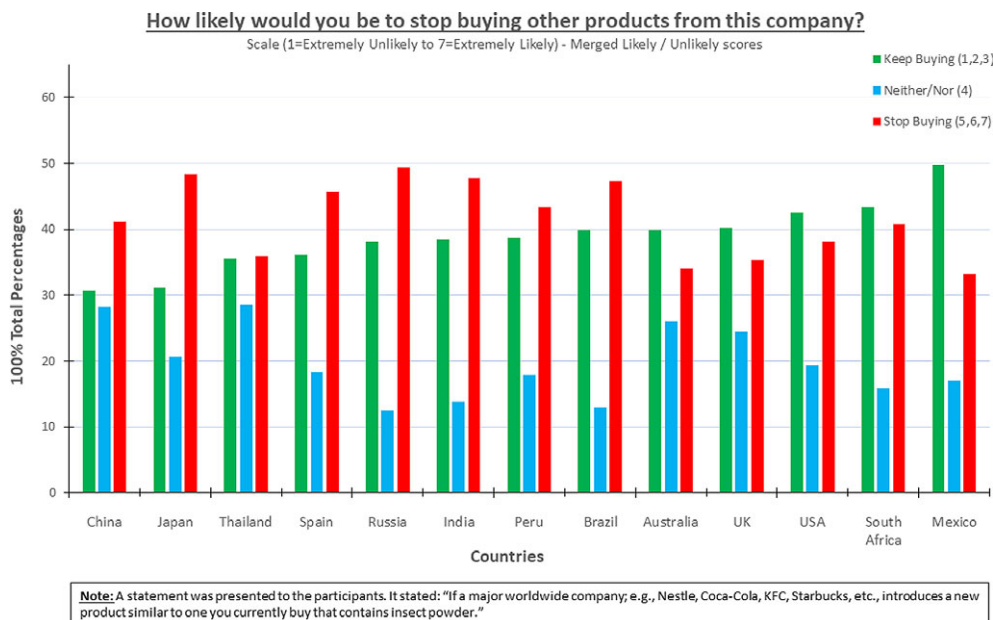


FIGURE 6 Brand equity: percentages of specific results consumers indicated related to future purchases of a brand if that brand introduced an insect based product to its brand portfolio

and males between 35 and 54 years old indicated quite low correlation for those variables ($\tau \sim -0.11$). That shows that the impact of willingness to try insects had little effect on brand equity if companies chose to include insects. The United States is categorized as a “Disgust–Impact on brand equity” country, but the impact is lower than some other countries. Consequently, disgust (or unwillingness to try) was not the major factor in brand equity. However, approximately 40% of US consumers, regardless of their willingness to try insect-based products, would be less willing to eat other products from a brand where some products contained insects.

3.4.2 | Mexico

The highest score on the willingness to try insect based products displayed the lowest score on the likeness to stop buying other products, demonstrating a moderate to strong negative correlation for males and females in addition to the two oldest age groups (Male/35–54 $\tau = -0.33$; Female/35–54 $\tau = -0.24$). Thus, Mexico belongs to the No disgust–Impact on brand equity category. Basically, when the willingness to eat decreases, the likelihood that a person would stop buying other products increases.

3.4.3 | Australia

There is a negative and moderate correlation between gender and ages (e.g., M/35–54 $\tau = -0.276$; F/35–54 $\tau = -0.348$) except for the youngest females and males group. The p -values for these groups are .025 and .425, respectively showing little correlation. Thus, in Australia the disgust factor might affect or impact the brand equity, people most likely will stop buying other products. Australia is the second highest score in terms of buying other products from this specific company, belonging to the category of, “Disgust–Impact on brand equity”.

3.4.4 | China

Chinese consumers showed strong ambivalence for the impact on brand equity. All of the age or gender groups showed little correlation between willingness to eat insects and the brand question. Although they generally do not showed disgust toward insect based products, 41% of the participants would stop buying other products from this company. Therefore, China is nominally part of the “No Disgust, No Impact” group. However, it must be understood that there is a relative high percentage of Chinese consumers (~25%) who were scored as uncertain (neither unlikely nor likely) for both questions. This uncertainty would need to be further investigated, but could indicate an opportunity to develop a new product under a different brand within a company's business units.

3.4.5 | Spain

Over 50% of Spaniards are disgusted by the idea of trying insect products, they also are likely to stop buying other products from this company. The moderate and negative correlation ($\tau \sim -0.35$) predominates among all the age and gender groups except for the young males and females which are uncorrelated. The lower the disgust the slightly higher the impact on the brand equity. In

consequence, Spain is classified in category of “Disgust–Impact on brand equity”.

3.4.6 | Brazil

Brazil is the only country that showed a positive and strong correlation between willingness to eat and the likelihood that they would stop eating other products in a brand ($\tau > 0.70$) for all demographic categories. This powerful relationship is unexpected because it indicates that as people were more willing to eat insect based products, those same people would reject other products in a brand that used insect based ingredients. This is the opposite of what was expected, but indicates that although insect based products could be accepted, they clearly need to be branded differently. Brazil along with Russia, Japan, and India, is one of the top four countries that would stop buying other products from a brand that used insects in some of their products. Our criteria places them in the category of No Disgust–No Impact, but it does provide a different view of impact than those countries.

3.4.7 | India

Fifty-eight percentage of Indians were not willing to try insect based products and 48% were ready to stop purchasing other products from a brand that included insects in their products. A low correlation between these questions places India in the “Disgust–No Impact” category. It is crucial to understand that in this country, the religion factor, which would not allow many consumers to eat insect based products was high (53% of respondents indicated this as a reason for not eating such products). Moreover, when they were asked to provide other reasons for not eating insects, 75% agree that insects carry diseases. In addition, 53% of the participants mentioned that they have an actual allergic reaction to some insects. Although this last factor is unlikely to be literally true, the fact that consumers believe they are allergic means they would not likely eat such products. Those three factors produce a powerful effect on the outcome of willingness to try an insect based product.

3.4.8 | Russia

Consumers from Russia had the highest percentage (63%) who were unlikely to try an insect based product and 49% would stop buying other products from that brand. Negative, moderate correlations were found for all the age groups and genders (e.g., M/18–34 $\tau = -0.245$ and p -value = .001), showing that as willingness to eat insect-based products decreases, the impact on other products in a brand, and thus, brand equity tends to increase. That relationship places Russia in the category of Disgust–Impact on the brand equity.

3.4.9 | South Africa

Consumers in South Africa showed a moderate/strong, negative correlation between willingness to eat and brand equity for all the demographic groups (e.g., M/55+ $\tau = -0.640$; F/55+ $\tau = -0.465$) except for the young males who showed no correlation. South Africans demonstrated that as the willingness to try an insect product reduces, the likelihood that consumers will stop buying other products from that brand increases. For older males and females (over

55 years old), the correlation increased significantly. South Africa is categorized as a Disgust–Impact on brand equity country.

3.4.10 | United Kingdom

British participants were reluctant to try insect based products (49%) and they were likely to stop buying other products in the brand if insects were used as an ingredient. The moderate, negative correlation coefficients displayed an impact on the brand equity. The highest two values were showed in the two oldest female groups (35–54 and 55+) with a correlation of -0.454 and -0.444 , respectively. This places the United Kingdom firmly in the category of “Disgust–Impact on brand equity”.

3.4.11 | Peru

Peruvians generally are willing to try insect based products (58%) placing second behind Mexico in terms of the percentage of the population willing to try insect-based products. However, they also were likely to stop buying other products if insect-based products were introduced by a brand. A negative correlation for willingness to eat and willingness to eating other foods in the brand was found between all the age groups and genders (e.g., M/18–34 $\tau = -0.237$; F/18–34 $\tau = -0.234$), excluding the females over 55 years old. This showed the expected inverse relationship between the two variables under investigation. Consequently, brand equity is affected, and Peru is placed as a No Disgust–Impact on brand equity country.

3.4.12 | Japan

Japan displays a general unwillingness to trying an insect based product (62%). Following this tendency, 48% of the respondents were likely to stop buying other products from the same company. Moreover, the correlation coefficients were negative across all the demographic groups which reflect the expected inverse relationship observed in several of the countries. Japan, thus is a clear Disgust–Impact on brand equity country.

3.4.13 | Thailand

Thailand places third after Mexico and Peru in terms of willingness to try insect based products. Examining the relationship between the two questions shows that with the exception of 35–54 years old males and females and 18–34 years old males who showed little correlation, other demographic groups showed negative correlations as expected. Thailand is the part of the category where although some people are willing to try insect products, there still is an inverse relationship suggesting that as willingness to try decreases, the likelihood that other products in the brand would be rejected is higher, placing Thailand in the No disgust–Impact on brand equity category.

3.5 | External variables

External variables are the reasons that a participant would not consider eating foods containing insect powder as an ingredient. Religion is one reason that does not allow all or certain insects in the participant's diet. A second issue is the concept that insects carry diseases. Lastly is an actual allergic reaction (similar to that for shellfish) to some

insects. See Supporting Information 2 for the total frequency percentages for all the countries.

India was the only country that showed religion as a major influential factor. All other countries had well less than 50% of their consumers who stated this. Connecting religion with the research questions shows why the elevated scores for the unwillingness to try insect products was prevalent in India, where many people are Hindus and Buddhist (both of which suggest, but do not necessarily require, a vegetarian diet). Although Chakravorty (2014) identified about 255 species of edible insects in India, Chakravorty pointed out that most insects are eaten by specific ethnic tribes. Religion would primarily be a factor in countries where religious beliefs about foods could interfere with consumption. For example, Mohamed and Daud (2012) showed that religion definitely impacts the choice of fast food restaurants in Malaysia.

India also showed the highest percentage of people (75%) strongly agreeing that insects carry diseases, which affects the results of the two research questions. Most respondents (>50%) agreed with this in each of the countries, except Mexico. This specific factor should be the starting point for extensive research on zoonotic to educate different populations and countries about the impact of eating insects on disease susceptibility and prevention. That is a clear opportunity for further research.

Allergic reactions to insects were again most commonly reported for India (52.7%) where the participants strongly, somewhat or agree to this reaction. Moreover, India was the only country that showed a positive outcome to allergic reactions when clustering and comparing the seven-point scale values. Japan presented a unique result where the respondents were uncertain when it comes to allergic reactions; 42% selected neither agree nor disagree. Except for Mexico, the rest of the countries followed the same trend as Japan, uncertainly in a large percentage of the population. The uncertainty of the majority of the countries probably relates to the fact that many people have not knowingly tried products with insect-based ingredients. This creates another opportunity for future studies based on allergic reactions. Indeed, more studies are necessary to prove that insects are allergens or not. According to Broekman et al. (2017), shrimp allergic patients are most likely at risk of food allergy to mealworm and other insects.

3.6 | General discussion

Consumers in many countries exhibit food neophobia toward products with insect-based ingredients. Even in countries classed as acceptor countries (for example, Mexico and China), where more people are willing to try such products, there was a portion of the population that would not. In addition, as the willingness to try an insect based product decreased, the impact on brand equity (not eating other foods by that brand) increased. That finding is key because it suggests that if opportunity exists for companies to create products containing insect powder, they must be careful that the disgust factor does not overflow onto other products in the brand. The development of new brands for insect-based products appears more appropriate than revamping existing products to make them higher in protein from insects. Tan, Verbaan, and Stieger (2017) suggested that neophobic

tendencies around disgust will need to be overcome even when good products are available.

This trend generally was true for all countries except for China and India, which did not present a correlation with brand equity. Brazil was different from all other countries showing that as willingness to eat insects increased the willingness to stop eating other products by that brand also increased, which is not explained by the data.

In India and China, religion and allergic reactions have the highest percentages as mentions for not eating insects which may be the reason why willingness to eat and impact on brand do not correlate highly in those countries. Instead there is an influence beyond disgust that impacts those questions. These two countries need further investigation on the external factors that influenced the outcome of the desire to eat insect products.

In several countries, the young males and females did not display a correlation between willingness to eat and impact on brand. Therefore, neophobia may be less of an impact on that age group.

The belief that insects carry diseases was high in almost all countries and this provides a clear research topic for further investigation. Clearly consumers need further education on insect proteins to diminish the barrier disgust toward insect products.

Insect based products or using insect powder as an ingredient is becoming more familiar around the world, but this study suggests that willingness to try an insect-based product is still low. In addition, the purchase intention of other products from this company often may decline because of the impact to brand equity if insects are added to some products in the brand. As large international companies begin to compete in this marketplace, education, and new brands will be needed to overcome neophobic tendencies associated with insects in many countries.

4 | CONCLUSIONS

This research provides a global perspective (13 diverse countries) on the willingness to eat an insect based product and the brand impact of a company adding insect ingredients to a well-known brand. This research suggests that many consumers around the world are not yet willing to try an insect based product. Clearly the advantages of such products (nutritional, environmental, cost, etc.) will need to be communicated more fully and issues such as fear, disgust, and disease will need to be addressed for consumers to embrace insect use as an ingredient. More understanding of issues such as religious and allergy limitations will need to be considered. Younger consumers appear to be more receptive to the idea of insects as food. In addition, analysis by country suggested that some countries such as Mexico, Peru, and Thailand were far ahead of some other countries in their willingness to eat such products.

This study is the first to investigate the impact of a company including insect ingredients on brand equity as it relates to willingness to continue eating other products produced by a company if an insect-based product is introduced into the brand. Results demonstrate a negative correlation is established showing that generally as unwillingness to try increases, the purchase intent toward other products within a brand, even those not containing insect ingredients decreases. Even within some countries where willingness to try a

product containing insect ingredients was high, a substantial number of people indicated they would stop buying other products from that brand. This indicates that new products containing insect based ingredients will need to be developed under new brands that do not implicate and potentially compromise existing brands.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

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