International Journal of Innovative Research and Scientific Studies, 8(2) 2025, pages: 3110-3121

IJIRSS
International Journal of Innovative Research & Scientific Studies

ISSN: 2617-6548

URL: www.ijirss.com

The cultural acceptability of insects as food: An empirical study in Cambodia

Alexander Franco

Faculty of Business, CamEd Business School College, Phnom Penh, Cambodia.

(*Email: gappfranco@cam-ed.com*)

Abstract

This is a pioneering study regarding Cambodia that examined aspects of entomophagy (the consumption of edible insects) in that country. An inferential sample of the undergraduate population of a business college in Phnom Penh was drawn based on convenience sampling. The respondents provided data by answering an anonymous, self-administered questionnaire that contained seven demographic independent variables (gender, year of study, where the respondent was raised - urban vs. rural, religion, socio-economic family status, perceived risk to human health, and prior consumption of edible insects). The questionnaire also contained thirty attitudinal questions measured on Likert scales. The study found that gender was not a significant factor in receptivity to consuming insects. However, year of academic study, where the respondent was raised, religion, socio-economic family status, and perceived risk to human health (a manifestation of food neophobia) all had partial support. The study also found strong support for consuming beef, pork, chicken, and fish from animals that were fed insects as feed. This study contributes to the sparse academic literature on the commercialization of insects as food since the marketing component of any adoption strategy requires knowledge of the degree of receptivity by the different segments of a given population.

Keywords: Cambodia, Edible insects, Entomophagy, Environmental sustainability, Food neophobia.

DOI: 10.53894/ijirss.v8i2.5954
Funding: This study received no specific financial support.
History: Received: 27 February 2025 / **Revised:** 28 March 2025 / **Accepted:** 1 April 2025 / **Published:** 4 April 2025

Competing Interests: The author declares that there are no conflicts of interests regarding the publication of this paper.
Transparency: The author confirms that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.
Institutional Review Board Statement: Ethical approval was granted (Reference # CAM24-1028S, dated 09/05/24) by the institution's review board for human subject participation that involved using a voluntary and anonymous, self-administered questionnaire in a classroom setting with the informed consent of the participants.
Publisher: Innovative Research Publishing

1. Introduction

Insect consumption, known as entomophagy, has a long history as a traditional practice in various cultures worldwide and is gaining attention as a sustainable alternative to conventional protein sources. With the global population projected to reach almost ten billion by 2050, ensuring food security while minimizing environmental impact is a critical challenge [1]. Edible insects have been proposed as a solution due to their high nutritional value, efficient feed conversion rates, and reduced

greenhouse gas emissions compared to livestock production [2-5]. Despite these benefits, the acceptability of insect consumption varies widely across cultures, influenced by socio-cultural, psychological, economic, and regulatory factors.

Cultural perceptions of insects as food vary significantly across regions. In many parts of Asia, Africa, and Latin America, insects are a traditional dietary component, consumed for their taste, nutritional value, and availability. Conversely, in Western cultures, entomophagy is generally viewed with aversion, often rooted in socio-cultural norms that associate insects with filth and health threats [6]. The disgust factor, a psychological barrier to eating insects, is prevalent in these regions and represents a significant challenge to the industry's expansion. Food neophobia, the fear or reluctance to consume new or unfamiliar foods, plays a significant role in shaping dietary choices and cultural food acceptance [7, 8]. This psychological trait can influence people's willingness to explore novel food sources, including edible insects that can serve as a sustainable and nutrient-rich alternative to traditional animal proteins. In many countries, but particularly in Western ones, food neophobia presents a barrier to the acceptance of insects as food. Insects, despite being a common dietary component in parts of Africa, Asia, and Latin America, are often perceived in the West as unhygienic or unpleasant. This negative perception is driven by cultural biases, lack of exposure, and the association of insects with pests. Consequently, individuals with high levels of food neophobia may reject insect-based foods without consideration of their nutritional and environmental benefits.

Southeast Asia is a region where the consumption of insects has deep cultural roots and is practiced widely as part of traditional diets. In particular, Cambodia, Laos, Thailand, and Vietnam have long histories of entomophagy, with various species playing significant roles in local cuisine and food security. In Thailand, the edible insect industry has become a multi-million-dollar industry, with over 20,000 small-scale farms producing crickets and other insects for domestic consumption and export [9, 10].

In Cambodia, insects are widely consumed as both snacks and ingredients in traditional dishes. Commonly eaten species include crickets, grasshoppers, giant water bugs, silkworm pupae, tarantulas, and red tree ants. Among these, fried tarantulas (a-ping) have become particularly famous, not only as a local treat but also as a novelty for tourists [11].

The acceptability of insect consumption is influenced by cultural factors, as well as psychological and sensory factors, such as taste, texture, and presentation. Studies suggest that consumers are more likely to accept insect-based foods when the insects are processed and displayed in familiar forms such as cooked dishes, protein bars, and powders [12, 13]. Another potential issue regarding the acceptability of insects is the impact of globalization and urbanization. Younger Cambodians, particularly in urban locations like Phnom Penh and Siem Reap, are adopting more Westernized diets, and many perceive insect consumption as old-fashioned or undesirable.

Even though Cambodia is a nation with deep-rooted entomophagy traditions, no empirical studies in that country have been conducted that examine variables dealing with the acceptability of insects as food. Therefore, this is a pioneering study that seeks to address the following research questions:

1. Which insects are considered acceptable for consumption by Cambodians?
2. Do the specific demographic variables of gender, academic year of study, where the respondent was raised (Phnom Penh vs. provinces), religious identification, socio-economic status of the family, perceived risk to human health, and prior consumption of insects impact the acceptability of insects as food?
3. Will respondents consume meat products (specifically chicken, beef, pork, or fish) from animals that were raised on insect feed?
4. Will expressed food neophobia affect receptivity toward accepting insects as food?

2. Literature Review

The body of academic literature regarding entomophagy is limited as to geographic diversity. Most have focused on studying the attitudes of Europeans, Guiné et al. [14]; IPIFF [15], and Sogari et al. [16]. Sogari et al. [16] examined 102 studies on entomophagy and found most were conducted in Europe and that only two were performed in Southeast Asia (the two, specifically, in Thailand). However, another was performed in Myanmar [17]. No empirical studies on this subject were conducted in Cambodia.

A second limitation on the existing literature is the disproportional reliance on disgust scales that place too much emphasis on negativity [18-20]. In a study by La Barbera et al. [21], an Entomophagy Attitude Questionnaire was administered, where 11 of the 33 questions contained the word "disgust," or "sickens," or the phrases "stomach-churning" and "turn my stomach" (p. 3). In contrast, this study focused on a broader scope of investigation that examined seven demographic variables and thirty-three attitudinal questions that covered aspects of food neophobia but also examined a wide range of other variables affecting entomophagy.

Regarding gender, the preponderance of the literature found that males were more receptive to insects as food than females [22-26]. However, other studies found little to no difference based on gender [17, 27-29].

H_1: There will be a statistically significant difference in ratings of the receptivity statements by gender.

The age range of respondents for this study was 18 to 23 years old, which was too narrow for statistical analysis. Therefore, the demographic variable of age could not be used. However, by examining the academic year of study, an assessment could be made as to whether increasing exposure to knowledge in a program of higher education increases receptivity to insects as food. No previous empirical studies have examined the impact of entomophagy on the year of higher education study.

H_2: There will be a statistically significant difference in ratings of the insect statements by academic year in college (Freshman, Sophomore, Junior, and Senior).

No academic literature exists on an empirical representation of urban (in this case, the capital city of Phnom Penh) versus rural (Cambodian provinces outside the capital), by way of inferential sampling within Cambodia, to assess the impact of receptivity of insects as food, based on where the respondent was raised. Only one study (performed in Zimbabwe) indicated that there was less preference for edible insects in urban areas than in rural ones [30].

H_3: There will be a statistically significant difference in ratings of the insect statements by where the respondent was raised, in Phnom Penh vs. other provinces.

The impact of religion on entomophagy was examined by Aung et al. [17], who found no difference in receptivity to insects as food. However, the study, conducted in Myanmar, compared Buddhists to Muslims. This study compared Buddhists to Christians. In studies involving European nations (with mostly Christians as respondents), expressions of non-entomophagy were higher.

H_4: There will be a statistically significant difference in ratings of the insect statements by religion (Buddhist vs. Non-Buddhist).

Regarding self-identified socio-economic status, the majority of studies that used this variable [25, 30, 31] found that those with higher incomes were less receptive to edible insects, while other studies found that socio-economic status made no difference [27, 29].

H_5: There will be statistically significant differences in the ratings of insect statements by self-reported socio-economic family status.

Most studies that addressed food neophobia found that fear significantly affected the willingness to eat insects, citing health concerns about food safety (e.g., cleanliness of insects), allergies, lack of nutritional value, and contaminants [17, 22, 24, 25, 29]. However, a couple of studies found that perceived nutritional value was not a significant predictor [14, 21].

H_6: There will be statistically significant differences in mean ratings of perceived risk to human health associated with eating insects for the low probability versus the high probability of eating insects groups.

As to insect-based feed, the academic literature is sparse, with the vast majority of the studies indicating that respondents were receptive to consuming animal products where the feed provided for the animals consisted of insects [22, 23, 32-35]. However, no particular research inquiry addressed all of the following: beef, pork, fish, and chicken in one study, thus making this study unique.

H_7: There will be significant differences in mean probability ratings for beef raised on insects relative to the mean probability rating for the combined nine insects in the study.

H_8: There will be mean probability rating differences for pork raised on insects vs. the mean probability rating for eating the nine insects.

H_9: There will be mean probability rating differences for fish raised on insects vs. the mean probability rating for eating the nine insects.

H_{10}: There will be mean probability rating differences for chicken raised on insects vs. the mean probability rating for eating the nine insects.

Finally, a review of the academic literature on entomophagy found that those who have familiarity with edible insects by way of prior consumption were more receptive to incorporating edible insects into their diet [36-40].

H_{11}: There will be statistically significant differences in the ratings of insect statements by prior consumption vs non-consumption of insects.

3. Research Design and Methodology

The undergraduate population of a business-oriented college in Phnom Penh, Cambodia, was studied based on convenience sampling. The Krejcie and Morgan [41] table was utilized to create an inferential sample of 327 respondents from a general population of 2,127 students. Regarding the demographic (independent) variables being examined, the sample reflected the general population percentage breakdown in terms of gender and year of study: females (222 respondents in total, representing 68% of both the sample and general populations) and males (105 respondents in total, representing 32% of both the sample and general populations). In terms of study by year, respondents were selected to match the actual percentages of the general population: Year 1 (freshman) consisted of 89 respondents or 27% of the general and sample populations; Year 2 (sophomore) consisted of 76 respondents (23%); Year 3 (junior) consisted of 85 respondents (26%); and Year 4 (senior) consisted of 77 respondents (24%). The school's administration had no specific data for the demographic variables regarding where the respondents grew up, their socio-economic family status, or their religious affiliation.

The study operationalized receptivity variables (see Table 1) into a set of statements to which respondents were requested to indicate their level of agreement on a five-point Likert scale from "Strongly Disagree" (value of 1) to "Strongly Agree" (value of 5).

An anonymous, self-administered paper questionnaire, consisting of seven demographic variables and thirty attitudinal questions, was administered in a classroom setting. Potential respondents were informed that participation was voluntary and that non-participation would not adversely impact the student. Informed consent was obtained from all subjects involved in the study. The process was anonymous, with respondents instructed not to write their name or student identification number. The questionnaires were in Khmer and had previously been translated into Khmer from English and translated back by a native speaker of Khmer to assess for any loss in translation [42]. A pretested questionnaire in Khmer was then administered to the inferential sample population. The thirty attitudinal statements used are listed in Table 1 in the order in which they were presented in the survey. The reliability analysis for these statements produced a Cronbach's Alpha of .775, exceeding the .70 requirement for internal consistency [43].

4. Data Presentation and Discussion of Findings

There was a total of 327 students who participated in this study. Participants were requested to respond to a series of 30 items examining opinions and beliefs about eating various insect-related food products, and also their willingness to try new food products. Ratings ranged in a Likert-scale format from 5 (High Probability) to 1 (Low Probability) or 1 (Strongly Disagree) to 5 (Strongly Agree) depending on the statement. Photographs of prepared meals involving edible insects were displayed on the questionnaire alongside the relevant questions to aid the respondent in making a choice. The subject of each of the questions is provided in Table 1 in the same order as presented in the survey.

Table 1.
Listing of topics covered in the survey's attitudinal questions.

Item Number	(Where 1 = Low Probability to 5 = High Probability)	$\bar{X}$	SD
	I am willing to eat animal raised with food from insects		
1	Chicken Insect Fed	3.57	1.048
2	Beef Insect Fed	3.37	1.234
3	Fish Insect Fed	3.25	1.144
4	Pork Insect Fed	2.92	1.236
	I am willing to eat a type of insect		
5	Crickets/Grasshoppers	2.75	1.245
6	Ants (many species)	2.04	1.080
7	Mealworms	1.92	0.969
8	Small Stink Bugs	1.35	0.747
9	Silkworm Larvae	1.86	0.929
10	Bees /Wasps	1.63	0.985
11	Beetles	1.72	1.013
12	Large Water Bugs	3.46	1.570
13	Tarantulas	1.80	1.136
14	I'm more likely to eat food where I can't see the actual insect	3.48	1.294
15	I would eat unprocessed (raw) food made from insects	1.56	1.028
16	I would eat processed (cooked & packaged) food made from insects	2.72	1.298
Food Neophobia and Beliefs About Eating Insects (Where 1 = Strongly Agree and 5 = Strongly Disagree)			
17	Eating insects is a risk to human health	3.37	1.006
18	Eating insects is good for the environment	2.97	0.817
19	In the future, most people will eat insects	2.80	0.901
20	Eating insects is immoral	2.82	0.841
21	Eating insects is for people with limited resources	2.48	0.854
22	I would be disgusted to eat any food with insects	3.30	0.963
23	I constantly try new and different foods	3.44	0.976
24	I don't trust new food	2.67	0.808
25	If I don't know a meal, I don't try it	2.87	0.965
26	Foreign food is too strange to eat	2.43	0.956
27	At dinners/events where I am invited, I try new foods	3.61	0.710
28	I'm afraid to eat things I've never eaten before	2.96	0.929
29	I eat almost anything	2.79	1.030
30	I like to try new foreign food restaurants	3.83	0.875

As indicated in the means and standard deviations presented above, there is a good bit of variation in how people responded to the items on the survey. The question, therefore, became: are these differences generally equally spread across the population, or do mean ratings vary significantly by group?

In order to address this question, tests for mean differences across groupings were performed. Table 2 begins by providing group membership totals for the groups of gender, year in college, location growing up, and religion for the sample.

Table 2.
Grouping Variables.

Gender		University Classification				Location Growing Up		Religion*	
Male	Female	Fr.	Soph.	Jr.	Sr.	Phnom Penh	Provinces	Buddhist	Non-Buddhist
105	222	89	76	85	77	164	163	295	27

Note: *The non-Buddhists identified as being Christians.

The first hypothesis suggested that there would be statistically significant differences in the mean ratings of the statements about insects and foods by gender. In order to test that assertion, a t-test was performed between the two groups.

Out of the 33 statements rated by men and women students only one, Trying New Foods at Events was found to have been rated significantly different by the two gender groups (t = -2.469, df = 176.227, p = .015 mean difference = -.219) with females being less likely to try new foods than males (females $\bar{X}$ = 3.68, sd = .661 vs. males $\bar{X}$ = 3.46, sd = .661). Since the Levene test indicated a violation of homogeneity of variance, the option not to assume homogeneity was used. Hypothesis 1 received only minimal support, with only one significant mean difference between gender groupings out of the 30 statements that the two groups rated.

The second hypothesis suggested differences in mean ratings by academic year/university classification (i.e., Freshman, Sophomore, Junior, and Senior). In order to test this hypothesis, a MANOVA test was selected as the appropriate statistical tool, and because the Levene test indicated that the assumption of homogeneity of distributions was violated, the more robust Welch test was selected to be used [44]. There were no significant differences in the mean ratings for the four groups across all 30 of the statements that the groups rated. The university classification groupings are a single population when it comes to their ratings of statements regarding insects. Hypothesis 2 was rejected.

Hypothesis 3 suggested that there would be statistically significant mean ratings of the insect statements by groupings of persons who were raised in Phnom Penh versus those who were raised in the provinces. In order to test this hypothesis, a t-test was performed on the two groupings for the 30 statement ratings. The results of that test are provided in Table 3.

Table 3.
T-test Results of Mean Insect-Statement Ratings by Where Respondent Was Raised.

Location							
	Phnom Penh		**Provinces**				
Receptivity Statement	**(164)**		**(163)**		**Mean**		
	M	**SD**	**M**	**SD**	**Differ**	**t**	**p**
Chicken Insect Fed[1]	3.18	0.984	3.96	0.964	-.780	-7.240	< 0.001
Beef Insect Fed[1]	2.58	1.009	4.17	0.877	-1.586	-15.178	< 0.001
Fish Insect Fed[1]	2.63	0.972	3.87	0.959	-1.231	-11.525	< 0.001
Pork Insect Fed[1]	2.24	1.056	3.61	1.003	-1.370	-12.026	< 0.001
Eat Crickets/Grasshoppers[1]	2.00	1.080	3.50	0.898	-1.503	-13.687	< 0.001
Eat Ants[1]	1.62	1.036	2.47	0.951	-0.850	-7.732	< 0.001
Eat Mealworms[1]	1.46	0.955	2.20	0.833	-0.745	-7.518	<0 .001
Eat Small Stink Bugs[1]	1.26	0.715	1.44	0.770	-0.179	-2.184	0.030
Eat Silkworm Larvae[1]	1.55	0.942	2.17	0.811	-0.611	-6.286	< 0.001
Eat Bees/Wasps[1]	1.46	0.942	1.80	0.999	-0.346	-3.225	0.001
Eat Beetles[1]	1.33	0.807	2.10	1.052	-0.775	-7.477	< 0.001
Eat Large Water Bugs[1]	2.80	1.737	4.12	1.023	-1.318	-8.365	< 0.001
Eat Tarantulas[1]	1.57	1.151	2.02	1.077	-0.451	-3.660	< 0.001
Eat Insect Risk to Health[2]	3.50	1.018	3.24	0.980	0.261	2.359	0.019
Eat Insect Immoral[2]	2.98	0.847	2.66	0.804	0.325	3.561	< 0.001
Eat Insect - People with Limited Resources[2]	2.62	0.703	2.34	0.964	0.284	-3.046	0.003
Disgusted by Food with Insect[2]	3.45	1.087	3.15	0.795	0.304	2.887	0.004
Constantly Try New Foods[2]	3.63	1.005	3.25	0.909	0.382	-3.603	<0.001
Don't Trust New Foods[2]	2.53	0.750	2.80	0.841	-0.277	3.145	0.002
Eat Almost Anything[2]	2.93	1.116	2.65	0.917	0.280	-2.479	0.014
Like Trying Foreign Food[2]	3.93	0.800	3.73	0.937	0.203	2.106	0.036

Note: [1] Where 1 = Low Probability to 5 = High Probability
[2] Where 1 = Strongly Agree and 5 = Strongly Disagree.

Out of the 30 statement ratings for the two groups, 19 or 63.3% of the statements received statistically significant mean rating differences. Where the statement required an assessment of probability to engage in insect-eating behavior, those who were raised in the provinces indicated significantly higher probabilities of engaging in those behaviors for all 9 of the statistically significant mean rating differences. For only one rating of probability did the two groups not differ: Eating Insect Food when you Cannot See the Insect. This indicates a consistently higher likelihood of eating insect-related foods for those persons raised in the provinces. In looking at the statements to which the groups were to express their level of agreement, those from Phnom Penh had significantly higher agreement with Eat Almost Anything, Constantly Try New Foods, People Who Ate Insects Have More Limited Resources Eat More Insects, and Like Trying Foreign Foods, while those from the provinces scored higher with Did Not Trust New Foods, were less likely to be Disgusted by Insect Foods, and were more likely to disagree that Eating Insects is a Risk to Human Health or is Immoral to Eat. Based on the mixed results reported, this Hypothesis 3 is partially supported.

The next hypothesis, Hypothesis 4, indicated that there would be statistically significant mean differences by religion, which for this population included Buddhists and non-Buddhists (who identified as Christians). In order to detect these differences, a t-test was run on the data. Again, the option not to assume equal variances for the two groups was utilized where appropriate. The results of this analysis are presented in Table 4.

Table 4.
T-test Results of Mean Insect-Statement Ratings by Religion.

Religion							
	Buddhist (295)		**Non-Buddhists* (27)**				
Insect-Statement	**M**	**SD**	**M**	**SD**	**Mean Differ**	**t**	**p**
Chicken Insect Fed[1]	3.67	1.003	3.09	1.159	0.576	3.773	<0.001
Beef Insect Fed[1]	3.45	1.254	3.00	1.106	0.446	2.658	0.009
Pork Insect Fed[1]	3.01	1.228	2.44	1.198	0.575	3.175	0.002
Eat Crickets/Grasshoppers[1]	2.97	1.190	1.76	0.942	1.210	7.093	< 0.001
Eat Ants[1]	2.15	1.108	1.56	0.788	0.590	4.680	< 0.001
Eat Mealworms[1]	1.93	1.005	1.38	0.623	0.551	5.288	<0 .001
Eat Silkworm Larvae[1]	1.99	0.938	1.27	0.560	0.712	7.514	< 0.001
Eat Bees/Wasps[1]	1.72	1.050	1.24	0.429	.486	5.627	< 0.001
Eat Large Water Bugs[1]	3.71	1.458	2.36	1.648	1.344	5.613	<0.001
Eat Tarantulas[1]	1.68	0.922	2.44	1.751	-0.758	-3.125	0.003
Can't See Actual Insect[1]	3.67	1.116	2.45	1.597	1.212	5.367	< 0.001
Eat Processed Insect Prod[1]	2.60	1.318	3.38	1.009	-0.786	-4.971	< 0.001
Eat Insect Risk to Health[2]	3.49	0.959	2.76	0.999	0.731	5.108	<0.001
Foreign Food Strange[2]	2.34	0.946	2.89	0.896	-0.550	-3.962	< 0.001
Eat Almost Anything[2]	2.84	1.009	2.53	1.103	0.308	2.028	0.043

Note: *The non-Buddhists identified as being Christians.
[1] Where 1 = Low Probability to 5 = High Probability
[2] Where 1 = Strongly Agree and 5 = Strongly Disagree.

Of the 30 mean comparisons, 15 statements (50.0%) had significantly different mean ratings for the two groups. With the exception of Eat Tarantulas, Eat Process Insect Products, and Foreign Food Strange, Buddhists had consistently higher mean ratings than did non-Buddhists, indicating higher probabilities of eating insect-related foods as compared to the non-Buddhists. Mean differences between the groups were highest for Eat Crickets/Grasshoppers (1.210), Eat Large Water Bugs (1.344), and Can't See Actual Insect (1.212), with Buddhists exhibiting higher mean ratings and, greater probability of eating for each. Based on this outcome, Hypothesis 4 was partially supported.

The survey also collected data from respondents, allowing for additional comparisons of mean statement ratings. This included a self-report as to whether or not the respondent had eaten insects before, a Low vs. High mean probability of consuming the nine insect types examined in this study, and a self-report of socio-economic status as Below Average, Average, or Above Average. The numbers of members in each group are presented in Table 5.

Table 5.
Grouping Variables.

Ate Insects Before		**Mean Probability of Eating 9 Insect Types**		**Self-Report Socio-Economic Family Status**		
Yes	**No**	**Low**	**High**	**Below Average**	**Average**	**Above Average**
243	84	179	148	60	224	43

Hypothesis 5 suggests that the mean ratings of the insect-food related statements would vary significantly by students' self-reporting of socio-economic family status. MANOVA with the Welch test was once again selected for examining the data for significant mean differences. The results of this test are presented in Table 6.

Table 6.
Statistically Significant Differences in Mean Ratings by Socio-Economic Family Status.

Statement	**Source**	**DF**	**SS**	**MS**	**F**	**Welch's F**	**p**
Chicken Insect Fed	Between	2	8.790	4.395	4.074	4.945	0.009
	Within	324	349.546	1.079			
	Total	326	358.336				
Beef Insect Fed	Between	2	58.366	29.183	21.594	41.946	< 0.001
	Within	324	437.860	1.351			
	Total	326	496.226				
Fish Insect Fed	Between	2	46.525	23.262	19.813	28.092	< 0.001
	Within	324	380.411	1.174			
	Total	326	426.936				
Pork Insect Fed	Between	2	51.657	25.828	18.752	24.582	< 0.001
	Within	324	446.276	1.377			
	Total	326	497.933				
Eat Crickets/Grasshoppers	Between	2	66.682	33.341	24.621	22.302	< 0.001

	Within	324	438.755	1.354			
	Total	326	505.437				
Eat Ants	Between	2	9.788	4.894	4.278	5.630	0.005
	Within	324	390.695	1.144			
	Total	326	380.483				
Eat Mealworms	Between	2	6.056	3.028	3.266	4.368	0.016
	Within	324	300.354	0.927			
	Total	326	306.410				
Eat Small Stink Bugs	Between	2	5.791	2.895	5.325	16.581	< .001
	Within	324	176.160	.544			
	Total	326	181.951				
Eat Silkworm Larvae	Between	2	29.947	14.974	19.284	*	< 0.001[b]
	Within	324	251.582	0.776			
	Total	326	281.529				
Eat Bees/Wasps	Between	2	17.119	8.560	9.272	*	< 0.001 [b]
	Within	324	299.107	0.923			
	Total	326	316.226				
Eat Beetles	Between	2	15.784	7.892	8.022	53.948	< 0.001
	Within	324	318.766	.984			
	Total	326	334.550				
Eat Giant Water bugs	Between	2	94.808	47.404	21.679	21.726	< 0.001
	Within	324	708.464	2.187			
	Total	326	803.272				
Eat Tarantulas	Between	2	16.458	8.229	6.596	18.820	< 0.001
	Within	324	404.221	1.248			
	Total	326	420.679				
Eat Raw Insect Food	Between	2	5.716	2.858	2.734	6.403	0.002
	Within	324	338.748	1.046			
	Total	326	344.465				
Eat Insect Risk Health	Between	2	8.363	4.181	4.209	3.165	0.048
	Within	324	321.863	0.993			
	Total	326	330.226				
Eat Good for Environment	Between	2	44.876	22.438	42.067	53.480	< 0.001
	Within	324	172.818	0.533			
	Total	326	217.694				
Most Eat in Future	Between	2	7.370	3.685	4.640	3.784	0.028
	Within	324	257.309	0.794			
	Total	326	264.679				
Eat Insect Immoral	Between	2	9.967	4.983	7.326	6.208	0.003
	Within	324	220.388	.680			
	Total	326	230.355				
Eat with Limit Resources	Between	2	7.111	3.556	0.4999	4.304	0.017
	Within	324	230.467	3711			
	Total	326	237.578				
Constant try New Food	Between	2	22.150	11.075	12.440	15.154	< 0.001
	Within	324	288.437	.890			
	Total	326	310.587				
Don’t Trust New Food	Between	2	8.759	4.379	6.958	5.679	0.005
	Within	324	203.908	0.629			
	Total	326	212.667				
Don’t Know Don’t Try	Between	2	18.901	9.451	10.765	10.078	< 0.001
	Within	324	284.444	0.878			
	Total	326	303.346				
Foreign Food Strange	Between	2	19.672	9.836	11.454	11.323	< 0.001
	Within	324	278.242	0.859			
	Total	326	297.914				
Try New at Event	Between	2	6.836	3.418	7.073	15.222	< 0.001
	Within	324	157.274	0.485			
	Total	326	164.110				
Afraid of Never Eaten	Between	2	11.772	5.886	7.073	8.907	< 0.001

	Within	324	269.629	0.832			
	Total	326	281.401			9.585	<0.001
Like Try Foreign Food	Between	2	16.480	8.240	11.445		
	Within	324	233.269	0.720			
	Total	326	249.749				

Note: * Welch test was not applicable since at least one group had zero variance.

A Howell-Games post hoc test examined a total of 99 pairings of mean ratings for the statements made by the students. Out of these pairings, a total of 54 (54.5%) were found to have mean statement ratings that were significantly statistically different. A total of 38 (70.4% of the total found to be significantly different) of these statistically significant differences were found between the group self-rated as socio-economically high vs. the self-reported low group (20 pairings, 52.6%) and the self-reported medium socio-economic group (18 pairings, 47.4%). The group identified as low appeared in 36 statistically different pairings, of which 16 pairings (44.4%) were with the group identified as medium and 20 (55.6%) with the group identified as high socio-economically. The medium group appeared in 34 pairings (63.0% of the total found to be significantly different) and the low group appeared in 36 pairings (66.7% of the total found to be significantly different). So, with appearances by the low group in 66.7% of the parings, 63.0% for the medium group, and 70.4% for the high group, all groups had roughly equal representation in the groups appearing in the statistically significantly different pairings. Based on this empirical evidence, partial support was provided for Hypothesis 5. In sum, those with self-identified high socio-economic family status had lower receptivity to acceptance of insects as food than those with a self-identified lower socio-economic family status.

The next hypothesis, Hypothesis 6, was designed to examine a possible rationale for why individuals vary significantly in their mean ratings regarding the probability of eating insects. The hypothesis was tested to determine if there would be statistically significant differences in mean ratings of perceived risk to human health associated with eating insects for the low probability versus the high probability of eating insects groups.

The low vs. high probability of eating insects groups were formed by summing the mean probability of eating the nine insect types for each respondent and dividing that total by 9 to get a mean average probability rating for all of the insect types. While probability of eating ratings were relatively low across the entire sample, with only two respondents having a mean probability rating of over 4 out of 5 ($\bar{X}$ = 4.44 and 4.56) and three respondents reporting 3 or more out of 5 ($\bar{X}$ = 3.00, 3.33, and 3.44), a mid-point for the sample's mean ratings was identified. Those with a mean of 2.12 or lower fell into the low probability group, and those with a mean of 2.13 or greater fell into the high probability group. This, as can be seen in Table 5, resulted in two groups (179 vs. 148). A t-test conducted on the two resulting groups indicated that their mean probability rating scores were statistically significantly different, with the low group's mean at $\bar{X}$ = 1.52, SD = 0.371, and the high group mean at $\bar{X}$ = 3.51, SD = 0.956, t = 24.839, p < .001.

In order to determine statistically significant differences in perceived risk to human health due to insect consumption, a t-test was conducted on mean responses to the statement: Eating Insects is a Risk to Human Health. Recall that higher mean ratings indicate higher levels of agreement with the statement. The mean Risk rating for the Low group was $\bar{X}$ = 3.51, SD = .956, and the High group had a mean of $\bar{X}$ = 3.20, SD = 1.041, t = 2.876, p = .004. Therefore, Hypothesis 6 was supported. Fear of the unknown, as well as perceived health risk, constituted reasons why respondents chose not to consume insects.

This study's survey asks respondents to rate their probability of eating four various meat products if the animals from which they came were fed a diet of insects. The question then became: will respondents have significantly different mean probability ratings of eating these four meat products relative to those ratings for eating the insects themselves? To test this, a set of four related hypotheses was tested. The first of these stated that there would be significant differences in mean probability ratings for beef raised on insects relative to the mean probability rating for the combined nine insects in the study. The second stated that there would be mean probability rating differences for pork raised on insects vs. the mean probability rating for eating the nine insects. The next stated that there would be mean probability rating differences for fish raised on insects vs. the mean probability rating for eating the nine insects. The final of these mean comparisons suggested that there would be mean probability rating differences for chicken raised on insects vs. the mean probability rating for eating the nine insects.

In order to test these Hypotheses, 7 to 10, a t-test was conducted on the data comparing the mean probability rating of the nine combined insect types ($\bar{X}$ = 2.048, SD 0.719) against mean probability ratings for the four meat products raised on insects (see Table 1). The results of this test are provided in Table 7.

Table 7.
T-test Results of Mean Probability Ratings for Insect-Fed Meats vs. Combined Insect Eating Rating.

Mean Probability ratings For Eating Meat Raised on Insects vs. Eating Insects							
	Meat from Insect-Fed Animals		**Combined 9 Insect Types**				
					Mean		
Meat Type[1]	**M**	**SD**	**M**	**SD**	**Differ**	**t**	**p**
Beef	3.37	1.234	2.048	0.719	1.322	19.383	> 0.001
Pork	2.92	1.236	2.048	0.719	0.873	12.772	> 0.001
Fish	3.25	1.144	2.048	0.719	1.200	18.964	> 0.001
Chicken	3.57	1.048	2.048	0.719	1.518	26.185	> 0.001

Note: [1] Where 1 = Low Probability to 5 = High Probability.

As indicated in the table, respondents rated eating the various meat products coming from animals fed insects significantly more probable than eating the nine types of insects directly. Three of the four meat types were rated over one point higher than the insects on the five-point scale. Pork that was fed insects was the one type of meat raised on insects that was closest in probability of eating to the combined insects, and yet that mean was still significantly more probable to be consumed than the insects. Based on these findings, beef, pork, fish, and chicken—all meat products based on insect feed—were found to have statistically significant higher mean ratings of respondents being willing to eat these products than the mean rating for consuming the nine insect types. These four hypotheses are all supported.

The last hypothesis, Hypothesis 11, stated that there will be statistically significant differences in mean statement ratings by whether the respondent had eaten insects prior to participation in this study. In order test this hypothesis, a t-test was performed on the ratings of the two groups. The results of this analysis are presented in Table 8.

Table 8.
T-test Results of Mean Insect-Statement Ratings by Prior Consumption of Insects.

Eaten Insects Before?							
	Yes		**No**				
	(243)		**(84)**		**Mean**		
Statement	**M**	**SD**	**M**	**SD**	**Differ**	**t**	**p**
Eat Bees/Wasps[1]	1.74	1.077	1.31	0.537	0.431	4.760	< 0.001
Eat Tarantulas[1]	1.88	1.247	1.57	0.682	0.305	2.793	0.006
Eat Raw Insect Food[2]	1.64	1.037	1.35	0.976	0.293	2.331	0.021
Eat Processed Insect Food[2]	2.97	1.268	2.01	1.114	0.959	6.560	<0.001
Eat Insect Risk to Health[2]	3.26	1.019	3.68	0.907	-0.415	-3.309	0.001
Eat Insect Good Environment[2]	3.03	0.810	2.80	0.818	0.231	2.238	0.027
Most Eat Insects in Future[2]	3.00	0.884	2.20	0.655	0.802	7.620	<0 .001
Eat Insects is Immoral[2]	2.73	0.886	3.08	0.625	-3.55	-3.998	< 0.001
Eat Insect Limit Resource[2]	2.59	0.915	2.14	0.518	0.450	5.518	<0 .001
Disgusted by Insect Food[2]	3.16	0.967	3.71	0.830	-0.558	-4.722	<0.001
Don't Trust New Foods[2]	2.31	0.772	2.79	0.806	-0.481	4.862	< 0.001
Foreign Food Strange[2]	2.05	0.940	2.56	0.904	-0.508	4.394	<0 .001
Afraid Never Eaten Food[2]	2.71	0.987	3.04	0.687	-0.327	3.333	0.001
Eat Almost Anything[2]	2.89	1.019	2.50	1.012	0.393	3.053	0.002

Note: 1 Where 1 = Low Probability to 5 = High Probability
2 Where 1 = Strongly Agree and 5 = Strongly Disagree

As depicted in the table, 14 of the 30 statements (46.7 percent) were shown to be statistically significantly different in mean statement ratings. However, as opposed to what was shown in Table 3, when differences were examined for the statements by whether persons had previously consumed insects, the majority of the differences were in statements relating to the probability of consuming various types of insect foods. Unsurprisingly, prior consumers of insects indicated a lower neophobic attitude regarding insect consumption by having higher mean ratings for consumption of insects a Risk to Health (3.26 vs. 3.68), viewing Eating Insects as Immoral (2.73 vs. 3.08) and being Disgusted by Insect Food (3.16 vs. 3.71). Based the statistically significant mean rating differences, Hypothesis 11 received partial support.

5. Conclusion and Recommendations for Future Research

In sum, a total of eleven hypotheses were proposed. The results of the tests of these hypotheses are presented in Table 9.

Table 9.
Hypotheses and Results.

Hypothesis	**Result**
H_1: There will be a statistically significant difference in the ratings of the insect statements by gender.	Minimal Support: 1 of 30 Statements
H_2: There will be a statistically significant difference in ratings of the insect statements by academic year in college (Freshman, Sophomore, Junior, and Senior).	Rejected: 0 of 30 Statements
H_3: There will be a statistically significant difference in ratings of the insect statements by where the respondent was raised, in Phnom Penh vs. other provinces.	Partially Supported: 21 of 30 Statements
H_4: There will be a statistically significant difference in ratings of the insect statements by religion (Buddhist vs. Non-Buddhist).	Partially Supported: 17 of 30 Statements
H_5: There will be statistically significant differences in the ratings of insect statements based on self-reported socio-economic family status.	Partially Supported: 29 of 30 Statements, 54 of 99 pairings
H_6: There will be statistically significant differences in mean ratings of perceived risk to human health associated with eating insects for the low probability versus the high probability of eating insects groups.	Supported

H_7: There will be significant differences in mean probability ratings for beef raised on insects relative to the mean probability rating for the combined nine insects in the study.	Supported
H_8: There will be mean probability rating differences for pork raised on insects versus the mean probability rating for eating the nine insects.	Supported
H_9: There will be mean probability rating differences for fish raised on insects versus the mean probability rating for eating the nine insects.	Supported
H_{10}: There will be mean probability rating differences for chicken raised on insects versus the mean probability rating for eating the nine insects.	Supported
H_{11}: There will be statistically significant differences in the ratings of insect statements based on prior consumption versus non-consumption of insects.	Partially supported: 17 of 30 Statements

The variable of gender received minimal support, as is expected in entomophagous countries such as Myanmar [17]. Differences by academic year of study were rejected, indicating that increased exposure to higher education had no impact on receptivity to consuming edible insects. There was partial support for the hypothesis dealing with the location where the respondent grew up, with those raised in Phnom Penh indicating less receptivity to consuming edible insects and demonstrating greater food neophobia regarding insects, but not regarding the consumption of foreign food. As for religion, there was partial support, with Buddhists indicating more receptivity than non-Buddhists (self-identified Christians in this study), reflecting the findings of Christians in studies conducted in Europe and the United States. Regarding socio-economic family status, those with a higher status were less receptive to edible insects. This paralleled the finding of the location where the respondent was raised, where urban dwellers (usually more affluent than rural dwellers) were less receptive to the consumption of insects. Finally, those who exhibited a greater display of food neophobia and/or fear of health risk factors related to insects were less receptive to incorporating them into their diet.

Respondents of this study were asked to rate their probability of eating four meat products (beef, pork, chicken, and fish) if the animals were fed a diet of insects. Various studies examined one of these meat products, but this study was the first to examine all four. Acceptance of all four of these products was indicated, consistent with the preponderance of the existing academic literature on insects as animal feed. Finally, this study indicated that those who had prior experience in consuming insects displayed greater receptivity to them as food than those who had never consumed edible insects. Additionally, those with prior consumption indicated lower levels of neophobic reactions to insects. These findings were consistent with prior academic literature.

This pioneering study (the first for Cambodia) was limited in that it examined only one higher education institution in Cambodia. Therefore, its inferential sampling did not intend to represent the entire country. Future researchers should attempt to cover both rural and urban areas as well as a broad representation of the socio-economic and educational attainment levels within the country. These future studies should be geared toward facilitating marketing strategies to gauge consumer attitudes, preferences, and apprehensions regarding consumer acceptance of edible insects as food.

As Cambodia navigates modernization and global trends, there is significant potential to leverage its traditional entomophagy for sustainable development [45, 46]. The growth of the edible insect industry presents opportunities for the country to position itself as a leader in sustainable food production and to offer a solution to global food security challenges. However, most of the research on commercializing insects as food is still in its infancy. Future research is needed to help design an adoption strategy to support the consumption of edible insects. Any adoption strategy would need to incorporate environmental and sustainability drivers, regulatory and ethical considerations, and a campaign of general education regarding the economic importance and nutritional benefits provided by an edible insect industry.

References

[1] P. Kranthi, A. Vedasree, T. Sahu, P. Yazhni, and S. Samuththirapandi, "Insects on the menu: Evaluating entomophagy for future food security," *International Journal of Innovative Science and Research Technology*, vol. 9, no. 12, pp. 1350-1365, 2024. https://doi.org/10.5281/zenodo.14558017

[2] R. Karmakar, J. Rani, and P. Kaur, "Insects: Alternative protein source for human diet," *International Journal for Research in Applied Science & Engineering Technology*, vol. 12, no. 11, pp. 88-95, 2024. https://doi.org/10.22214/ijraset.2024.64483

[3] S. Kour, W. K. Balwan, and P. Kour, "Edible insects: A sustainable solution for the future and feed security," *Scholars Bulletin*, vol. 10, no. 4, pp. 108–120, 2024. https://doi.org/10.36348/sb.2024.v10i04.001:contentReference[oaicite:1]{index=1}

[4] A. M. Liceaga, J. E. Aguilar-Toalá, B. Vallejo-Cordoba, A. F. González-Córdova, and A. Hernández-Mendoza, "Insects as an alternative protein source," *Annual Review of Food Science and Technology*, vol. 13, pp. 19–36, 2022. https://doi.org/10.1146/annurev-food-052720-112443

[5] E. R. Omuse *et al.*, "The global atlas of edible insects: Analysis of diversity and commonality contributing to food systems and sustainability," *Scientific Reports*, vol. 14, p. 5045, 2024. https://doi.org/10.1038/s41598-024-55603-7

[6] M. Olivadese and M. L. Dindo, "Edible insects: A historical and cultural perspective on entomophagy with a focus on western societies," *Insects*, vol. 14, no. 8, p. 690, 2023. https://doi.org/10.3390/insects14080690

[7] J. Ammann, C. Hartmann, and M. Siegrist, "Does food disgust sensitivity influence eating behaviour?: Experimental validation of the Food Disgust Scale," *Food Quality and Preference*, vol. 68, pp. 411–414, 2018. https://doi.org/10.1016/j.foodqual.2017.12.013

[8] G. Sogari, M. Amato, I. Biasato, S. Chiesa, and L. Gasco, "The potential role of insects as feed: A multi-perspective review," *Animals*, vol. 9, no. 4, p. 119, 2019. https://doi.org/10.3390/ani9040119

[9] P. B. Durst and Y. Hanboonsong, "Small-scale production of edible insects for enhanced food security and rural livelihoods: Experience from Thailand and Lao People's Democratic Republic," *Journal of Insects as Food and Feed*, vol. 1, no. 1, pp. 25–31, 2015. https://doi.org/10.3920/JIFF2014.0019

[10] A. Müller, "Insects as food in Laos and Thailand: A case of 'Westernisation'?," *Asian Journal of Social Science*, vol. 47, no. 2, pp. 204–223, 2019. https://doi.org/10.1163/15685314-04702003
[11] J. Mitsuhashi, *Edible insects in the world*. Boca Raton, FL: CRC Press, 2016.
[12] J. J. Schouteten *et al.*, "Emotional and sensory profiling of insect-, plant- and meat-based burgers under blind, expected and informed conditions," *Food Quality and Preference*, vol. 52, pp. 27–31, 2016. https://doi.org/10.1016/j.foodqual.2016.03.011
[13] S. A. Siddiqui, N. A. Bahmid, C. M. Mahmud, F. Boukid, M. Lamri, and M. Gagaoua, "Consumer acceptability of plant-, seaweed-, and insect-based foods as alternatives to meat: A critical compilation of a decade of research," *Critical Reviews in Food Science and Nutrition*, vol. 63, no. 23, pp. 6630–6651, 2023. https://doi.org/10.1080/10408390.2022.2036096
[14] P. F. Guiné, S. G. Florença, and C. A. Costa, "Consumers' perception about edible insects' nutritional value and health effects: Study involving 14 countries," *Animals*, vol. 14, no. 11, p. 1631, 2024. https://doi.org/10.3390/ani14111631
[15] IPIFF, *EU consumer acceptance survey: 2024 European edible insects report by IPIFF*. Brussels, Belgium: International Platform of Insects for Food and Feed, 2024.
[16] G. Sogari, D. Menozzi, C. Hartmann, and C. Mora, *How to measure consumer acceptance toward edible insects? - A scoping review about methodological approaches. In G. Sogari, C. Mora, & D. Menozzi (Eds.). Edible insects in the food sector: Methods, current applications and perspectives*. Springer. https://doi.org/10.1007/978-3-030-14828-4_3, 2019b.
[17] M. T. T. Aung, J. Durr, C. Borhemeister, and J. Borner, "Factors affecting consumption of edible insects as food: Entomophagy in Myanmar," *Journal of Insects as Food and Feed*, vol. 9, no. 6, pp. 721-740, 2023. https://doi.org/10.3920/JIFF2022.0151
[18] C. Hartmann and M. Siegrist, "Development and validation of the food Disgust scale," *Food Quality and Preference*, vol. 51, pp. 118-122, 2018. https://doi.org/10.106/j.foodqual.2017.07.013
[19] B. G. Olantunji *et al.*, "The disgust scale: Item analysis, factor structure, and suggestions for refinement," *Psychological Assessment*, vol. 19, no. 3, pp. 281-297, 2007. https://doi.org/10.1037/1040-3590.19.3.281
[20] A. Van Huis and B. Rumpold, "Strategies to convince consumers to eat insects: A review," *Food Quality and Preference*, vol. 110, pp. 1-14, 2023. https://doi.org/10.1016/j.foodqual.2023.104927
[21] F. La Barbera, F. Verneau, M. Amato, and K. G. Grunert, "A self-reported measure of attitudes toward the eating of insects: Construction and validation of the entomophagy attitude questionnaire," *Food Quality and Preference*, vol. 79, pp. 1-9, 2020. https://doi.org/10.1016/j.foodqual.2019.103757
[22] P. Bazoche and S. Poret, "Acceptability of insects as animal feed: A survey of French consumers," *Journal of Consumer Behaviour*, vol. 20, no. 2, pp. 251-270, 2021. https://doi.org/10.1002/cb.1845
[23] I. Baldi, M. Mancuso, M. Peri, L. Gasco, and M. T. Trentinaglia, "Consumer attitude and acceptance toward fish fed with insects: A focus on the new generations," *Journal of Insects as Food and Feed*, vol. 8, no. 11, pp. 1249-1263, 2021. https://doi.org/10.3920/JIFF2021.0109
[24] C. Hartmann, J. Shi, A. Giusto, and M. Siegrist, "The psychology of eating insects: A cross-cultural comparison between Germany and China," *Food Quality and Preference*, vol. 44, pp. 148-156, 2015. http://dx.doi.org/10.1016/j.foodqual.2015.04.013
[25] S. M. Lim, C. N. Thien, A. K. Toure, and B. Poh, "Factors influencing acceptance of grasshoppers and other insects as food: A comparison between two cities in Malaysia," *Foods*, vol. 11, pp. 1-12, 2022. https://doi.org/10.3390/foods11203284
[26] I. S. Schardong, J. A. Freiberg, N. A. Satana, and N. S. Santos Richards, "Brazilian consumers' perception of edible insects," *Ciencia Rural*, vol. 49, no. 10, pp. 1-12, 2019. https://dx.doi.org/10.1590/0103-84cr20180960
[27] C. H. De Farias Domingues, J. R. Borges, C. F. Ruviaro, D. G. P. Guidolin, and J. R. M. Carrijo, "Understanding the factors influencing consumer willingness to accept the use of insect to feed poultry, cattle, pigs and fish in Brazil," *PLoS One*, vol. 15, no. 4, pp. 1-11, 2020. https://doi.org/10.1371/journal.pone.0224059
[28] J. Dupont and F. Fiebelkorn, "Attitudes and acceptance of young people toward the consumption of insects and cultured meat in Germany," *Food Quality and Preference*, vol. 85, p. 103983, 2020. https://doi.org/10.1016/j.foodqual.2020.103983
[29] S. Spartano and S. Grasso, "UK consumers' willingness to try and pay for eggs from insect-fed hens," *Future Foods*, vol. 3, pp. 1-6, 2021. https://doi.org/10.1016/j.fufo.2021.100026
[30] F. A. Manditsera, C. M. Lakemond, V. Folgiano, C. J. Zvidzai, and P. A. Luning, "Consumption patterns of edible insects in rural and urban areas of Zimbabwe: Taste, nutritional value, and availability are key elements for keeping the insect-eating habit," *Food Security*, vol. 10, pp. 561-570, 2018. https://doi.org/10.1007/s12571-018-0801-8
[31] O. Ochieng, A. Mukhebi, and M. Orinda, "Effects of social, cultural, and economic factors on consumption of edible insects for household food security," *East African Journal of Arts and Social Sciences*, vol. 6, no. 1, pp. 39-53, 2023. https://doi.org/10.37284/eajass.6.1.1060
[32] P. Ferrer Llagostera, Z. Kallas, L. Reig, and D. Amores de Gea, "The use of insect meal as a sustainable feeding alternative in aquaculture: Current situation, Spanish consumers' perception and willingness to pay," *Journal of Cleaner Production*, vol. 229, pp. 10-21, 2019. https://doi.org/10.1016/j.jclepro.2019.05.012
[33] D. Menozzi, G. Sogari, C. Mora, M. Gariglio, and L. Gasco, "Insects as feed for farmed poultry: Are Italian consumers ready to embrace this innovation?," *Insects*, vol. 12, pp. 1-16, 2021. https://doi.org/10.3990/insects2050435
[34] J. C. Ribeiro, A. T. Gonçalves, A. P. Moura, P. Varela, and L. M. Cunha, "Insects as food and feed in Portugal and Norway - Cross-cultural comparison of determinants of acceptance," *Food Quality and Preference*, vol. 102, p. 104650, 2022. https://doi.org/10.1016/j.foodqual.2022.104650
[35] R. Roccatello, S. Cerroni, and S. Dabbou, "Sustainability of insect-based feed and consumer willingness to pay novel food: A stated preference study," *Future Food*, vol. 9, pp. 1-14, 2024. https://doi.org/10.1016/j.fufo.2024.100336
[36] C. Clarkson, M. Mirosa, and J. Birch, "Consumer acceptance of insects and ideal product attributes," *British Food Journal*, vol. 120, no. 12, pp. 2898-2911, 2018. https://doi.org/10.1108/BFJ-11-2017-0645
[37] S. G. Florenca *et al.*, "The motivations for consumption of edible insects: A systemic review," *Foods*, vol. 11, 2022. https://doi.org/10.3390/foods11223643
[38] L. Orsi, L. L. Voege, and S. Stranieri, "Eating edible insects as sustainable food? Exploring the determinants of consumer acceptance in Germany," *Food Research International*, vol. 125, p. 108573, 2019. https://doi.org/10.1016/j.foodres.2019.108673
[39] Y. Schlup and T. Brunner, "Prospects for insects as food in Switzerland," *Food Quality and Preference*, vol. 64, pp. 37-46, 2018. https://doi.org/10.1016/j.foodqual.2017.10.010

[40] W. Verbeke, "Profiling consumers who are ready to adopt insects as a meat substitute in a Western society," *Food Quality and Preference*, vol. 39, pp. 147-155, 2015. https://doi.org/10.1016/j.foodqual.2014.07.008

[41] R. V. Krejcie and D. W. Morgan, "Determining sample size for research activities," *Educational and Psychological Measurement*, vol. 30, pp. 607-610, 1970. https://doi.org/10.1177/001316447003003081

[42] Z. Domyei and T. Taguchi, *Questionnaires in second language research: Construction, administration, and processing*, 2nd ed. New York: Routledge, 2009.

[43] J. Hair, W. C. Black, B. J. Babin, and R. E. Anderson, *Multivariate data analysis: A global perspective*, 2nd ed. Upper Saddle River, NJ: Prentice-Hall International, 2010.

[44] M. Mendes and E. Akkartal, "Comparison of ANOVA F and Welch tests with their respective permutation versions in terms of Type 1 error rates and test power," *Kafkas Üniversitesi Veteriner Fakültesi Dergisi*, vol. 16, no. 50, pp. 711-716, 2010. https://doi.org/10.9775/kvfd.2009.1507

[45] B. Borsai, "Edible insects as a new frontier in nutrition for sustainable development," *Nutrition & Food Science*, vol. 12, no. 1, pp. 001-009, 2023. https://doi.org/10.190-8/NFSIJ.2023.12.555828

[46] K. W. Lange and Y. Nakamura, "Edible insects as future food: Chances and challenges," *Journal of Future Foods*, vol. 1, pp. 38-46, 2021. https://doi.org/10.1016/j.jfutfo.2021.10.001