DOI: 10.52131/pjhss.2024.v12i2.2158

Pakistan Journal of Humanities and Social Sciences

Volume 12, Number 02, 2024, Pages 987-1000
Journal Homepage:
https://journals.internationalrasd.org/index.php/pjhss

Exploring Locust Consumption Acceptance Factors among Pakistani University Students: Insights for Sustainable Food Adoption

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ARTICLE INFO

Article History:
Received: April 17, 2024
Revised: May 16, 2024
Accepted: May 17, 2024
Available Online: May 18, 2024

Keywords:
Sustainable Food
Edible Insects
Pakistan
Dietary Choices
University Students

Funding:
This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

ABSTRACT

In the past years, the food security issue has become clearer, and resources have been sought to improve the sustainable food chain with the aim of reducing the harm to the environment caused by traditional food systems. Through the arrival of edible insects, sustainability and nutritional prowess emerge as a solution in view. On the downside/on the other/however, public acceptance is one of the key factors that limit their (AV) placement. The scientists have frantically worked on the identification of the factors that make up one's decision to improve on the level of eating insects. This paper details the research conducted with a group of 125 students who come from numerous public institutions in Pakistan, with the focus to determine their readiness to incorporate consuming bugs which is a fresh protein source in their cultural sphere. The investigation was multifaceted one and covered the spectrum from disgust effects, safety risks, to cultural factors, knowledge gap, environmental issues, and religious considerations. Implementing a five-point Likert scale questionnaire administered through the use of Google Forms, the study brought to the fore critical aspects that stimulate the decisions and intentions of students regarding whether to eat insects to control the escalating locust population. The research pinpoints several factors as being the most important in shaping participants´ attitude towards the idea of either trying or avoiding the locust-based food – those would be something like disgust, deeply held religious views, and merely care toward the surrounding environment. On top of this, cultural influences and knowledge gaps became the essential determinants that worked to promote those decisions. This analysis applied a multipronged approach to investigate the multifarious parts that affect food choices, especially with regard to dietary innovation such as locusts. This research, not only shows a broader approach to the analysis of insect consumption in Pakistan but also contributes to effective educational programs leading to a rise in awareness level on this issue. These strategies are quite essential in the context of the issue and can contribute to the development of cheap, high-quality food and the resolution of the global food security quandary.

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1. Introduction

It was in the last decade when entomophagy, an ancient culture of insect eating as food source, was increasingly explored as a solution to several urgent challenges faced by the whole world. It is not only because of its novelty initially that this practice has a plethora of benefits that extend far beyond those from dietary traditions. Edible insects, which have

differentiated themselves from other sources of nutrition due to their exceptional nutritional value and contribution to food security, economic sustainability, and environmental conservation, have multiple sides and far-reaching impacts. Additionally, consumer perceptions and acceptance of the idea of insect consumption have changed, while religious beliefs have turned out to be quite a critical determinant of what people choose to eat. Facing the multi-faceted nature of food security and the environment, the idea of eating insects becomes a crucial and provoking issue on the edge of it. Through this exposition, I explicitly pinpoint the variety of aspects of edible insects, highlighting the importance of entomophagy in solving the global issues of our time.

Taking things in the edible insects world a bit further is not just about protein but it's many other nutrients as well. On top of those, these insects which hinge on their insect peptides and bio-actives Lange and Nakamura (2023) are said to have a good health-supporting effect. Human nutritional demands are very diverse and edible insect comes in different species. All of which are independently rich in proteins, a good fat, vitamins, essential elements and even fibers (Badogu & Kumar, 2023). Scientific studies are always quick to acknowledge the nutritional value of this bug, which as shown previously, is as healthy as the human's usual animal proteins sources. Thus, the use of insects as a nutritional and ecological sound source of food is emphasized propelling the need to research deeper into this field (Belluco, Losasso, Maggioletti, Alonzi, Paoletti, & Ricci, 2013). Amid insects nutritional values received wide acknowledgement. Above all else, the World Health Organization (WHO) admits the fact that insects are a good protein source for those who are HIV-positive and nutritionally vulnerable people who might need to be provided with foods rich in proteins, such as amino acids to restore their bodies' immune systems. This assertion reflects the fact of the critical function of insects in the provision of certain food stuffs that may not be obtainable in the diet of a given person (WHO, 2008). Our world is grappling with a significant challenge: marketing the proper volume of animal-based proteins to make the target number in food demand. In actually it's true that many indigenous peoples have known the convenience of insects as a protein-packed food for a long time. It's worth thinking about updating our position and adapting the concept of insects as a worthy and renewable food for all humankind. The development of this alternative method could be a revolutionary solution to the path we are treading on in regards to our protein needs (Yen, 2009).

As the global human population soar, the struggle to balance land use intensifies, leading to recurring food shortages. Traditional meat production faces sustainability issues, worsened by crop diversion for biofuels and biomass energy. With rising demand for animal protein, we're on the brink of crises, exacerbated by climate change. Embracing entomophagy, or insect consumption, emerges as a sustainable solution to help address these food security challenges and combat future food shortages (Premalatha, Abbasi, Abbasi, & Abbasi, 2011; Rehman, Abro, Mustafa, Ullah, & Khattak, 2021). Global climate change threatens food security by reducing cereal yields and increasing the risk of undernutrition. Models estimate a 1-29% rise in moderate stunting and in severe stunting a 23% increase in Central Sub-Saharan Africa, and a 62% increase in South Asia by 2050 due to climate change, highlighting the urgent need for action to protect vulnerable populations (Lloyd, Kovats, & Chalabi, 2011). Van Huis et al. (2013) also pointed out that edible insects might be the answer to dangerous problems of malnutrition and food insecurity. It is an approach that strikes a perfect balance between sustainability and nutrition by offering the way out to those who are tormented by the harsh realities of hunger and nutrition deficiencies. This is also doing it part in food security. Regarding the future, adopting edible insects can be a key measure in dealing with issues like malnourishment. There might be the opportunity to have a better future and well-nourished people.

Insects represent a superior protein-to-output ratio against that of the traditional livestock, an invaluable hint because by 2050 meat prices are forecasted to rise by 18 percent to 26 percent. While insect's ability to transform plant proteins into insect's proteins goes beyond the power of mammals, it continues to be the most sustainable and affordable way for feeding vast numbers of humans (Deroy, Reade, & Spence, 2015). Insects have a special exception concerning the efficiency of food. And, they are able to feed on 2 kg of feed and become 1 kg of insect mass, which is so much better than the animal like bovines that can barely manage to gain 1 kg from 8 kg feed (Abril, Pinzón, Hernández-Carrión, & Sanchez-

Camargo, 2022; ul Mustafa, Abro, & Awan, 2021). The efficiency of the former stretches our resources further and makes a more sustainable and eco-friendly approach to food. We have a very good motive here to go beyond a mere value assignment of insects as an alternative food source for humanity. When it comes to sustainability, edible insects also offer another unique advantage. They can be raised on organic side-streams, like different forms of biological waste, including manure, compost, and even human waste. This ingenious approach not only reduces environmental contamination but also boosts the economic viability of insects. It's a win-win scenario, where not only waste is minimized but also creates a more sustainable and profitable path forward in our food practices (Offenberg, 2011). The livestock sector is a major contributor to greenhouse gas emissions further contributing to climate change and ammonia production that can harm soils by nitrification and acidification, posing environmental challenges. Meanwhile, insects emerged as an eco-friendly option, with a higher growth rate and lower greenhouse gas emissions compared to livestock and other conventional sources of meat and protein. They also produced less ammonia. This suggests that insects could provide a greener source of animal protein, offering a promising solution to reduce greenhouse gas and ammonia emissions in the food chain (Oonincx, Van Itterbeeck, Heetkamp, Van Den Brand, Van Loon, & Van Huis, 2010). Increasing global water demands endanger biodiversity and essential human needs. Over a billion people lack adequate drinking water, and polluted water spreads 90% of infectious diseases in developing countries. Agriculture, consuming 70% of freshwater, highlights the issue; 1 kg of cereal grain requires 1000 liters of water, while 1 kg of beef requires 43,000 liters. Sustainable water management is imperative to protect our environment and food security (Mahesar, Raza ul Mustafa, Latif, Azeema, Rao, & Ventriglio, 2023; Pimentel et al., 2004). Insects again stand out as a remarkably eco-friendly food source in this regard as their low environmental impact is evident in their minimal demands for both water and arable land as compared to cattle and other meat sources (Madau, Arru, Furesi, & Pulina, 2020).

The risk of edible insects transmitting zoonotic diseases is generally considered low. This is because insects designated for human consumption primarily feed on plant material and agricultural byproducts, which means they don't typically act as direct vectors for pathogens between humans and animals. Moreover, when it comes to entomophagy or insect-eating, there's a robust species barrier that prevents insect-specific pathogens from establishing themselves in the human body, even in some instances, insects infected with various pathogens are consumed by humans. The practice of insect breeding for consumption also holds potential benefits, particularly in the context of infectious animal diseases transferrable from other meat sources like animals and birds. This technique allows a farmer to avoid the widespread use of conventional animal breeding and look for an alternative insect breeding. This has created opportunities to replace traditional livestock with fewer animals for agriculture and husbandry. As a result, this can contribute to low risks of novel infectious diseases and zoonoses through the reduction of the number of conventional animals in agriculture and husbandry. This implies we should see the integrated approach to food production as a step towards the creation of a safer and more sustainable food system (Doi, Gałęcki, & Mulia, 2021).

One good thing that arthropods instead of foods and protein sources, which often bring a lot of benefits to the table, nonetheless meet continued resistance and remain generally neglected in many regions of the planet is quite intriguing (Hartmann & Siegrist, 2017). The unwillingness to take up the cultural food - in short direct entomophagy, or the consumption of insects - is generally caused by a strong feeling of disgust. In fact, the deeply-rooted aversion that specifically relates to insects as a food item is probably the most pronounced factor enhancing the low regard in which they are normally perceived (La Barbera, Verneau, Videbæk, Amato, & Grunert, 2020). Another element that contributes to the rejection of existing insects as food is the attitude of humans towards new foods. This ultimately natural attracted fear of eating new foods could take away from the thing people want the most is trying out this substitute protein source (Sogari et al., 2023; Ullah, Abro, ul Mustafa, & e Ali, 2023). Edible insects have indeed been hailed as a sustainable food source for the future, but the idea of entomophagy, or insect consumption, remains relatively unfamiliar to many (Ardoin & Prinyawiwatkul, 2021). Recent studies on consumer perceptions of entomophagy or insect consumption are gaining traction. Acceptance and perception vary by insect species and dishes or end products. Concealing insects in food enhances consumer acceptability. Men tend to be more willing than women, driven by taste preference. Insect consumption evokes

adventure and daring, adding an exciting, wild element to dining (Tuccillo, Marino, & Torri, 2020). As young people grow more aware of sustainability and climate concerns in food production, the appeal of insects may rise. A positive culinary experience and new insect-based products can also familiarize people with this eco-friendly option, opening up exciting business opportunities (Sogari, Bogueva, & Marinova, 2019). Promoting insect-based products should focus on educating consumers about their nutritional and environmental advantages. Young individuals emerge as a promising target demographic, with higher education levels often seen among entomophagy enthusiasts. Among potential early adopters, fitness-oriented men engaged in gym workouts or outdoor sports stand out as a key group. Insect based food category would likely also be accepted first by them (Herbert & Beacom, 2021).

Religion is a powerful factor in forming the purchasing decisions of the consumers, sometimes in favor of and sometimes in the disfavor of different products and services. For example, in Islam, there is the Halal food concept, which carries special meaning. Among the varied consumer possessing faith based product like halal food, the young generation is the most vital group. Over the long run, their value grows, making the needs and wants of these customers a key area of focus (Hassan & Pandey, 2020). Locusts, a kind of insect, are considered to have a special status in the world of consuming insects according to Islamic views, as all schools of thought and jurisprudence in Islam unanimously accept their consumption. With a consensus among Muslims worldwide about the lawfulness of eating locusts, there is no doubt about that. This agreement stems on the multiple hadiths related to Prophet Muhammad and his companions. These hadiths confirm the permission of locust consumption in Islam. It should be pointed out that all four major Islamic jurisprudence schools (Hanafi, Shafi, Hanbali and Maliki), each represented by renowned imams, are in agreement on the permissibility to consume locusts. This identical perspective emphasizes the value of locusts as a halal food commodity within Islam (Bodenheimer, 1951). Maliki jurisprudence, part of the four schools of FIqh (Muslim jurisprudence), stands amongst other schools in its distinct and contrasting perspective. However, within Islam, they maintain that the same insects, here called hashraat, are generally regarded as halal by default, unless there is a genuine risk of health issues or barging against people’s norms. This rule derives from the Quranic verses of surah al-Ma'idah, and those verses support the consumption of what the Earth brings throughout, except for what is expressly forbidden by Shariah or potentially harmful. In essence, since there's no explicit prohibition concerning all hashraat, including insects, in Islamic teachings, the Maliki School takes a permissive stance. Every edible insect which is more nutrition than detrimental, and socially acceptable for the consumption process, is accepted as halal by them. Thus, this certain opinion in the Maliki School, expressing the complexity and diversity of Islamic jurisprudence (Tajudeen, 2020), lays emphasis on this aspect.

2. Literature Review

Research by Guiné, Florença, Anjos, Correia, Ferreira, and Costa (2021), through surveying and analytic techniques like descriptive statistics, tree classification analysis, factor analysis, and cluster analysis, has shown that most people have the lack of knowledge about Eating Insects. Some even admitted that they have formed no meaningful opinion on it. Their research, focused on questions about sustainable consciousness, social-demographic factors, and the role of motivation in consumption, emphasized the importance of sustainable behavior. They got hold of the necessary information through an online questionnaire made available via the Google Forms platform with the input of 213 individuals which helped in creating the much needed insight on Eating Insects and sustainability. As indicated by De Koning et al. (2020), the study was designed by considering a holistic assessment of insect-based protein substitutes as a possible option in the protein sources list. It examined the assonantal consumer sentiments, underlying the triggering factors as well as their efficacy to switch to protein-alternatives, including insects, in a manner where those who try and attract those who not only purchase, but also pay a premium, do so. A robust set of data with 3091 responses from nine countries including the United States, France, UK, New Zealand, Netherlands, Brazil, Spain and the Dominican Republic was painstakingly retrieved in the mentioned study through the use of questionnaire survey. Structural Equation Modeling was employed to find out that quite a significant barrier to bug-based consumer alternatives correlates with neophobic foods. Meanwhile, their consumer acceptance and attractiveness have been boosted due to their type and qualities, which depend on their nutrient content,

environmental impact, healthiness, and sensory characteristics. This research's questionnaire represents a unique collection of questions and statements that mirror the framework utilized in previous studies.

Verneau, La Barbera, Amato, Riverso, and Grunert (2020) adopted a comprehensive approach to gain insights into and predict consumer behavior concerning and focus on edible insects. The data collection involved the administration of questionnaires to 300 respondents comprising Italian and Danish consumers. The respondents were recruited within university canteens. The study's findings revealed a heightened interest in edible insects, driven by their novelty and perceived benefits within a group. This group was characterized by individuals who display both an inquisitive and discerning approach to food shopping. Basic descriptive analyses were conducted on the sample, and the reliability of measures was assessed using Pearson's alpha coefficient. Hierarchical cluster analysis, employing Ward's method and based on Food-Related Lifestyle (FRL) dimensions, facilitated the classification of participants into clusters, while ANOVAs were employed to examine differences between these clusters. Furthermore, a linear regression model was employed to estimate the impact of various study variables on consumers' intentions. The study conducted by Santisi, Magnano, and Scuderi (2021), delved into the correlation between two distinct attitudes - food neophobia and food disgust. – in insect-eating. Data was attained through the distribution of a questionnaire, which was anonymous and filled out online by a sample of 487 Italian citizens. The involvement in the study was propelled by the researched and their affiliates' proximity to the participants. Three assessment tools: food neophobia scale and two others, namely perceived vulnerability to disease and food disgust scale, were utilized to evaluate subjects. Moreover, food revulsion and food neophobia were found to be positively associated. Furthermore, the structural mediation model was employed showing the significant mediation effect between food neophobia and food disgust.

The study conducted by Bae and Choi (2021) was focused on the 'Extended Theory of Planned Behavior' which aims to assess consumer acceptance for edible insect products at first before delving into the study of consumers' future purchase behaviors of these products. The survey respondents were collected from two Korean regions specifically for using the convenience sampling technique, and each response for each question was evaluated based on a 5-point Likert scale. Statistics techniques have been used such as independent t-test, multiple regression analysis, and descriptive statistics. The study has come up with some key conclusions. The results revealed the importance of proper campaigns to build subjective norms for promoting the acceptance of insect edible as part of regular diet, which plays an essential role in leading people to purchase it. These outcomes, in addition, have implications to the industry of the insect-based food products and its consumers' preferences, and provide the direction on how to accelerate their acceptance. Research done by Ros-Baró, Sánchez-Socarrás, Santos-Pagès, Bach-Faig, and Aguilar-Martínez (2022) in Catalonia, Spain involved 1034 consumers who were given a questionnaire developed and conducted using the Qualtrics online platform, and distributed through various social media channels. The key factors of acceptance were captured using the data collected from the questionnaire responses, which include neophobia, social norms, familiarity, consumption experiences, and awareness of benefits. The data was examined and the binary Yes/No responses were treated as nominal and dichotomous categorical variable. The chi-squared test belonging to the Pearson family was employed to examine the association between the dichotomous variables. Descriptive analysis was conducted and absolute and relative frequencies were presented.

Su et al. (2023) had a research which explored the acceptance of edible insect products by Chinese consumers and also their preferences in terms of price, insect species and cooking methods. Overall, 510 questionnaires were completed. Spearman's correlation coefficient analysis was utilized to show that insect consumption positively correlated with factors such as age, education, and occupation while displaying negative correlations with gender and dietary preferences. Logistic regression analysis was further used that underscores the pivotal role played by the publicity and promotion of edible insects as food in shaping consumer acceptance and advocating for the heightened promotion of insects as a food source, with a particular emphasis on highlighting their environmental friendliness was highlighted as significantly influence factor towards consumer attitudes and behaviors regarding insect-based food products.

3. Methodology

This study begins with an aim to collect data by administering a questionnaire to 129 respondents who were university students using an online questionnaire through Google Forms. The questionnaire was anonymous, and participants did not receive any payment. After cleaning of data, we were left with 125 responses. In this study, the respondents are university students representing different universities in Pakistan. The questionnaire used in this survey consists of seven parts, the first part is the demographic information, the second is the questions related to Disgust, the third part is the questions related to the doubts about safety, and the fourth part related to cultural reasons, the fifth part consist of questions related to lack of knowledge, the sixth part related to environment-friendly consumption and seventh and last one consists of questions related to religious permissibility. The questionnaire had a total of 29 items adopted from Ros-Baró et al. (2022), which was modified further and consisted of 4 questions on Disgust, 4 questions on doubts about safety, 4 questions on cultural reasons, 4 questions on lack of knowledge, 4 questions on environment-friendly consumption, and 4 questions on religious permissibility.

Table 1: Cronbach's Alpha, Mean & Standard Deviation

Disgust		$\bar{x}$	**σ**
	Despite initial feelings of disgust, willing to try eating locusts (E1)	2.06	1.214
	Open to overcoming feelings of disgust and trying locust-based food products as an alternative protein source (E2)	2.23	1.258
Cronbach's α = .797	Concerned about the potential for disgust when consuming locusts as a food source (E3)	2.75	1.395
	Feel comfortable eating locusts as a regular part of the diet, considering any initial feelings of disgust (E4)	1.90	1.091
Safety Concerns		$\bar{x}$	σ
	Safety concerns strongly influence decisions regarding including locusts as a food source (S1)	3.11	1.381
	Willing to try eating locusts if have no doubts about their safety (S2)	2.32	1.305
Cronbach's α = .762	Have significant concerns about the safety of consuming locusts as a protein source (S3)	3.06	1.285
	Doubts about the safety of eating locusts significantly influenced the decision not to try them as a food source (S4)	3.22	1.319
Cultural Factors		$\bar{x}$	σ
	Cultural factors strongly influenced decision not to eat locusts (C1)	3.28	1.348
	Willing to adapt dietary choices to incorporate locusts if they are culturally accepted as a food source (C2)	2.29	1.183
Cronbach's α = .774	Have significant concerns about cultural norms and perceptions surrounding the consumption of locusts (C3)	2.90	1.237
	Cultural considerations greatly influenced the decision not to eat locusts (C4)	3.12	1.371
Lack of Knowledge		$\bar{x}$	σ
	Lack of knowledge about the nutritional value and safety of eating locusts strongly influences the decision not to try them as a food source (L1)	3.13	1.295
	Willing to learn more about the nutritional benefits and safety considerations of eating locusts if they are made readily available (L2)	3.04	1.234
Cronbach's α = .749	Have significant concerns about potential health risks associated with consuming locusts due to lack of knowledge (L3)	3.18	1.251
	Limited understanding of locusts significantly influences decision not to include them in diet (L4)	3.37	1.202
Environmental Sustainable Consumption		$\bar{x}$	σ
Cronbach's α = .766	Important to consider environmentally sustainable consumption when making food choices, including the consumption of locusts (E1)	3.12	1.140
	Willing to incorporate locust-based food products into	2.51	1.147

	the diet, knowing that they are considered an environmentally sustainable protein source (E2)		
	Have significant concerns about the environmental impact of traditional protein sources compared to consuming locusts as a food source (E3)	2.70	1.093
	Considerations of sustainable consumption greatly influence the decision to include or exclude locusts from my diet (E4)	2.88	1.140
Religious Permissibility		$\bar{x}$	σ
	Consider the religious permissibility of consuming locusts in decisions regarding their inclusion in diet (R1)	3.41	1.232
	Willing to incorporate locust-based food products into the diet if they are deemed religiously permissible in faith (R2)	2.95	1.217
Cronbach's α = .870	Have significant concerns about adhering to religious dietary restrictions and whether consuming locusts aligns with religious beliefs (R3)	3.22	1.224
	Religious considerations greatly influence the decision to eat or abstain from locusts as part of the diet (R4)	3.34	1.296

Source: Authors' own Calculation

Second, the 5-point Likert scale type was used to administer every question. The means and standard deviation for the questionnaire are reported in Table 1. Reliability was excellent for all six parts, disgust (Cronbach's α = 0.797), safety concerns (Cronbach's α = 0.762), cultural factors (Cronbach's α =.774), lack of knowledge (Cronbach's α =.749), environmental sustainable consumption (Cronbach's α =.766), and religious permissibility (Cronbach's α = .870) as reported in Table 1 also. The statistical analysis, which included canonical linear discriminant analysis was performed using the SPSS program.

4. Results & Discussion

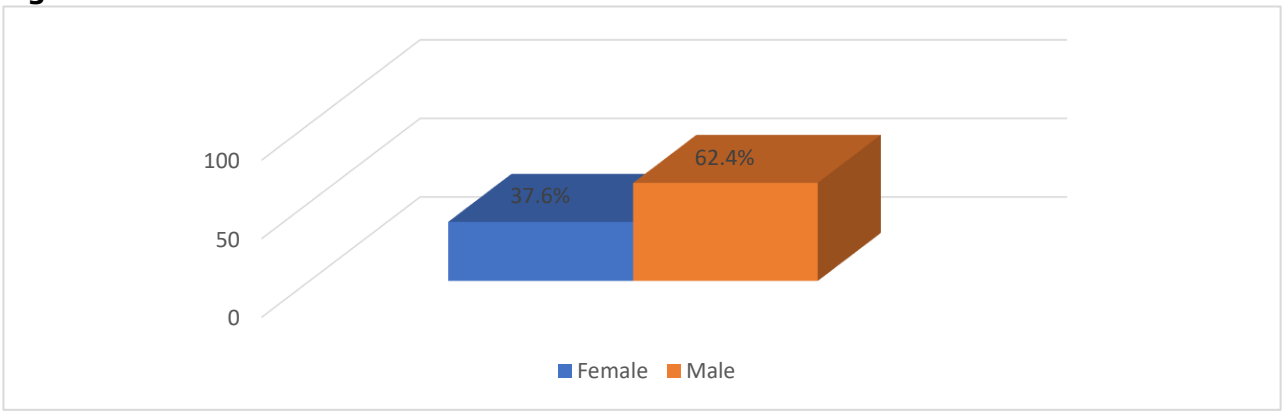
The study's sample comprised 125 respondents, with a gender distribution indicating 47 (37.6%) females and 78 (62.4%) males. These percentages reflect the gender composition of the respondents, providing a snapshot of the demographic representation in the research sample.

Table 2: Sample Gender

Gender	N	%
Female	47	37.6
Male	78	62.4

Source: Authors' own Calculation

Figure 1: Gender



Source: Author's own Work

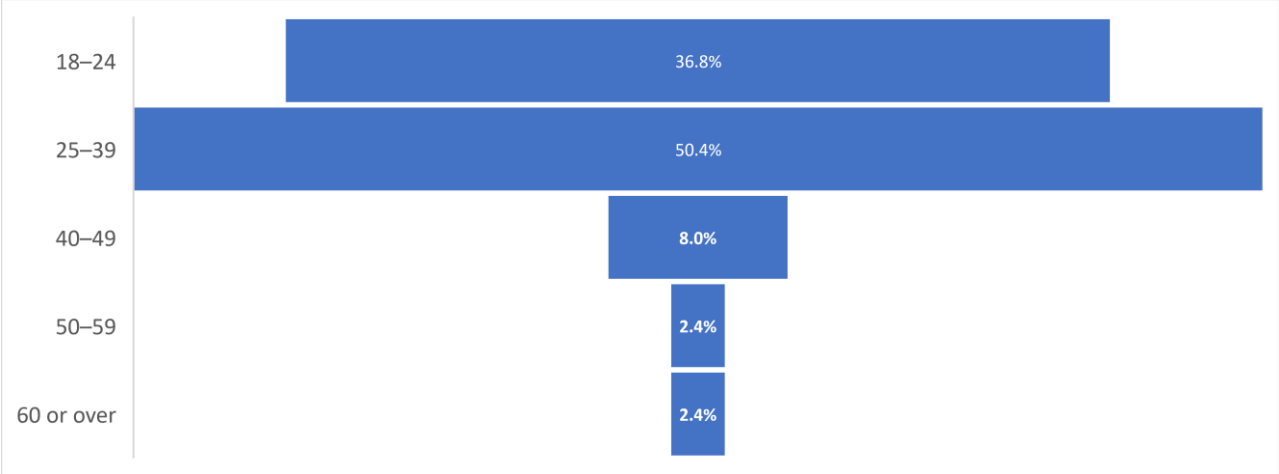
The research sample, comprising 125 university students, exhibited a diverse age distribution. The 18–24 age bracket, constituting 46 participants (36.8%), and the 25–39 age group in which the majority of respondents falls, encompassing 63 individuals (50.4%). A lower ratio is evident in the 40–49 age band where 10 participants (8%) are present. Furthermore, three individuals each for the 50–59 and the 60 or older categories (2.4%). Accordingly, this classification is very useful since it gives specific details about the age distribution of the respondents.

Table 3: Sample Age

Age	N	%
18–24	46	36.8
25–39	63	50.4
40–49	10	8
50–59	3	2.4
60 or over	3	2.4

Source: Authors' own Calculation

Figure 2: Age



Authors' own work

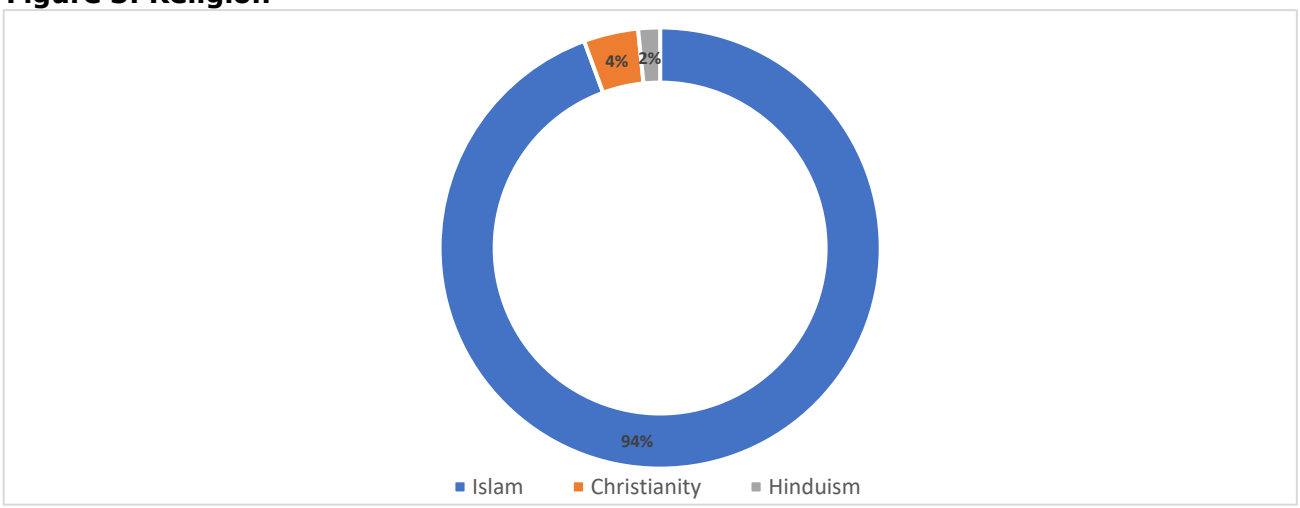
This study's participants, having 125 university students, predominantly believers in Islam with having in all 94%. 4% of the sample. Only a smaller fraction of respondents specify Christianity as their faith, and its share is 4.0% of the sample. Hinduism is the religious confession of 2 persons, making up 1.6% of the total sample. It can be viewed as an important part of the demographic perspective as it offers the insights into the religious structure of the research subjects.

Table 4: Sample Religion

Religion	**N**	**%**
Islam	118	94.4
Christianity	5	4.0
Hinduism	2	1.6

Source: Authors' own Calculation

Figure 3: Religion



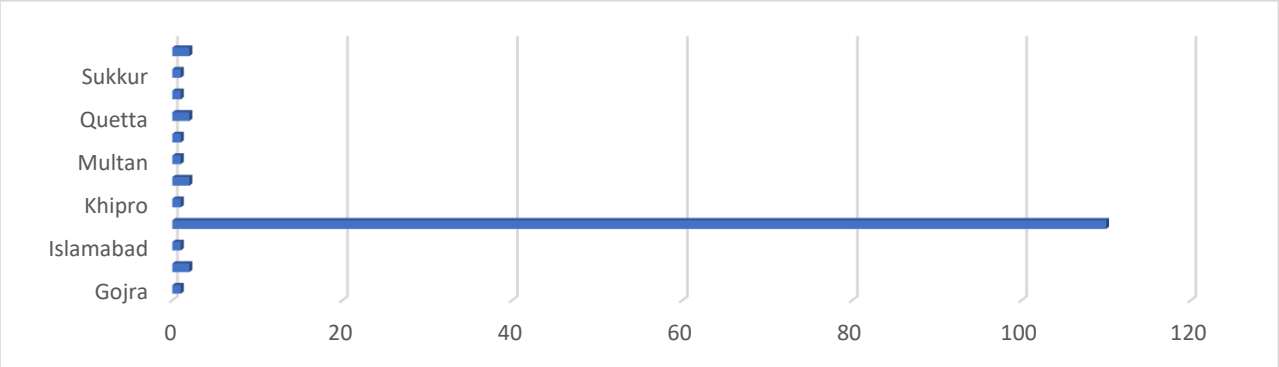
Authors' own work

Table 5: Sample Residence

Residency	N	%
Gojra	1	0.8
Hyderabad	2	1.6
Islamabad	1	0.8
Karachi	110	88
Khipro	1	0.8
Lahore	2	1.6
Multan	1	0.8
Peshawar	1	0.8
Quetta	2	1.6
Rahim Yar Khan	1	0.8
Sukkur	1	0.8
Uthal	2	1.6

Source: Authors' own Calculation

Figure 4: Residence



Source: Author's own Work

The research sample of 125 university students has shown that the students from diverse geographical areas have resided there. Majority of participants, 110 people (88%), are from Karachi highlighting that urban representation is also high. Some other participants cities with fewer numbers include Hyderabad, Lahore, Quetta, and Uthal each being 1. 6% of the sample. Gojra, Islamabad, Khipro, Multan, Peshawar, Rahim Yar Khan, and Sukkur each are representing one member of participant samples which is 0. 8% for each for the whole sample. This distribution of the residence, of course, gives a geographical context to the surveyed students and makes the information about their diverse backgrounds possible. The research uses a diverse selection of university student affiliations among the 125 surveyed students. It is the University of Karachi with the highest percentage i.e 22.4% of the sample, after that by Mohammad Ali Jinnah University with 18.4%. Universities such as Bahria University represent 7.2% and the Federal Urdu University of Art, Science and Technology has 7.2%. While Iqra University includes 5. 6%, and Aga Khan University, Dow University of Health Sciences, and Hamdard University are represented by a moderate number of participants that make the sample diverse in general. Beside these there are also smaller samples from many other universities. This distribution to several universities brings an extra depth to the findings of the study thus giving nuanced insights into perceptions and acceptability of students from different academic institutions towards consuming locust as a source of protein.

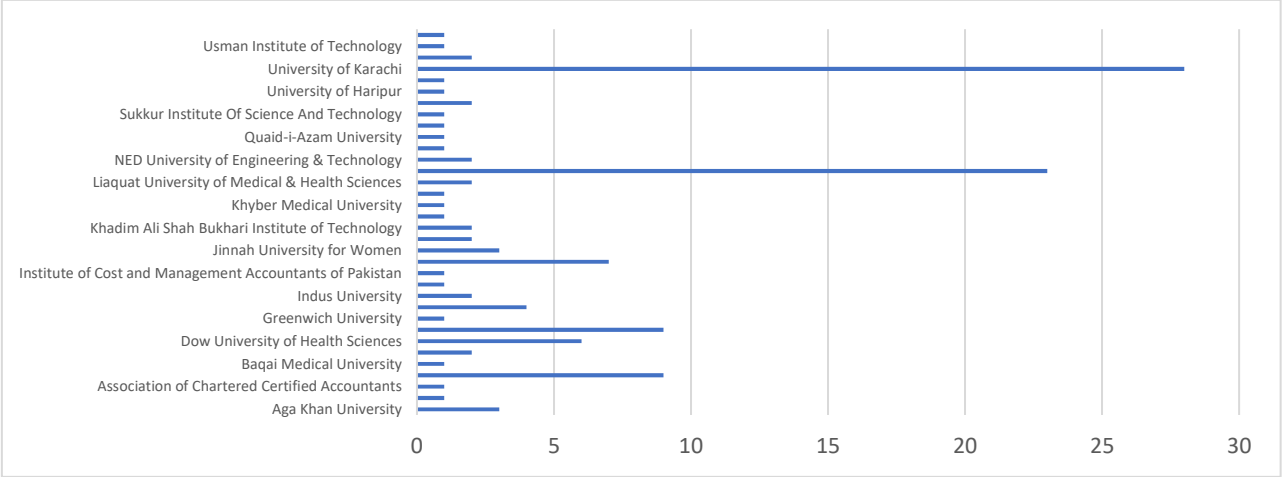
Table 6: Sample University

University	N	%
Aga Khan University	3	2.4
Applied Economics Research Centre	1	0.8
Association of Chartered Certified Accountants	1	0.8
Bahria University	9	7.2
Baqai Medical University	1	0.8
Benazir Bhutto Shaheed University	2	1.6
Dow University of Health Sciences	6	4.8

Federal Urdu University of Art Science and Technology	9	7.2
Greenwich University	1	0.8
Hamdard University	4	3.2
Indus University	2	1.6
Institute of Business Administration	1	0.8
Institute of Cost and Management Accountants of Pakistan	1	0.8
Iqra University	7	5.6
Jinnah University for Women	3	2.4
Karachi University Business School	2	1.6
Khadim Ali Shah Bukhari Institute of Technology	2	1.6
Khwaja Fareed University of Engineering & Information Technology	1	0.8
Khyber Medical University	1	0.8
Liaquat College of Medicine & Dentistry	1	0.8
Liaquat University of Medical & Health Sciences	2	1.6
Mohammad Ali Jinnah University	23	18.4
NED University of Engineering & Technology	2	1.6
Newports Institute of Communications & Economics	1	0.8
Quaid-i-Azam University	1	0.8
Shah Abdul Latif University	1	0.8
Sukkur Institute Of Science And Technology	1	0.8
University of Balochistan	2	1.6
University of Haripur	1	0.8
University of Home Economics	1	0.8
University of Karachi	28	22.4
University of Sindh Jamshoro	2	1.6
Usman Institute of Technology	1	0.8
Ziauddin University	1	0.8

Source: Authors' own Calculation

Figure 5: Residence



Source: Author's own work

The discriminant analysis of the Disgust factors (D1-D4) revealed the presence of three canonical discriminant functions, with the first function explaining a substantial portion (99.2%) of the variance. This function was significantly associated with the Disgust variables. The Wilks' Lambda test showed a statistically significant difference in the means between the groups ($\Lambda = 0.290$, $\chi^2 = 148.731$, $df = 12$, $p < 0.000$), indicating that these factors significantly contributed to distinguishing groups based on their willingness to try locust-based food products. The standardized canonical discriminant function coefficients indicated that overcoming feelings of disgust (D2) was the most influential variable in the first function and the second one was feeling comfortable eating locusts as a regular part of the diet (D4). The discriminant analysis of the Safety Concerns factors (S1-S4) resulted in three canonical discriminant functions, with the first function explaining 80% of the variance. Still, the Wilks' Lambda test indicated that the results were not statistically significant ($\Lambda = 0.850$, $\chi^2 = 19.561$, $df = 12$, $p = 0.076$). The variables' safety concerns strongly influenced the decision to include locusts as food sources (S1) influenced the most first function having the highest

standardized canonical discriminant function coefficients in this function. and the next one was doubts about the safety of locusts as food sources (S4).

Table 7: Eigenvalue, Variance & Correlation

		Eigenvalue	% of Variance	Canonical Correlation
Function 1	Disgust	2.385	99.2	0.839
	Safety Concerns	0.138	80.0	0.348
	Cultural Factors	0.181	89.9	0.392
	Lack of Knowledge	0.203	90.2	0.411
	Environmental Sustainable Consumption	0.492	87.8	0.574
	Religious Permissibility	0.599	89.8	0.612

Source: Authors' own Calculation

Table 8: Wilk's Lambda Test

		Wilk's Lambda	Chi-Square	df	Sig.
1 through 3	Disgust	0.290	148.731	12	0.000
	Safety Concerns	0.850	19.561	12	0.076
	Cultural Factors	0.830	22.392	12	0.033
	Lack of Knowledge	0.813	24.867	12	0.015
	Environmental Sustainable Consumption	0.627	56.099	12	0.000
	Religious Permissibility	0.585	64.238	12	0.000

Source: Authors' own Calculation

Discriminant analysis of the Cultural Factors (C1-C4) produced three canonical discriminant functions. The first function explained 89.9% of the variance. The Wilks' Lambda test revealed a statistically significant difference in the means between groups ($\Lambda = 0.830$, $\chi^2 = 22.392$, $df = 12$, $p = 0.033$), indicating that cultural factors played a significant role in influencing participants' decisions. The standardized canonical discriminant function coefficients revealed the most influential variable in the first function to be having significant concerns about cultural norms and perceptions (C3) with respect to the locusts consumption. Cultural elements, which affected C1 function, were also a key factor and next influential variable. The discriminant analysis of the Lack of Knowledge factors (L1-L4) resulted in three canonical discriminant functions, with the first function explaining 90.2% of the variance. The Wilks' Lambda test indicated a statistically significant difference in the means between the groups ($\Lambda = 0.813$, $\chi^2 = 24.867$, $df = 12$, $p = 0.015$), emphasizing that a lack of knowledge about locusts had a significant impact on participants' decisions. The standardized canonical discriminant function coefficients showed that serious concern over possible health risk of consuming locusts because of lack of knowledge (L3) took the influential place in first function and lack of knowledge about the nutritional value and safety of eating locusts as a food source strongly influenced the decision not to try locusts (L1) was the next influential variable in this function.

The discriminant analysis that was related to Environmentally Sustainable Consumption factors (E1-E4) had produced three canonical discriminant functions and with the first function explaining 87.8% of the variance according to stats. The Wilks' Lambda test revealed a significant difference in the means between the groups ($\Lambda = 0.627$, $\chi^2 = 56.099$, $df = 12$, $p < 0.000$), indicating that environmental sustainability considerations significantly influenced participants' decisions. The coefficients of the analysis related standardized canonical discriminant function highlighted the importance in the analysis of considering environmentally sustainable consumption when making food choices (E1) and considering sustainable consumption greatly influencing the decision to include or exclude locusts from diet E4 as the most influential variables in this function, according to the analysis. The discriminant analysis pertaining to factors of Religious Permissibility (R1-R4) showed and resulted in three canonical discriminant functions, with the first function explaining 89.8% of the variance, according to analysis. The Wilks' Lambda test indicated a significant difference in the means between the groups ($\Lambda = 0.585$, $\chi^2 = 64.238$, $df = 12$, $p < 0.000$), emphasizing that religious considerations played a significant role in participants' decisions. The standardized canonical discriminant function coefficients showed and resulted from the output that having significant concerns about adhering to religious dietary restrictions and whether consuming locusts aligns with religious beliefs (R3) and considering the religious permissibility of consuming locusts in decision regarding their inclusion in diet (R1) were the most influential variables in this function as per the output of the analysis.

5. Conclusions

In conclusion, this study delved into the determinants influencing the willingness of Pakistani university students to embrace locust-based food products. Employing a broad questionnaire to include amid other factors disgust, safety issue, culture considerations, lack of knowledge, environmentalism and whether religious is permissible the research focused and highlighted on entangled dynamics that affect participants attitudes. Descriminant analysis evidence the co-operation of key influencers which were directed towards the pity, the environment and religious morality/values. While cultural elements or the common knowledge have some important impact on the choice to eat forms of locust. Nevertheless, the research has its constraints. The fact that the sample consisted of a particular group, there is no control group to take into account self-reported data, and a cross-sectional design, so the research findings subsumption should be done carefully. What follows in the future perhaps can be improved by recruiting participants from different places, giving its longer lasting studies new life, exploring cultural differences set forth by in-depth qualitative research, intervening and studying the influence of various initiatives, and surveying the global scene by comparing people's sentiments every place on the planet. By taking these specific points into account, there will be more accurate and comprehensive understanding of the differences of factors involved in the acceptance of new food sources. Consequently, the findings of this research will both contribute to academic knowledge and provide practical implications.

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