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# Exploring the Consumption of Silkworms in Kenya: Consumer Perceptions, Nutritional Awareness, and Market Potential

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## Abstract

This study evaluates perceptions, awareness, and the potential for implementing silkworms as an alternative protein source in Kenya's food system. It investigated how cultural beliefs, nutritional perceptions, and market accessibility affect consumer attitudes and willingness to consume silkworm-based products. The weak and non-significant relationship between market availability and willingness suggests that adoption is more dependent on awareness and cultural perceptions. Although there was a fairly positive perception of nutritional value, willingness to consume was significantly influenced by cultural beliefs. Although generally low, knowledge of silkworms as food had a positive correlation with educational level. The findings highlight the need for culturally sensitive approaches and educational programs to promote silkworm consumption. Policymakers, public health groups, and agri-food entrepreneurs might use these insights to develop targeted programs that promote the use of alternative proteins.

Keywords- Silkworm Consumption, Alternative Protein, Sustainable Nutrition, Market Accessibility, Kenya

# 1. Introduction

Global food systems are facing several difficulties in the twenty-first century, especially in light of the loss of natural resources, urbanization, climate change, and rapid population increase. As the global population is projected to exceed 9 billion by 2050, ensuring food security, availability, accessibility, utilization, and stability remains a critical concern for policymakers, researchers, and communities worldwide (FAO, 2013). The increasing demand for foods high in protein and the unsustainable nature of conventional animal agriculture, which severely strains land, water, and energy resources, are two major factors contributing to this dilemma. Investigating substitute protein sources is vital and essential in this situation.

Silkworms (Bombyx mori), among other edible insects, have become a promising remedy for the increasing protein shortage. Compared to conventional livestock, insects are more effective at turning feed into protein, utilizing less water and land, and producing less greenhouse gas emissions(Van Huis, 2013). According to research, silkworms are a particularly nutritious food source because they are abundant in vitamins, unsaturated fatty acids, high-quality protein, and vital minerals, including calcium and iron(Kim et al., 2016). Additionally, silkworm farming is in line with global sustainability goals because it generates



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little waste and may be incorporated into circular economy models.

In many places, including Kenya, the use of foods derived from silkworms is still very low, despite these benefits. Despite being widespread in some regions of Africa, the consumption of insects, known as entomophagy, is frequently limited to rural areas and particular ethnic groups (Ayieko et al., 2008). While eating termites, grasshoppers, and locusts is common in some parts of Kenya, eating silkworms has not yet gained widespread acceptance or mainstreaming. This disparity emphasizes how important it is to comprehend consumer attitudes, behavior, and the obstacles to the use of silkworms as food.

A complex interaction of cognitive, cultural, psychological, and contextual elements shapes consumers' adoption of novel foods. Research has demonstrated that neophobia (fear of trying unfamiliar foods), lack of knowledge, social norms, and perceived health risks can all influence food choices, particularly when it comes to insect-based products (Tan et al., 2015). Lack of policies promoting the commercialization of edible insects, poor marketing infrastructure, and low awareness all contribute to these obstacles in Kenya. This study is based on the Theory of Planned Behavior (TPB), which suggests that an individual's behavioral intention is influenced by attitudes toward the behavior, subjective norms, and perceived behavioral control (Ajzen, 1991). Through the application of TPB to silkworm consumption, the study aims to investigate the ways in which personal beliefs, social influences, and perceived access impact the willingness to consume foods derived from silkworms. In order to investigate how market availability, pricing, and informative campaigns might either help or hinder the adoption of sustainable food habits, the study also consults behavioral economics and public health literature.

A considerable percentage of Kenyans suffer from protein-energy malnutrition, particularly in areas with low incomes and food insecurity (Kenya National Bureau of Statistics, KNBS, 2020). Although government initiatives and programs funded by donors seek to address these nutritional deficiencies, they frequently concentrate on conventional animal products and staple crops. A special chance to assist nutrition-sensitive agriculture and diversify protein sources can be provided by the introduction of silkworms into the food chain. However, market viability, cultural acceptance, and consumer awareness will all be necessary for a successful integration.

Thus, by examining public knowledge, adoption readiness, and the impact of cultural, informational, and economic factors, this study seeks to evaluate the potential of silkworms as a sustainable and nutritious protein source in Kenya. It generates data-driven insights for marketing, policy, and future research by fusing statistical analysis with a theoretical framework. It is anticipated that the results will inform scholarly research as well as real-world initiatives to enhance food security, lessen the impact of livestock on the environment, and promote more sustainable consumption patterns in Kenya and similar contexts.

In the end, this study tackles a critical intersection between culture, nutrition, and sustainability. It emphasizes how crucial it is to respect local beliefs and preferences while incorporating alternative proteins into food policy frameworks and consumer education initiatives. By doing this, it contributes to the expanding body of knowledge on edible insects and advances the global shift toward inclusive, resilient, and climate-smart food systems.

The remainder of this paper discusses the background and hypotheses development, where it covers the importance of alternative proteins in Kenya and the main hypotheses of the study concerning awareness, perceptions, and influencing factors. The research design, including the questionnaire structure, sampling, and analytical procedures, is described in the methodology section. The results summarize the statistical findings for each hypothesis, and the discussion and implications section interprets the results and highlights both theoretical contributions and practical strategies for promoting silkworm consumption.



Lastly, the conclusion summarizes the findings, acknowledges limitations, and makes recommendations for further research.

# 2 Theoretical Background

This study is grounded in the behavioral and consumer acceptance theories that describe how people develop opinions and make choices regarding new or unfamiliar food products. The main theoretical foundation is the Theory of Planned Behavior (TPB), which holds that three constructs, attitude toward the behavior, subjective norms, and perceived behavioral control have an impact on behavioral intention. These factors are essential to comprehending why customers might accept or reject meals derived from silkworms in the context of eating edible insects.

In order to present silkworms as a sustainable food source, attitudes must be influenced by perceived health benefits and nutritional awareness. Subjective norms are a reflection of social pressures, taboos, and cultural beliefs. These factors are especially important in Kenya, where traditional dietary norms may have an impact on entomophagy openness. Contrarily, perceived behavioral control influences consumers' practical capacity to carry out their goals and encompasses the product's accessibility and availability.

Additionally, components of innovation diffusion theory aid in the investigation of silkworm adoption by addressing aspects like awareness, trialability, and relative advantage in comparison to current protein sources. Combining these theories enables a comprehensive knowledge of the factors that influence and hinder the consumption of silkworms and aids in the creation of plans to increase consumer acceptance within Kenya's changing food system.

## 2.1 Hypothesis Development

Edible insects like locusts, termites, and grasshoppers are widely accepted and traditionally consumed in many African societies. Silkworms are still not widely known as a food source, though. As van Huis (2013) emphasized, unfamiliarity with edible insects often leads to rejection, not because of the intrinsic nature of the insects themselves, but due to a lack of information and exposure. Because silkworms are more commonly associated with the production of silk than with a protein source, there seems to be little public awareness of their consumption in Kenya. This information gap is further exacerbated by the absence of market presence, academic attention, and public campaigns.

In the Kenyan context, more commonly recognized edible insects include termites and locusts, which are part of certain ethnic cuisines (Alemu et al., 2015). However, silkworms are not traditionally consumed in Kenya, and their introduction may be met with skepticism. Tan et al., (2015) further support this by noting that cultural exposure and individual experience significantly influence consumer openness to entomophagy. This suggests that low awareness directly correlates with low adoption potential. Previous research has shown that raising awareness is frequently the first obstacle to launching new food products, which supports this. This study assesses the number of Kenyans who have even heard of eating silkworms and how their knowledge, or lack thereof, influence their willingness to eat them. Therefore, the following hypothesis is proposed:

H1. There is low public awareness of silkworms as an edible food source in Kenya.

Numerous studies have demonstrated that knowledge, particularly nutritional knowledge, significantly shapes attitudes and behaviors toward novel foods, including edible insects. When individuals are aware of the health benefits associated with a product, they are more likely to develop a favorable attitude toward it and, consequently, express willingness to try or adopt it. Verbeke (2015) found that increased knowledge about the environmental and nutritional advantages of edible insects was associated with a higher



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willingness to consume them. Similarly, Hartmann et al., (2016) observed that consumers with higher awareness of insect protein's benefits demonstrated more openness to including insects in their diets.

Schösler et al., (2012) also emphasized that one major barrier to entomophagy (insect consumption) is lack of knowledge, suggesting that providing consumers with accurate information about nutritional and ecological benefits can increase acceptance levels. These findings align with the Theory of Planned Behavior (Ajzen, 1991), which posits that attitudes (influenced by knowledge) shape behavioral intentions. If someone believes that silkworms are nutritious, they are more likely to view consuming them positively, leading to greater willingness. This study investigates the nutritional knowledge level of Kenyans on Silkworm-based food products and whether they are willing to consume them. Therefore, the following hypothesis is proposed:

H2. There is a significant positive relationship between nutritional knowledge of silkworms and the willingness to try silkworm-based food products.

Dietary behavior is strongly influenced by cultural conventions and food beliefs. Ethnic and regional customs and beliefs determine how insects are consumed in Kenya. Certain insects may be considered improper or dirty in some groups, but they may be accepted in others. Silkworms are likely to be viewed with skepticism or even disgust because they are not a traditional element of Kenyan food culture. When unfamiliar foods are presented, these emotional responses are typical (Rochow, 2009). This examines if such cultural beliefs will provide a significant obstacle to the adoption of silkworms. Regardless of the nutritional advantages, consumer willingness may remain low if silkworms are viewed as foreign, unsafe, or taboo. The study investigates if educating people about environmental advantages and nutrition might change their opinions. Therefore, the following hypothesis is proposed:

H3. Cultural perceptions significantly influence the willingness to consume silkworm-based food.

Hartmann et al., (2016) found that products where insects are not visible, such as those incorporated into flour or processed snacks, are significantly more acceptable to Western consumers. Verbeke (2015) emphasized that the visibility of insects plays a strong role in consumer acceptance, and that incorporating insects into familiar processed foods may reduce resistance. Tan et al.. (2016)Highlighted that food presentation style, especially minimizing the insect's recognizability, positively affects acceptance, particularly among insect-naive consumers. In the Kenyan context, where insect consumption may not yet be mainstream, respondents may be more open to adopting insect-based foods if they are integrated subtly into more familiar formats. This aligns with findings in other nonentomophagic societies where reducing the visibility of insects tends to reduce psychological barriers, particularly disgust and fear. Therefore, the following hypothesis is proposed:

H4: Willingness to try silkworm-based food significantly differs based on the preferred form of consumption.

In developing countries, such as Kenya, where traditional diets may not include insects like silkworms, market presence not only influences accessibility but also reinforces perceptions of food legitimacy and safety (Kim et al., 2019). Tan et al., (2015) found that increased exposure and market presence significantly influenced the willingness of Western consumers to consider edible insects as a viable protein source. In the context of edible insects like silkworms, consumers are more likely to adopt such novel food products when they are easily obtainable in common market settings, such as supermarkets and restaurants (Van Huis et al., 2013). Limited access and distribution often serve as practical barriers, regardless of a consumer's knowledge or positive perception of the food item (Verbeke, 2015).

The acceptance of silkworms is heavily reliant on market systems, despite growing knowledge and positi-



ve attitudes. Customers won't be able to include silkworm-based foods in their diets if they are not readily available, reasonably priced, or visible in Kenyan markets. According to earlier research, the economic success of edible insects is severely hampered by a lack of supply chain development. The majority of edible insect sales in Kenya are informal, and official retail mechanisms are gradually developing. The purpose of this study is to determine whether respondents would be more willing to sample silkworms if they were offered in supermarkets. Therefore, the following hypothesis is proposed:

H5. Market availability and accessibility impact the likelihood of silkworm adoption in consumer diets.

# 3. Methodology

# 3.1 Research Design

This study adopted a mixed-method approach, combining qualitative and quantitative research techniques. This approach guarantees a thorough comprehension of consumer perceptions, nutritional awareness, and the market potential for silkworm consumption in Kenya. A cross-sectional survey design was used, allowing data collection at a specific point in time from diverse consumer groups. This design was suitable for evaluating current awareness, attitudes, and willingness to consume silkworms.

# **3.2 Sample Design**

**Population:** The target population was made up of adult Kenyan residents across different regions and socio-economic backgrounds. Both urban and rural respondents were included in the population, regardless of their prior exposure to edible insects, because the purpose of the study is to evaluate general awareness, attitudes, and willingness to consume silkworms as an alternative food source.

**Sampling Technique:** Convenience sampling method used was with random selection based on availability and willingness to participate. Respondents were approached through digital platforms, including WhatsApp, where a. While logistical and time constraints necessitated the use of convenience sampling, efforts were made to ensure a balance of demographics by disseminating the survey across a variety of networks, including WhatsApp and e-mail, where respondents were contacted.

**Sample Size:** The sample size for this study was determined by the number of individuals who were available and willing to participate. A total of 272 respondents took part in the survey, identified through convenience sampling. No formal sample size calculation was utilized because participation was voluntary and the study was exploratory in nature. The responses obtained were adequate to offer an understanding of awareness and perceptions of silkworm consumption in Kenya.

## 3.3 Data Collection

A structured questionnaire was used to collect data for this investigation, and the questionnaire was distributed online. Both closed-ended and Likert-scale questions were included in the survey to assess awareness, perceptions, and willingness to consume silkworm-based food products. Google Forms was the main tool used for online distribution, and it was shared on WhatsApp and other social media sites to reach a wide range of people. All participants gave their full consent before to filling out the survey, and participation was entirely voluntary. A total of 272 responses were collected over a period of one month, and all responses were used for analysis.

## **3.4 Analysis Techniques**

Data analysis for the data gathered from the 272 respondents was done using the Statistical Package for the Social Sciences (SPSS). Both descriptive and inferential statistical methods were applied to address the study's objectives and test the hypotheses. Finding broad trends and response patterns throughout the sample was made easier by these analyses.



The degree of awareness was assessed using descriptive statistics, and cross-tabulations were conducted to investigate the connections between awareness and demographic factors including age, gender, and education level. Nutritional knowledge were determined using one-sample t-tests to a neutral midpoint on the Likert scale. A Chi-square test of independence was employed to investigate the relationship between cultural beliefs and silkworm consumption. For this, responses on the Likert scale were entered into categorical variables. To examine whether willingness to try silkworm-based food products differs significantly based on preferred form of consumption, a one-way Analysis of Variance (ANOVA) was conducted. To investigate the connection between willingness to consume and perceived availability/accessibility, a correlation analysis was performed.

# 4. Results

# 4.1 Profile of participants

The demographic profile of participants is presented in Table 1. The respondents were between the age of 18 years to 55 years and above. Majority of the respondents were male, employed and had a College/university degree.

Demographic	Frequency	%
Gender		
Male	143	53
Female	129	47
Age		
18-25	44	16
26-35	143	53
36-45	37	14
46-55	27	10
Above 55	21	7
Education		
No formal education	2	0.7
Primary	2	0.7
Secondary	11	4
College/University	195	72
Postgraduate	62	23
Occupation		
Student	30	11
Employed	130	48
Self-employed	62	23
Unemployed	36	13
Farmer	14	5

 Table 1: Demographic profile (n=272)



#### 4.2 Relationship between public awareness and Silkworm consumption

Table 2 shows the results of a cross-tabulation between awareness of silkworm as food and the various demographic variables. According to the results, 153 (56.3%) out of 272 respondents were aware of Silkworm as an edible food source while 119 (43.8%) were not aware. To investigate the connection between gender and knowledge of silkworm consumption as food, a cross-tabulation was performed, and the results are as shown. According to the findings, 66 (51.2%) of females and 87 (60.8%) of males said they had heard of silkworms being eaten. On the other hand, 63 (48.8%) of women and 56 (39.2%) of men had never heard of it. A slightly higher percentage of male respondents among all respondents were aware that silkworms are consumed.

A chi-squared test of independence was used to determine whether this observed difference was statistically significant. The test result in Table 3 shows that there was no statistically significant relationship between gender and awareness ( $\chi^2$  (1, N = 272) = 2.580, p =.108). This implies that awareness of silkworm consumption in this sample is not significantly influenced by gender, even though a slightly higher percentage of men were found to be aware

The results revealed significant differences across age groups as shown in Table 2. Respondents in Age Groups 46–55 (70.4%) and 18–25 (67.2%) showed the most awareness, while Group over 55 showed the lowest awareness, with only 28.6% indicating familiarity with silkworm consumption. Interestingly, Age Group 36-45 had more unaware (51.4%) than aware (48.6%) individuals. These findings suggest that age plays a role in the level of awareness regarding edible insect consumption, with older individuals less likely to be informed.

Additionally, a Chi-square test of independence revealed a significant relationship between age group and awareness of silkworm consumption, with  $\chi^2$  (4, N = 272) = 12.15, p =.016. This supports the hypothesis H1 by indicating that age group influences public awareness and that awareness levels varied significantly across age groups. The results of the Chi-square test are presented in Table 3.

A cross-tabulation between education level and awareness of silkworm consumption revealed that awareness was lowest among respondents with no formal education (0%) and highest among those with college/university education. Of those who had attended college or university, 56.9% were aware, while 43.1% were unaware . The trend supports the idea that education adds to knowledge about eating edible insects by indicating a positive correlation between awareness and educational attainment. The results for the cross-tabulation are as presented in Table 2.

To investigate further, the study used a Chi-Square test of independence to investigate the relationship between education and awareness levels of silkworms as an edible food source in Kenya and the results are as presented in Table 3. The Pearson Chi-Square value was 4.637 with 4 degrees of freedom, and the associated p-value was 0.327. The p-value is greater than the traditional significance level of 0.05, which means that there is not enough evidence to suggest a significant association between education and awareness. This indicates that there is insufficient evidence to suggest a significant association between education between education and awareness. Awareness of silkworms as an edible food source does not differ significantly across education levels among the respondents.



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# Table 2: Summary of cross-tabulation of awareness of silkworm consumption by demographic variables

Demographic	Categories	Aware	% Aware	Not aware	% Not aware	Total (n)
Gender	Male	87	60.8	56	39.2	143
	Female	66	51.2	63	48.8	129
	Total	153	56.3	119	43.8	272
Age	18-25	30	68.2	14	31.8	44
	26-35	80	55.9	63	44.1	143
	36-45	18	48.6	19	41.4	37
	46-55	19	70.4	8	29.6	27
	Above 55	6	28.6	15	71.4	21
	Total	153	56.3	119	43.8	272
Education	No formal	0	0	2	100	2
	education					
	Primary	2	100	0	0	2
	Secondary	7	63.6	4	36.4	11
	College/University	111	56.9	84	43.1	195
	Postgraduate	33	53.2	29	46.8	62
	Total	153	56.3	119	43.8	272
Occupation	Student	18	60	12	40	30
	Employed	63	48.5	67	51.5	130
	Self-employed	44	71	18	29	62
	Unemployed	22	61.1	14	38.9	36
	Farmer	6	42.9	8	57.1	14
	Total	153	56.3	119	43.8	272

# Table 3: Summary of chi-square test results for awareness of Silkworm consumption by demographic variables (n=272)

Variable	χ² Value	df	p-value	Interpretation	
			(Asymptotic)		
Gender	2.580	1	0.108	Not significant ( $p > 0.05$ ). No	
				strong relationship.	
Age	12.145	4	0.016	Significant ( $p > 0.05$ ). Age	
				influences awareness.	
Education	0.923	4	0.921	Not significant. No	
				association between	
				education and awareness.	

# 4.3 Relationship between nutritional knowledge of silkworms and the willingness to try silkwormbased food products.

A one-sample t-test was conducted to evaluate participants' self-rated knowledge of their nutritional kno-



wledge on Silkworms to explore the potential of silkworms as a sustainable and nutritious alternative protein source. The average rating was 2.09 on a 5-point scale (1 = No Knowledge, 5 = Very Knowledgeable), indicating generally low awareness.

Although the results indicate that respondents possess some knowledge regarding the nutritional value of silkworms, the mean score (M = 2.088) falls below the midpoint of the 5-point Likert scale, suggesting relatively low to moderate awareness. These findings as shown in Table 4 support the hypothesis (H2) by revealing an opportunity for education and awareness initiatives to close the knowledge gap and promote silkworms as a viable alternative protein in Kenya's food system.

# Table 4: One-Sample t-Test of Nutritional Knowledge of Silkworms

(N = 272)

	t	df	Sig. (2-tailed)	Mean Difference	95% CI (Lower)	95% CI (Upper)
Nutritional Knowledge	29.803	271	<.001	2.088	1.95	2.23

4.4 Relationship between cultural perceptions and the willingness to consume silkworm-based food. A chi-square test of independence was performed using two sets of data, the full sample of respondents (N = 272) and a filtered subgroup of participants (N = 71) who specifically mentioned cultural beliefs or taboos as a factor influencing their decision in order to test the hypothesis that cultural perceptions significantly influence the willingness to consume silkworm-based food (H3).

# 4.4.1 Full Sample Analysis

There was no statistically significant association between the two factors in a cross-tabulation of cultural beliefs/taboos and desire to consume food products made from silkworms. The Pearson Chi-Square value was  $\chi^2(4) = 3.776$ , p = 0.437. The findings imply that willingness to consume meals made from silkworms was not significantly influenced by cultural views when taken into account for the entire sample. Results are presented in Table 5.

# 4.4.2 Subgroup Analysis: Culturally Influenced Respondents

A focused chi-square test was performed on the subset of 71 respondents who chose "cultural beliefs/taboos" as the basis for their food choice in order to investigate the influence of cultural perceptions in more detail. A Pearson Chi-Square value of  $\chi^2(1) = 2.580$ , p = 0.108 was obtained from the test as presented in Table 5. This p-value does not approach statistical significance because it is still above the standard alpha level of 0.05, even though it is lower than that of the entire sample and suggests a possible trend.

According to the results, neither the overall sample nor the culturally impacted subgroup showed a statistically significant correlation between their desire to eat silkworm-based food products and cultural views or taboos. While the subgroup analysis suggests a non-significant trend, it is not strong enough to prove the hypothesis. To clarify this relationship, future studies with a larger, more diverse sample size could be required.



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Group	χ²(Chi- Square Value)	df	p-value	Ν	Interpretation
Full sample	3.776	4	0.437	272	No significant association between cultural beliefs and willingness.
Cultural belifs/taboos subgroup	2.580	1	0.108	71	No significant association was found among those who cited cultural reasons.

# Table 5: Full sample analysis and Subgroup analysis

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## 4.5 Willingness to try silkworm-based food differs based on the preferred form of consumption.

To assess differences in willingness to try silkworm-based food based on preferred form of consumption, a one-way ANOVA followed by a Tukey HSD post hoc test was conducted. The homogeneous subsets shown in Table X group participants with similar mean willingness scores. The results show that participants who indicated "none" as their preferred form (Group 4) formed a distinct group with the lowest average willingness score (M = 2.47), significantly lower than those who preferred other forms. In contrast, respondents who preferred "whole cooked" (Group 1) reported the highest willingness (M = 3.91), forming a separate subset. Those who preferred processed snack (Group 3) and powdered (Group 2) products clustered in intermediate subsets (M = 3.15 and M = 3.44, respectively), with the powdered form overlapping into the highest subset. While some differences between groups were not statistically significant (e.g., between Groups 2 and 3), the table indicates a clear trend: respondents who were open to some form of silkworm-based food had higher willingness to try silkworm-based food significantly differs based on the preferred form of consumption.

Form of Silkworm-based		Subset for alpha	= 0.05	
food	Ν	1	2	3
4	57	2.47		
3	122	3.15	3.15	
2	70		3.44	3.44
1	23			3.91
Sig.		.076	.714	.333
Means for groups in	homogeneous su	bsets are displayed	•	•

Table 6:	Tukey	HSD	Homogeneous	Subsets
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- a. Uses Harmonic Mean Sample Size = 47.902.
- b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

# 4.6 Relationship Between Market Availability and Willingness to Adopt Silkworm-Based Food

The relationship between the perceived market availability and the willingness to consume food products made from silkworms was evaluated using a Pearson correlation analysis. Two factors were included in the analysis: (1) general willingness to try silkworm-based food products, measured on a 5-point Likert scale (1 = Not Willing, 5 = Very Willing), and (2) willingness to purchase if the product were available in supermarkets. Table 7 presents the correlation results.

There is a weak negative association between perceived availability and willingness to try food products made from silkworms, according to the correlation coefficient (r = -0.116). The p-value (p = .056) is marginally higher than the conventional alpha level of 0.05, indicating that the correlation is not statistically significant even though the association is negative. Therefore, the data does not give strong evidence that availability directly influences willingness to adopt, even though some respondents may express hesitancy even if the product is available.

These findings imply that although market availability is an important consideration, other factors such as cultural perceptions, awareness, and education may play a more dominant role in influencing adoption.

Variable	Pearson	Sig. (2-tailed)	Ν
	Correlation		
Would you be willing to			
purchase silkworm-	1	-	272
based food if it were			
available in			
supermarkets?			
How willing are you to			
try silkworm-based food	-0.116	0.056	272
products?			

**Table 7: Pearson Correlation** 

# 5. General Discussion

The present study set out to investigate the potential of silkworm-based food products as a sustainable and nutritious alternative protein source in Kenya. Edible insects have been suggested as potential substitutes as global food systems are facing unprecedented pressure from population growth, climate change, and unsustainable agricultural practices. The introduction of novel protein sources, like silkworms, could have both nutritional and environmental benefits in Kenya, where food insecurity, protein-energy malnutrition, and fluctuating food costs present serious public health and economic challenges. However, consumer knowledge, perceptions, cultural attitudes, and market dynamics are critical to the successful integration of such alternatives into regional food systems. This study investigated these factors through a comprehensive survey, and the results provide valuable insights into the advantages and disadvantages of



eating silkworms in Kenya.

The findings indicate a modest level of public awareness, with slightly more than half (56.3%) of the respondents having heard of silkworms being eaten. In spite of this, a one-sample t-test showed that self-reported knowledge of the nutritional advantages of silkworms had a comparatively low mean score of 2.09 (on a 5-point scale). Even while this score was much higher than zero, it nonetheless emphasizes that awareness is not always the same as informed comprehension. Strategies for public health communication are hampered by this nutritional literacy gap. Fewer Kenyans are aware of the specific health advantages of silkworms, such as their high protein content, presence of essential amino acids, and potential cholesterol-lowering qualities, even though many are aware that insects can be eaten. The public must be given targeted, fact-based information emphasizing the nutritional advantages of silkworms over traditional protein sources like beef or chicken in addition to awareness if adoption is to take hold.

To ascertain if demographic characteristics influence awareness, age, gender and educational attainment were examined. There was no statistically significant correlation between awareness and education ( $\chi^2 = 4.637$ , p = 0.327) or between gender and awareness ( $\chi^2 = 2.580$ , p = 0.108), according to crosstab analysis, but a Chi-square test of independence revealed a significant relationship between age group and awareness of silkworm consumption ( $\chi^2 = 12.15$ , p = .016). Descriptive data showed that slightly more men and those with College/University education expressed awareness, despite these findings suggesting that awareness may be rather similarly distributed across these categories. This might be a reflection of larger patterns in which men and those with higher levels of education have easier access to media and knowledge, or they might be more receptive to new culinary innovations. The lack of statistical relevance, however, suggests that initiatives to encourage the consumption of silkworms shouldn't unduly favor one gender or educational attainment over another. To reach a wide range of people, messaging should instead be inclusive and shared on a variety of channels, such as social media, community centers, marketplaces, and schools.

Cultural resistance, which is typically based on taboos, traditional beliefs, and ideas about the acceptability or purity of food, is one of the most commonly mentioned possible obstacles to insect consumption in Africa. The study looked at how cultural beliefs/taboos and readiness to try silkworm goods relate to each other in order to evaluate this. Although a subset of respondents did cite cultural views as a rationale for rejection, chi-square analysis revealed no significant correlation between cultural beliefs and consumption willingness ( $\chi^2 = 3.776$ , p = 0.437). This outcome is unexpected and encouraging. It implies that although cultural beliefs/taboos could have an impact on eating habits, they might not be as strict or widely accepted as previously thought. Rather, there seems to be a rising willingness to try new foods when they are presented in appealing and familiar forms (e.g., silkworm flour used in bread or porridge), especially among younger or urbanized populations. It also illustrates how culture is dynamic and changes over time in response to exposure, need, and knowledge.

The study revealed significant differences in willingness to try silkworm-based food depending on the preferred form of consumption. Participants who indicated they would not try silkworms in any form had the lowest willingness scores, while those open to whole cooked or powdered forms showed higher willingness. Notably, powdered and processed formats were associated with greater acceptance, likely due to reduced visibility of the insect and lower levels of food neophobia (Tan et al. 2015; Schouteten et al. 2016). These findings support the hypothesis that product form influences consumer openness and suggest that introducing silkworm-based foods in less recognizable forms could enhance adoption in the Kenyan market.



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Product availability and market accessibility are commonly mentioned as either facilitators or obstacles to the adoption of novel foods. In order to investigate this, the study looked at the relationship between the likelihood of buying silkworm products if they were sold in supermarkets and the willingness to try them. A weak negative association that was not statistically significant was seen in the results (r = -0.116, p = 0.056). Although it makes sense that more availability would result in increased willingness, this result casts doubt on that theory. It implies that merely placing silkworm items on store shelves might not be enough to spur customers' curiosity. Consumers must first be convinced of the product's safety, nutritional worth, and palatability. Furthermore, availability may be subordinated to deeply ingrained beliefs about food, taste expectations, and unfamiliarity. Therefore, distribution alone is not enough for market introduction strategies. They should entail public tasting, attractive packaging, endorsement by reputable health professionals, and cookery demonstrations that present silkworms in a familiar culinary setting. Incentivizing early adopters and normalizing consumption through school feeding programs or government nutrition plans could potentially assist spark widespread acceptance.

The Theory of Planned Behavior, which guided this study, places a strong emphasis on the relationship between behavioral intention and actual behavior. The TPB holds that intention is the best predictor of behavior and is influenced by subjective norms, perceived behavioral control, and attitudes toward the behavior. In this study, behavioral intention is represented by willingness to try foods made from silkworms, and the results indicate that although attitudes are generally neutral to moderately positive, actual intention to purchase is still tentative. Intention is influenced by a variety of factors, including market presence, cultural acceptance, and nutritional awareness. Crucially, the discrepancy between willingness and actual buying behavior highlights the significance of enabling factors, including peer approval, taste testing, and price. As a result, TPB helps identify important action points, such as strengthening perceived control (via accessibility and simplicity of use), influencing norms (through social campaigns), and modifying attitudes (through education).

The study has broader implications for sustainable development and food policy in addition to the statistical conclusions. Silkworms offer a scalable and sustainable solution as Kenya and other African nations struggle to diversify their protein sources in the face of population and climatic constraints. Silkworms generate substantially fewer greenhouse gas emissions and require less land, water, and feed than animals. Insect farming could boost rural economies and lessen reliance on imported food if they are included into local diets. However, a multi-sectoral strategy involving public health, education, agriculture, and commerce is needed to realize this potential. To foster an environment that supports entomophagy, the Ministries of Agriculture and Health must collaborate with academic institutions, private business owners, and the media.

## **5.1 Theoretical Implications**

By using the Theory of Planned Behavior (TPB) as a lens, this study adds to the body of theoretical discussion on food acceptance and behavior (Ajzen, 1991). Subjective standards, perceived behavioral control, and attitudes toward the conduct all influence an individual's behavioral intentions, according to TPB. In this study, social attitudes and perceived benefits seemed to have an impact on people's willingness to consume silkworm-based food products, but cultural beliefs did not have a statistically significant impact. This calls into question several well accepted beliefs that the main factor influencing entomophagy rejection is cultural resistance(Looy et al. 2014).

Accessibility and affordability are examples of behavioral control factors that may have less influence than expected unless combined with strong attitudinal support, according to the weak but existent



relationship between availability and willingness (Sogari et al. 2019). Furthermore, the relatively low level of nutritional knowledge among respondents highlights the theory's emphasis on the necessity of informed attitudes as a prelude to behavioral intention, even though education level did not significantly affect awareness or willingness(Tan et al. 2015). By indicating that the adoption of novel foods, such as edible insects, may necessitate both cognitive and experiential engagement to change consumer norms, these findings emphasize the significance of context-specific elements and expand the TPB framework (Hartmann and Siegrist 2017).

# **5.2 Practical Implications**

Practically, the results provide useful information for public health advocates, food producers, and legislators who want to support sustainable protein substitutes in Kenya and other comparable settings. First, there is a pressing need for nutritional education efforts, as seen by the inadequate self-reported knowledge about silkworm nutrition (mean = 2.09). In addition to protein content, information should highlight food safety, culinary flexibility, and environmental benefits (Van Huis, 2013). This is consistent with previous studies that indicate consumers are more receptive to new foods when they are presented with reliable and favorable information (Tan et al. 2015).

Second, cultural attitudes continue to play a key role in forming consumer narratives, even though they were not a statistically significant barrier in this study. Community leaders, influencers, and local chefs can be used to position silkworm consumption within culturally relevant contexts, decreasing potential psychological and social resistance (Mancini et al. 2019). Additionally, sensory familiarity, which studies indicate is essential for altering perceptions, may be facilitated by food tastings, demonstrations, and incorporation into regional cuisine (Hartmann et al. 2017).

Third, supply-side tactics, like putting products in supermarkets, might not work without concurrent measures to boost demand, given the limited influence of market availability alone. This implies that every market-entry endeavor must incorporate integrated marketing tactics and inclusive product creation (taking flavor, pricing, and packaging into account) (Sogari et al. 2019).

Lastly, this study lends support to the notion that integrating edible insects into food systems is a systemic innovation problem that necessitates coordination across regulatory frameworks, cultural dynamics, and consumer behavior.

# 5.3 Limitations of the Study

This study has limitations despite its contributions. When it comes to socially sensitive subjects like food taboos or unconventional eating habits, the use of self-reported data may create bias. The sizeable sample may not accurately reflect all Kenyan areas or ethnic groups, and the cross-sectional methodology restricts the ability to draw conclusions about causality. To validate these results and obtain a deeper understanding of consumer decision-making, future research should investigate sensory evaluation studies, ethnographic techniques, and longitudinal designs. To further customize marketing tactics, it would also be advantageous to segment the population into groups based on age, income, or urban/rural residency.

## 6. Conclusion

This study provides a complex picture of Kenya's potential for embracing food products made from silkworms. There isn't a lot of opposition, but there are some obstacles, especially in the areas of hesitant willingness and inadequate nutritional understanding. Cultural resistance, which is frequently thought to be a substantial obstacle, was not statistically significant. This creates a window of opportunity for market innovation, education, and proactive participation. Silkworms have the potential to be a crucial part of



Kenya's sustainable food future if they are handled holistically, with cultural sensitivity and scientific rigor. They provide ecological sustainability and nutritional resilience in a world that is changing quickly.

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