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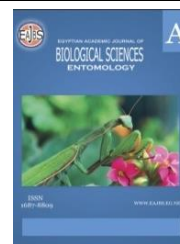
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Influence of Gender Integration on The Utilization of Edible Insects for Food and Nutrition Security

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ABSTRACT

In Western Kenya, insects have historically been consumed more as a delicacy than a primary nutritional source. With the growing popularity of Entomophagy as an alternative protein and the challenges posed by climate change and declining food production, there is a renewed interest in edible insects as a sustainable and efficient protein solution. Notably, there are prevailing gendered views on insect consumption in these communities. For instance, while women and children have embraced this delicacy, many adult males have reservations. This study delved into gender dynamics around the consumption and production of edible insects, with a focus on Bungoma County a region with a longstanding tradition of insect consumption. Given the scant literature on this subject, the research aimed to deepen the understanding of how gender roles, knowledge levels, and decision-making power influence the use of insects for nutrition and food security. Data was collected from 384 Bungoma farming households, constituting 78% of the county's farming demographic, using questionnaires, interviews, and purposive sampling techniques. Descriptive, Chi-square test of associations and the Kruskal-Wallis H test were used in quantitative analysis whose findings were presented in tables and figures. Thematic coding was applied in analysis of qualitative data. Key findings revealed that gender had no significant influence on utilization of edible insects for food and nutrition security ($H(1) = 2.726, P=0.099$). Gender-based decision making was found to have significant influence on the utilization of edible insects for food and nutrition security ($H(2) = 6.821, P=0.033$). Gender-based knowledge was also found to significantly influence the utilization of edible insects for food and nutrition security ($H(1) = 3.963, P= 0.047$). The study's findings underscore the need for community awareness programs to alter perceptions of insects as mere complements to diets. To bolster this, counties should ensure accessible nutritional information and prioritization of gender-inclusive approaches in promoting entomophagy.

INTRODUCTION

Edible insects have formed part of the food humans consume for thousands of years, and they remain an important source of protein and other nutrients in many cultures worldwide (Liceaga, 2022). Compared to other animal protein sources, edible insects are nutritious, contain high-quality protein, vitamins, and minerals, and can be obtained responsibly. They are also a highly efficient and low-cost protein source that can be generated on a small scale using low-tech techniques, which might help solve global food poverty (Adegboye *et al.*, 2021). Due to their potential to produce sustainable and healthy food, edible insects have gained popularity (Baiano, 2020). Despite its potential, eating insects is rare in many countries. Some cultures have unfavorable views of eating insects and little understanding of their nutritional value (Adegboye *et al.*, 2021). In addition, gender dynamics in edible insect consumption and production require more study to determine how they affect food and nutrition security.

According to Tripathi *et al.* (2019), the world's population is predicted to reach 9.7 billion, leading to a rise in food consumption, by 2050. Yet, achieving this demand would be difficult due to the need for sustainable and equitable food production. Malnutrition and food insecurity persist in many countries, particularly developing ones (Duro *et al.*, 2020). Insect manufacturing, a small-scale protein source that needs minimal equipment, may solve food shortages. Insects supply protein, vitamins, and minerals and are more ecologically friendly than other animal proteins (Akhtar & Isman, 2018). Many countries only consume and produce edible insects for a tiny portion of the population, despite their potential. Some cultures may have misconceptions about consuming insects and lack knowledge on their health benefits (Melgar-Lalanne, Hernández-Álvarez, & Salinas-Castro, 2019). Since gender's role in edible insect consumption and production is unknown, further research is needed to understand how gender dynamics affect food and nutrition security.

Bungoma County, located in the Western region of Kenya, it is a culturally key insect consuming area but has been identified as a food-insecure region (Lutomia *et al.*, 2019). Previous studies have suggested that gender disparities, dispositions, practices, and power play in decision-making affect the edible insect value chain at the household level and, ultimately, food and nutrition security. Therefore, integrating gender in the edible insect value chain ensures equal access to resources, empowerment through education and training, and decision-making power in nutrition.

Kröger *et al.* (2021) conducted a study on the acceptance of insect-based food products in Western Societies to determine how edible insects could replace/substitute meat protein in Western diets. They used a systematic review to gain an analytical understanding of nutrients and nutrition values, and their findings indicate that edible insects as an alternative protein source are developing rapidly. However, subjective norms and social pressure have resulted in the perception of entomophagy as a food alternative to meat in developing countries. The researchers recommended that future studies adopt a comparative approach and explore multiple protein sources.

According to the Ministry of Agriculture, Livestock, Fisheries, and Cooperatives (MoALFC, 2021), food insecurity in Bungoma County is 42%. Around 24% of children under five years are moderately or severely stunted, compared to a national average of 26%. In it, the population of children under five years who are wasted (moderate or severe) stands at 2%, compared to a national average of 4%; children under five years who are underweight stand at 9% against 11% at the national level. Moreover, children who are overweight or obese stand at 3%, compared to the national average of 4% (County Government of Bungoma, 2018, KNBS, 2014). Malnutrition is attributed to poor

diversification of food sources, including an over-dependence on crops such as maize. However, the county produces enough food for consumption and sale to other parts of the country.

The main research objective was to evaluate gender integration in the utilization of edible insects for food and nutrition security. The main research question studied was: how does gender play a role in dietary decision-making, specifically in relation to the consumption of edible insects, and what factors might contribute to these gender-based differences in decision-making?

By examining attitudes, perceptions, and cultural beliefs, assessed through interviews, surrounding insect consumption in Bungoma County (Barsics *et al.*, 2017; Bartkowicz, 2020), and identifying factors influencing this practice and its relation to gender dynamics (Alemu *et al.*, 2017; Alemu & Olsen, 2019), the study generates new insights that could inform policy interventions and implementations aimed at enhancing food security. These findings are relevant for public sector, government, and stakeholders in addressing food security challenges not only in Bungoma County but also in other regions with similar cultural practices.

This study's findings relied on collecting individual's insights concerning the use of edible insects meaning that biased or inaccurate information from respondents could affect the research findings. Further, reliance on local perceptions from Bungoma County may not reflect situations in other regions with prevalent insect consumption.

MATERIALS AND METHODS

Research Design:

The study adopted a mixed-method research design. This research design combined both quantitative and qualitative approaches, allowing for a comprehensive understanding of the factors affecting the utilization of edible insects in Bungoma County (Creswell & Poth, 2018). A mixed-method research design was well-suited for this study as it sought to provide a more in-depth understanding of the cultural and gender-related factors influencing the consumption of insects, which was critical in informing policy interventions and implementations aimed at enhancing food and nutrition security in Bungoma County and other similar regions. The quantitative component of the study involved the collection and analysis of numerical data, such as the frequency of edible insect consumption and the influence of gender dynamics on food security. Quantitative data was collected using questionnaires administered to a representative sample of individuals in Bungoma County. This component allowed for the generalization of findings to the larger population and providing a basis for policy interventions. The qualitative component of the study explored the lived experiences of respondents through the conduction of interviews. Interviews were conducted to assess the attitudes and perceptions of residents regarding the consumption of edible insects and how they contributed towards gender dynamics. Qualitative data was collected using in-depth interviews, enabling the researcher to triangulate the findings and enhance the credibility of the study. By adopting a mixed-method research design, the study gave a rich and in-depth understanding of the current state of edible insect consumption and its relationship to gender dynamics and food security in Bungoma County. This approach enabled the development of more robust policy interventions and implementations, informed by a comprehensive and rigorous analysis of the factors influencing edible insect consumption in the region.

Research Area:

This was a mixed study proposed to be conducted in Bungoma County which has an approximate population of 1670570 (KNBS, 2019a). The region is in western Kenya

which hosts a community that has traditionally consumed edible insects and borders counties that have hosted interventions to promote food from edible insects through pilot trials under “FlyingFoods”, “INSFeed” and “GREEiNSECT” Projects (Ayieko *et al.*, 2010; Kinyuru *et al.*, 2013; Looy *et al.*, 2014), also borders Eastern Uganda; a key insect consuming region. However, despite these interventions and history of utilizing edible insects, Bungoma County faces high food insecurity of 42% compared to the national average of 26% (MoALFC, 2021). The region’s strong cultural ties, beliefs and perceptions as well as gender dynamics concerning edible insects made it suitable as a research area from which valuable insights could be gained.

Bungoma County covers a land area of 3032.4 km², of which 618 km² is gazetted forest reserve, 61 km² is non-gazetted forest, and 50.7 km² is Mt. Elgon National Park. The County’s major physical features include Mt. Elgon; Chetambe, Sang’alo, and Kabuchai hills; the Nzoia, Kuywa, Sosio, Kibisi and Sio-Malaba/Malakisi rivers; and waterfalls like Nabuyole and Teremi (MoALFC., 2021). The altitude of the county ranges from 1,200 m above sea level to 4,321 m above sea level at the summit of Mt. Elgon (County Government of Bungoma, 2018).

Sample Size Determination and Sampling Procedure:

A sample size of 383.64 rounded to 384 respondents was selected using KREJCIE-MORGAN FORMULA (Morgan, 1970).

In this case, the population size was N=280,445 and wanted to calculate the sample size using the formula, assuming a proportion p=0.5 (maximum variability).

The formula for calculating the sample size using the Krejcie-Morgan formula is:

$$n = \frac{Z^2 * N * p * (1 - p)}{[e^2 * (N - 1) + Z^2 * p * (1 - p)]}$$

where:

- n is the required sample size
- Z is the critical value for the desired confidence level (at 95% confidence level, Z=1.96)
- N is the population size
- p is the proportion of the population with the characteristic of interest (assumed to be 0.5 for maximum variability)
- e is the desired margin of error

Substituting the given values into the formula, we get:

$$n = \frac{(1.96)^2 * 280,445 * 0.5 * (1 - 0.5)}{[(0.05)^2 * (280,445 - 1) + (1.96)^2 * 0.5 * (1 - 0.5)]}$$

Simplifying this expression, we got:

$$n = 383.64$$

$$n = 384$$

Subsequently the study used a purposive sampling technique. The used personal judgement to choose cases that helped answer research questions and achieve research objectives. Snowballing sampling was employed during data collection to identify the next respondents for the interviews through referrals.

Data Collection Procedures:

The study employed a mixed methodology approach to collect data, using questionnaires and interviews. This approach aimed to gather information on attitudes, perceptions, and cultural beliefs surrounding the consumption of insects in the region. Both qualitative and quantitative data were collected through key informant interviews (KII), and questionnaires, with purposive sampling used to identify respondents. Five trained fieldworkers, including three research officers and two field supervisors, conducted the interviews in the respondent's preferred language of English or Swahili, translating when necessary.

The data collection process for this mixed research study involves several steps. First, enumerators were trained to familiarize themselves with the research instruments, such as interview guides, and questionnaires, ensuring consistency and accuracy in data collection. Second, in-depth interviews with key informants were conducted at their appointed times, using an interview guide to gather comprehensive information on the subject of study. Additionally, the researcher visited selected households, markets, and other relevant locations in Bungoma County to observe the consumption and handling practices of edible insects, their sources, and their preparation and storage methods.

Questionnaires were used to collect quantitative data from a broader sample of participants. These self-administered questionnaires contained closed-ended questions to gather information on demographics, attitudes, knowledge, and practices related to insect consumption. The questionnaires were distributed either physically or electronically, depending on the preferences and accessibility of the respondents. With permission from respondents, interviews were audio-recorded, and notes were taken during the process. All interviews were reviewed by the research supervisors for quality and translations made where possible. A pilot study was conducted in the neighboring Kakamega county to test the validity and reliability of the research instruments, using the test and retest technique. The pilot area was selected on the basis that it shared similar social-cultural practices with Bungoma concerning consumption of edible insects (Wanjala *et al.*, 2023). Lastly, the researcher validated the collected data by checking for fraud, screening, procedure adherence, and completeness to ensure the accuracy and representation of the variables of the study. By following these steps, the research study collected data that helped answer the research questions and achieve the research objectives.

Data Analysis:

The study utilized a mixed-method research design, combining questionnaires and interviews to gather data on attitudes, perceptions, and cultural beliefs about insect consumption in Bungoma County. The collected data underwent both quantitative and qualitative analysis to deeply understand gender dynamics and cultural factors influencing edible insect consumption. For the quantitative aspect, data from the questionnaire was entered into Excel for cleaning and coding. Afterwards, they were transferred into Version 26 of the Statistical Package for Social Sciences for analysis.

The study generated descriptive statistics such as frequencies, percentages, means and standard deviations that were applied to derive basic insight regarding the respondents and the study's themes. These results were presented in Tables and figures where appropriate. The study also derived statistics to evaluate the significance of gender dynamics in relation to the theme of utilization of edible insects for food and nutrition security. The statistics derived were the Chi-Square test and the Kruskal-Wallis H test. Chi-Square tests were done to evaluate whether significant differences existed among gender groups when the data type of the outcome factor of interest was in the nominal scale. Conversely, the Kruskal-Wallis H test was conducted when the outcome variable was in the ordinal scale. Post-Hoc tests were done using Dunn's test in the event a significant finding was gained in the Kruskal-Wallis H test and the groups being considered were more than two.

For the qualitative data from interviews, the study employed thematic analysis. During data familiarization, the study conducted deep analysis of the interview transcripts, images and field notes to grasp participants' narratives and experiences. This was done through the highlighting of significant elements in these narratives, such as characters and events. A thematic coding scheme was then crafted to label and categorize key phrases within the narratives, drawing from research objectives and emerging patterns. Following this, codes were grouped into overarching themes that captured core concepts and

relationships in the data. Connections between these themes were then explored, considering factors like culture, gender, and social norms. After synthesizing key insights from the data, the study compared findings to existing literature and sought feedback from participants and peers to ensure accuracy and relevance. This validation step ensures the findings' credibility. The final report presents a detailed account of participants' experiences, beliefs, and attitudes in a clear and compelling manner.

Ethical Considerations:

The study sought approval from the board of post-graduate studies of Jaramogi Oginga Odinga University of Science and Technology (JOOUST). All procedures involving use insects' subjects were reviewed and approved by the Jaramogi Oginga Odinga University of Science and Technology (JOOUST) ethical review committee. Research permits was sought from the board of post graduate studies of the Jaramogi Oginga Odinga University of Science and Technology and county's ministry of agriculture and livestock development. The researcher also ensured that informed consent from the respondent was taken before undertaking the research in the field. Permission was sought to ensure respondents voluntarily participated in the study giving assurance to maintain utmost confidentiality about the respondent's information. This was ensured by providing respondents with consent forms to sign before administering the research instruments.

RESULTS AND DISCUSSION

Perceptions of Insects as Food:

The respondents were asked whether they had ever eaten insects. Respondents who indicated they had were further asked to indicate which among the listed types of insects they had eaten. The findings are presented in Table 1.

Table 1: Insect Consumption.

Insect consumption	Frequency	Percentage	Types Eaten	Frequency	Percentage
Yes	325	84.6	Termites	274	84.4
			Grasshoppers	188	57.8
			Crickets	41	12.5
			Caterpillars	20	6.3
			Ants	46	14.1
			Beetles	46	14.1
No	59	15.4			
Total	384	100			

Table 2, indicates that majority of the respondents at 84.6%, had eaten insects at one point, with 15.4% indicating that they had never consumed them. The findings concur with Kisaka (2018) who found that edible insects constituted a significant part of the diet of residents in Bungoma County. On closer evaluation of the type of insects that the respondents had eaten, it emerged that termites (*chiswa*) were the most eaten at 84.4%, grasshoppers at 57.8%, ants and Beetles (*kamasirili*) at 14.1%, crickets at 12.5% and caterpillars (*Lisa*) at 6.3%. The findings reflect those of Kusia *et al.* (2021), concerning which insects were majorly consumed in Kenya as termites and grasshoppers were the most consumed and crickets and grubs such as beetles were consumed at lower rates. The findings indicate that entomophagy was still embraced; suggesting that the various generations in Bungoma County still viewed it as a viable practice for nutrition.

Gender Dynamics and Utilization of Edible Insects for Food and Nutrition Security:

This section presents the findings on gender dynamics and food and nutrition security. The results are presented in tables and figures, while the interview narratives are added to enrich the findings.

Food Purchase Decisions:

The study sought to understand the food purchase decisions of households in Bungoma County. The findings are presented in Table 2.

Table 2: Food Purchase Decisions

“Who makes decisions about food purchasing (provides food) in your household?”	Frequency	Percentage
Male head of household	59	15.4%
Female head of household	146	38%
Jointly	179	46.6%
Total	384	100

Table 2, indicates that in most of the households, decisions regarding food purchases were made jointly at 46.6%, with 38% indicating that the female head of the household made the decision. In comparison, 15.4% indicated that the male head of the household made the purchase decisions. These findings deviate from Pambo *et al.* (2016) that women in Western Kenya were the primary food purchase decision makers. The findings illustrate that households in Western Kenyan embraced shared decision-making in making nutritional decisions. The findings indicate that female-decision making was more than double that of male household decision making when not done jointly.

The interviewees indicated that joint purchase decisions would take place after short consultation of what was generally needed or required. Wabwoba (2017) noted that male contributions held more weight in nutrition-based decisions in Bungoma County suggesting that joint decisions could be skewed in favour of what the men supported. The majority of the responses indicated that the male head of the household was expected to finance the purchasing activities. In most cases, the final decisions of purchases would be done by the female member as market factors could influence the availability of products which could be subject to change. Further, the interviewees indicated that purchase decision-making tended to vary with the occasion for instance; male heads of households would have greater input in purchase decisions if the food was for a special occasion.

Involvement in Decision-Making:

The respondents were asked to indicate whether it was essential to involve both men and women in decision-making related to nutrition. The results are illustrated in Figure 1.

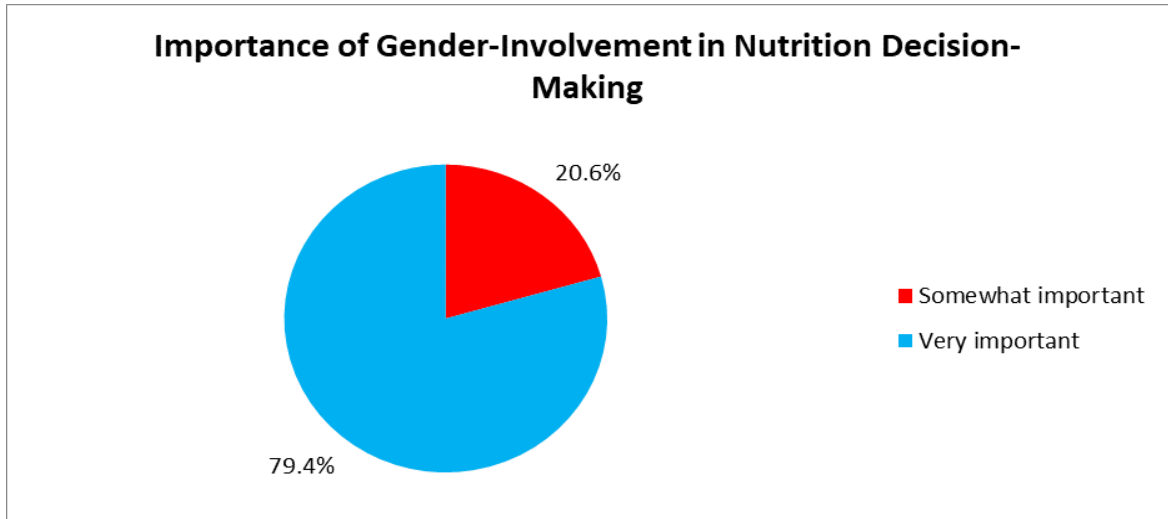


Fig 1: Importance of Gender-Involvement in Nutrition Decision-Making.

Figure 1, indicates that 79.3% of respondents agreed that involving both genders in nutrition decision-making was essential. 20.7% of the respondents stated that both genders needed to be involved in decision-making related to nutrition. Further, deliberations with the interviewees indicated that most supported both genders being involved due to the complexity of nutritional needs in the household. Men and women had different preferences concerning their diet needs and would want to have those preferences reflected in the food prepared in the home. It was also apparent that nutritional decisions were associated with gender roles and responsibilities (Ogutu *et al.*, 2022). For instance, the food to be prepared could require different types of inputs from men or women; the increase in joint responsibilities, especially in younger families, could see men take more significant roles in preparation as women also increased their input in providing resources. The respondents also indicated that the nutritional goals of a family were much easier to accomplish if both genders had a basic understanding or agreement on how they would be achieved therefore supporting the logic for joint participation in decision-making. Additionally, a health nutrition expert indicated that the different genders had nutrition-related health concerns that needed to be considered when making nutritional decisions at home. For instance, men would require more energy-giving foods if their daily activities were strenuous.

Association between Gender Roles and Insects Consumption:

This section provides the results from Chi-square association tests between gender roles and edible insect consumption after cross-tabulation between the gender roles in food purchasing decision-making and insect consumption. The findings are presented in Table 3.

Table 3: Association between Food Purchasing Decision-Making and Insects Consumption

Decisions about food purchasing	Edible Insect Consumption		Total	χ^2	p-value
	Yes	No			
Male head	46	13	59	5.179	0.075
Female head	129	17	146		
Jointly	250	29	179		
Total	325	59	384		

Note ** indicates a significant association at 95% confidence level

Table 3, indicates that gender-based decision-making roles were not statistically associated with whether or not a household consumed insects $\chi^2=5.179$, $P= 0.075$. The cross-tabulation results suggest that joint gender-based decision-making had the most responses in agreeing with insect consumption. These findings are contradictory to Wabwoba (2017) that the gender of the decision maker in the household was influential on the nutritional decisions in the household. The findings illustrate that in short-term consumption needs, the decision made by either gender is not influential.

Challenges Encountered by Women in Utilizing Insects as Food:

The respondents were asked to indicate the various challenges women encountered when seeking to access or utilize insects as food in their community. Some respondents stated resource dependence on men as the financial providers generally restricted women's access to insects as in most cases, the food would be bought from sellers, which was more convenient than harvesting. The respondents further indicated that women could face challenges in having adequate time to harvest and prepare insects for food while still being expected to take care of the household and to work semi-permanent and permanent jobs to supplement the household's income. Therefore, the workload in other roles could reduce the time available for preparing insects as food. This could explain Wanjala *et al.*(2023) that female-led households in Bungoma consumed edible insects less than male-headed households. The respondents also indicated that the position of women as secondary heads of the households could influence their decisions on whether insects would be part of the household diet.

“We Follow the Eating Preferences of Father and What He Likes”:

The decision-making role of the male heads among communities in Bungoma would therefore pose a challenge to the females' decisions regarding utilizing insects as food sources. The respondents also indicated that women's knowledge and awareness of the nutritional aspects of various kinds of insects could pose a problem in the utilization of insects. Health practitioners noted that the insect's nutritional value was mostly culturally based and informal. This meant that most women did not consider specialized information when deciding on insects as food given that most had reached secondary school and tertiary levels as the highest levels. Having concrete information on the nutritional value of various types of insects could very well see their greater utilization in diets. The lack of knowledge or information on nutritional aspects by women due to relatively low levels of education therefore meant that food choices were less based on their overall value in nutrition and more due to other factors such as habitual preparation and convenience.

Kruskal-Wallis Tests:

This section provides the results of significance testing among various aspects of gender with relation to the study's main outcome statement: “I am open to consuming insects if it contributes to food and nutrition security”

Gender and Acceptance of Edible Insects for Food and Nutrition Security:

The study sought to evaluate whether there were significant difference among genders with relation to the level of acceptance of edible insects for food and nutrition security. The statement, “I am open to consuming insects if it contributes to food and nutrition security” was compared among the two genders. The study evaluated the distribution of the two genders to determine if the assumption that they both should follow similar distribution patterns was met. Figure 2, provides the findings.

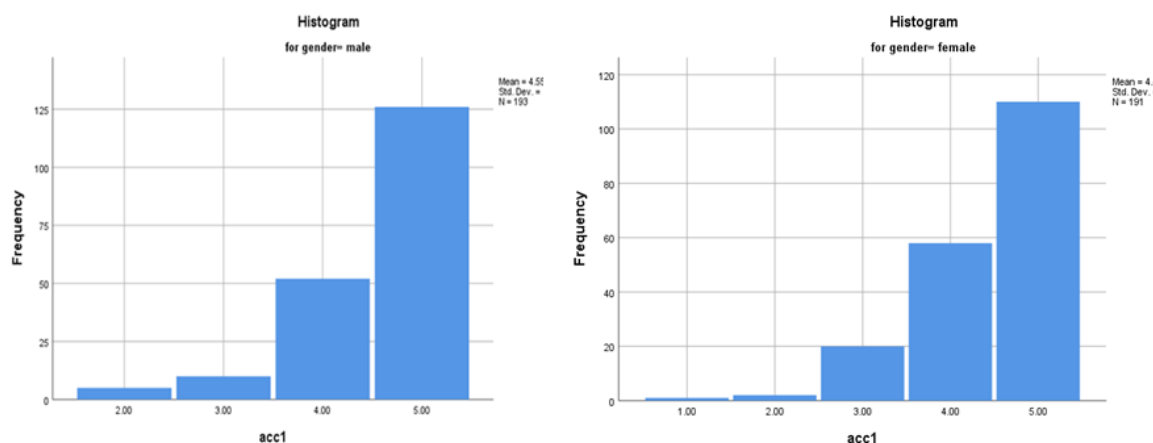


Fig 2: Gender Distribution Graphs.

Figure 2, indicates that the assumption that the groups being evaluated should follow similar distribution was met. The study therefore conducted the Kruskal Wallis test to determine if significant differences existed among genders concerning the utilization edible insects for food and nutrition security. The results are presented in **Table 4**.

Table 4: Kruskal-Wallis Test for Gender and Utilization of Edible Insects for Food and Nutrition Security.

		N	Mean Rank
Level of acceptance of edible insects for food nutrition and security	Male	193	200.52
	Female	191	184.39
	Total	384	
Test Statistics^{a,b}			
Level of acceptance of edible insects for food nutrition and security			
Kruskal-Wallis H		2.726	
df		1	
Asymp. Sig.		.099	
a. Kruskal Wallis Test			
b. Grouping Variable: Gender			

The Kruskal-Wallis H evaluation indicates that there was no statistically significant differences in level of acceptance of edible insects for food nutrition and security between the two genders, $H(1) = 2.726$, $P=0.099$. The findings illustrate that gender differences were not significantly influential in whether or not edible insects were accepted for food nutrition and security. These findings were different to those of Verbeke (2014) who indicated that gender was a significant determinant in the utilization of insects in the context of sustainable source of proteins.

Gender-based Decision-Making and Acceptance of Edible Insects for Food and Nutrition Security:

The study sought to evaluate whether there were significant difference across households whose food purchase decisions were either made by the male-head, female-head or jointly. These differences were evaluated with relation to the level of acceptance of edible insects for food and nutrition security. The statement, "I am open to consuming insects if it contributes to food and nutrition security" was compared across the three household types. The study evaluated the distribution of the three groups to determine if the assumption that they both should follow similar distribution patterns was met. Figure 3, provides the findings.

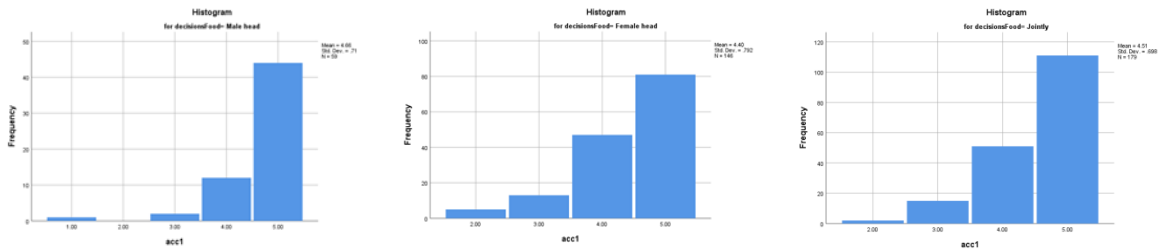


Fig.3: Distribution of Male-Headed, Female-Headed and Joint Decision-Making Households.

According to the findings illustrated in Figure 4.7, the distribution among the three groups was similar which allowed the study to evaluate whether there existed significant differences using the Kruskal-Wallis test. The findings from the test are presented in Table 5:

Table 5: Kruskal-Wallis Test for Gender-Based Decision Making.

		N	Mean Rank
Level of acceptance of edible insects for food nutrition and security	Male head	59	218.58
	Female head	146	180.22
	Jointly	179	193.92
	Total	384	
Test Statistics^{a,b}			
Level of acceptance of edible insects for food nutrition and security			
Kruskal-Wallis H		6.821	
df		2	
Asymp. Sig.		.033	
a. Kruskal Wallis Test			
b. Grouping Variable: Gender based Decision-Making			

Table 5, indicates that there were statistically significant differences in the level of acceptance of edible insects for food nutrition and security within gender-based decision making. $H(2) = 6.821, P=0.033$ where the highest mean ranking was from male-head decision making with 218.58. The second highest rank was from joint decision making with 193.92 and the third ranking was female head with 180.22. The study further conducted a Post-Hoc analysis using Dunn’s test to ascertain among the three groups which two pairs had significant differences among them indicated in Table 6.

Table 6: Dunn’s Test .

Pairwise Comparisons of Gender-Based decision making					
Sample 1-Sample 2	Test Statistic	Std. Error	Std. Test Statistic	Sig.	Adj. Sig. ^a
Female head-Jointly	-13.709	10.676	-1.284	.199	.597
Female head-Male head	38.361	14.768	2.597	.009	.028
Jointly-Male head	24.652	14.371	1.715	.086	.259
Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same.					
Asymptotic significances (2-sided tests) are displayed. The significance level is .05.					
a. Significance values have been adjusted by the Bonferroni correction for multiple tests.					

According to Table 6, the difference between female-headed households and male-headed households was significant, $P= 0.028$. This indicates that gender-based decision-making among households was significant when the decisions were either made by the female head or the male head. The findings illustrate that male-headed households had higher probability of using edible insects for food and security which corroborates. These findings enhance Wanjala *et al.* (2023) who indicated that edible insects were used by male-headed households to a greater extent as a source of food. The findings illustrate that edible insects may be used as a source of long-term nutrition and food security.

Conclusion:

Gender dynamics and edible insect intake in Bungoma County, Kenya, demonstrate how socio-cultural factors affect sustainable food practices. The influence of gender dynamics on the consumption of edible insects was illustrated in decision-making whose effect was found to be significant. The study determined that male-headed Bungoma County families were more likely to eat edible insects than female-headed ones. The endowment effects connected to males in the household means that their decisions have a higher probability of resulting in success in terms of nutrition and food security (Gebre *et al.*, 2021). The decision to adopt edible insects to ensure food security would also see increased channelling of resources dedicated to making the choice a success (Anyour, 2022). Thus, gender-based decision making was significantly related to the dietary orientation of a household and would therefore impact whether or not edible insects were utilized for food and nutrition security.

These results highlight power dynamics, cultural norms, and financial hierarchy that shape family food decisions. Women's struggles, including their dependency on males and lack of nutritional knowledge, highlight systemic issues that must be addressed. These constraints impede women's autonomy and the community's capacity to access edible insects' nutritional benefits.

The potential of insects as sustainable protein alternatives is even more significant given global food security problems, particularly given anticipated population increase. With the insights gleaned from this study, the following recommendations are proposed: first, community awareness programs which promote edible insect nutrition via inclusive community initiatives. These programs should correct myths and prejudices while providing facts. Secondly, distribution of nutritional information should be gender-equitable. Women, who frequently lead family nutrition, should be educated about edible insects. Thirdly, empowerment workshops which teach women about sustainable nutrition, family decision-making, and how to obtain and prepare edible insects. Also, collaborate with local governments and NGOs to promote edible insects. This involves resource availability, market creation, and insect farming incentives. Lastly, use local cultural influencers and community leaders to reframe edible insect tales to emphasize their historical relevance and possible future advantages.

This research delves into the intersectionality of gender and culture to gain new insights into the role of edible insects in food and nutrition security. The adoption and use of edible insects are influenced by gender dynamics and cultural factors, which affect attitudes and behaviors towards entomophagy. Women face specific challenges in accessing and using edible insects due to social norms and financial constraints, presenting opportunities for interventions promoting gender equality in food choices. Cultural narratives, superstitions, and beliefs also impact insect acceptance, with positive narratives promoting acceptance while negative superstitions discourage ingestion. Statistical tests reveal significant associations between cultural attitudes, household decision-making, gender roles, and insect consumption. Education and awareness play a crucial role in shaping attitudes towards edible insects, with fair information access increasing

consumption. A multifaceted approach is needed to promote insects as a sustainable food source that incorporates cultural awareness, gender equality, and innovative solutions to overcome challenges. The findings provide a foundation for policymakers, practitioners, and researchers to develop gender-inclusive policies that promote the sustainable use of edible insects for food security. This study contributes to understanding the impact of gender dynamics on dietary choices and security while strengthening gender studies, nutritional sciences, and sustainable food practices.

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