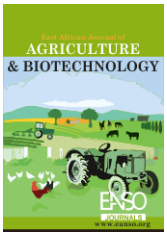

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Original Article

Dogs Owners' Perception on the Use of Black Soldier Fly, *Hermetia illucens* L (Diptera: Stratiomyidae) Larvae as an Alternative Source of Protein in Dog Food in Kenya

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ABSTRACT

In recent years, pet owners have begun to show more consideration for their companion animals, which includes paying more attention to their nutrition. This is thought to be a strategy to protect the welfare and health of their animals. As feed and food, using insects has gained increased interest from industry, investigators, policymakers, and the general public globally. Owing to their rapid biomass turnover and dietary value, consideration of insects to serve as novel high-quality protein sources to replace the conventionally used sources for pet foods is gaining momentum. In the formulation of pet foods, ingredients made from black soldier fly larvae (BSFL) are being investigated as sustainable substitutes for traditional animal-derived components. There is, however, limited information about using insects as a source of protein in dog food in Kenya. This study aimed at examining dog owners' perceptions toward the usage of Black soldier fly larvae protein in dog food. In this study, a structured questionnaire was used to perform a cross-sectional survey among 384 dog owners randomly selected in Kisumu and Nairobi counties, Kenya. In order to determine the key factors associated with the response variables, Frequency distribution analysis, t-tests and chi-square tests were run, while PCA, or principal component analysis, was employed to categorize the various traits of dog owners. Our results showed that dog owners perception of the benefits of BSFL, which had a mean score of 3.795 was significantly higher (t= 136.949; P<0.000) than the overall mean risk score of 3.491 (t= 122.022; P<0.000). This signifies a high degree of acceptance (t= 8.833; P<0.000). The PCA yielded three dimensions with the first component, 'environmental and economic conditions for rearing BSF' explaining 31.75% variance; the second component, 'lack of knowledge of BSF insect', explaining 25.77% variance while the third component, 'beneficial properties of BSFL' explaining 9.83%. The results suggest that BSFLs are generally favourably perceived by dog

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owners and probable are a substitute to the commonly used sources of protein in dog food.

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INTRODUCTION

Growing at an exponential rate, the global populace by 2050 is projected to reach. 9.6 billion, at a 1.2% annual increment. In the Eastern Africa region, it is predicted to grow at 2.8%. (DeSA, UN, 2015). The consequences of rising human population trends and rising living standards in developing nations indicate that there will be a rise in demand for sources of animal-derived protein for human diets (Bosch et al., 2019). According to van Huis et al. (2013), in order to secure food security, it is necessary to investigate additional sustainable and alternative sources of protein because this need heightens the worldwide rivalry for proteins in human food and animal feed. This is to support the current levels of animal production (Kim et al., 2019). The rising costs of feed call for affordable alternative sources of proteins (Huis, 2013). Special attention has been given to insects in the recent past and they are now being considered as a probable solution to food insecurity and sustainable financial empowerment of youth in the feed industry (Niassy et al., 2018). Insects are considered to provide an alternative because they are rich in proteins, minerals and they are highly efficient at converting feed. They are also successful in their reproduction, grow fast and can be reared on waste streams (Makkar et al., 2014). They also promote health by boosting the immune system and reducing the need for antibiotics in animal production (Gasco et al., 2018). Among the edible insects, is the black soldier fly (BSF), *Hermetia illuce*ns (Diptera: Stratiomyidae). It is currently being used in the formulation of commercial feeds for livestock such as poultry, pigs, and fish and pets, especially lizards. Given its capacity for mass production and its potential for high biomass turnover, it is very promising (Penazzi et al., 2021).

The culture of keeping dogs in Kenya is on the rise with many households owning exotic breeds, but there are no official statistics on dog ownership. The dog is a companion animal giving its owner company and security. However, the cost of keeping these tamed dogs is high due to the exorbitant cost of commercial feeds in the market, most of which are based on fishmeal as the source of protein. These protein sources are also in high demand by the growing human population which is at 2.8%

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annually in Eastern Africa, denoting competition for proteins for human consumption and dog consumption. A segment of the food industry that is expanding and continuously searching for new ideas and ingredients is the pet food industry (Donfrancesco, 2016). This industry represents an important sector of the food processing industry, which is realising an increasing consumer demand. It thus calls for collaboration between researchers and the food industry to discover novel products to meet these demands. Given that pets need a lot of protein, which can range from 18% t0 22% for dogs, protein is one of the most crucial elements in pet diets (Valdés et al., 2022). Incorporating insects into pet food could be the next big thing in the sector for pet food. The global industry for pet foods made from insects is expanding quickly (Siddiqui et al., 2023). An environmentally friendly source of protein could come from insects used in pet food. Considerable attention has been paid to them as a unique, sustainable and natural source of protein for people and pets. (El-Wahab et al., 2021). A research by (Kilburn et al., 2020) established that inclusion of crickets in dog diet was acceptable. According to earlier study (Beynen, 2018; Ravzanaadii et al., 2012) dogs favored BSFL meals in dry diets over yellow mealworm (*Tenebrio molitor*) meals. According to Yamka et al. (2019), it has been demonstrated that dogs will consume diets that are dry with BSFL meal content of 5, 10, or 20%. According to El-Wahab et al. (2021), adding BSFL meal to dog food can be a suitable source of protein with no adverse impacts on the digestibility of nutrients or quality of the faeces.

The adoption of insects as pet food is mostly influenced by individual attitudes toward unknown foods, exposure to culture, environmental awareness and concern about the long-term viability of food sources. It is important to appreciate the attitudes, concerns and motivations of pet owners that lead to them feeding their pets BSFL diets. Numerous studies have been published on the subject, but the research of pet owners' perceptions of pet foods is still in its infancy. There hasn't been much investigation into how pet owners feel about using insect-based pet diets, specifically BSFL. In light of this, the current study sought to assess dog owners' opinions regarding the potential inclusion of BSFL meal as an insect protein in dog food. The findings of this study may also encourage additional research in BSFL pet nutrition and offer understanding of changing feeding patterns and human-animal interactions.

METHODOLOGY

Study Area and Design

The research was conducted in two counties, namely, Nairobi and Kisumu, Kenya. It used a cross-sectional strategy with data collection done from a selected sample of dog owners living in Kisumu and Nairobi counties through in-person interviews based on a structured questionnaire. Nairobi and Kisumu, being the capital city and the third largest city in Kenya, respectively, were considered to be homes to a large proportion of the dog population in the country, and were purposively selected. When the current study was conducted, there was no information on the population and distribution of dog owners. Equation 1 illustrates how, proportionate to size sampling methodology, which was developed by Anderson (2007), was utilized to determine the necessary size of the sample for the investigation.

$$n = \frac{pqz^2}{e^2} \qquad (1)$$

Where $n =$ the study's sample size; $p =$ Population proportion comprising variable of interest (percentage of dog owners) in the area, hence when P=0.5 it is assumed that 50% of the households in the study area owns a dog; $q =$ Weighting variable computed as; $q = 1 - p = 1 - 0.5 = 0.5$; $z =$ Confidence level at 95% (standard value is 1.96); $e =$ Allowable error term as it is unclear with precision what percentage

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of the population there is. According to Anderson et al. (2007), a typical allowable error is less than 10%; as a result, we utilized a 5% error.

$$n = \frac{pqz^2}{e^2} \quad \frac{1.96^2 \times 0.5 \times 0.5}{0.05^2} = 384 \qquad (2)$$

Therefore 384 dog owners were sampled for this research.

To select the participants for the research, a two-stage random selection process was used. To create a sample of six administrative sub-counties, three administrative sub-counties from each of the two counties of Kisumu and Nairobi were chosen at random in the first stage. This was followed by collecting information from sub-county level registers on dog vaccination to construct a sampling frame for each of the six sub-counties, assuming that 50% of the households owned at least one dog. The households that took part in this study were then chosen using a systematic random sampling process.

Data Collection

Information was gathered from the respondents through in-person interviews using a structured questionnaire. The questionnaire was pretested at the East African Kennel Club dog event, involving non selected dog owners before the actual field survey. Based on the responses, the survey questions were changed and rewritten. Dog owners were contacted by phone or in person with the help of the local administrative authorities. The selected respondents, who were either household heads or an available adult member (>18 years of age), were interviewed. The study's objective was explained to the respondents and informed written and signed consent obtained prior to the interview. The structured questionnaire comprised two sections namely socio-demographic characteristics and perception of BSFL in dog food. For the perception sub-section, on a five-level scale, participants were asked to rate how much they agreed with each statement. (1 = Strongly disagree, 2 = Disagree, 3 = No opinion/Unsure, 4 = Agree, 5 = Strongly agree).

Analytical Framework

Principal Component Analysis (PCA) was used to capture the majority of the observed variance of the explanatory variables using the least amount of new variables, referred to as principal components (PCs), in order to gauge how dog owners felt about the use of BSFL as a substitute source of protein in dog food. The PCs are uncorrelated hence maximizes variance. PCA reduces the dimensionality of a large dataset and minimizes information loss while at the same time increasing interpretability (Patel et al.., 2018). Therefore, PCA was appropriate since it has the ability to yield robust and convincing results (Kisaka-Lwayo & Obi, 2012).

Responses for the PCA were recorded on a 5-point Likert scale (ranging from strongly disagree to strongly agree). The ordering was such that the the largest amount of variation is accounted for by the first principal component., The second principal component takes into account the variation that the first principal component did not take into account and is completely uncorrelated to the first. The process goes on and each additional principal component accounts for a different smaller variance as it progresses and is completely uncorrelated to each other. With coefficients equal to the eigenvectors of the correlation or covariance matrices, each principal component is a linear combination of the original variables. To assess dog owners' perception towards the use of BSFL meal, we used the calculated average scores produced by each PC as the dependent variable and perceptions indicators of perceived benefits and risks (Liñán, Santos, & Fernández, 2011).

According to Kisaka-Lwayo & Obi (2012) computation of the principal component is:

$$\text{“}PC_n = f\,(a_{ni}X_i \ldots\ldots + a_{nh}X_h) \qquad (3)$$

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Where PC= component score, n= total number of PCs, $a_{ni}…a_{nh}$= component loading and $X_i…X_h$= perception indicator variables". If there are more than one principle components, each one will be a continuous variable or quantity linked to the sum of the values of the constituent variables and their accompanying weightings or component loadings. Because the relationship is additive, the products must be combined together to determine the value of the primary component (Otieno et al., 2017; Kibirige, 2013).

This is presented mathematically as:

$$PC_1 = a_{11}X_1 + a_{12}X_2 + \ldots\ldots a_{1h}X_h \quad (4)$$

The first principal component is denoted as PC1. The first and second independent variables of PC1 are X1 and X2, and the coefficients (component loadings) connected with these variables are a11 and a12; a1h is the eigenvector of the covariance matrix between the variables or the regression coefficient of the hth variable. In order to determine the principal component, a linear additive model using these variables is necessary as shown by Equation 2. Since there are n primary components, it follows that n equations will be developed, each of which represents a linear combination of component loadings and variable values. Equation 5 is one way to represent this:

$$PC_1 = a_{11}X_1 + a_{12}X_2 + \ldots\ldots a_{1h}X_h$$

$$PC_2 = a_{21}X_1 + a_{22}X_2 + \ldots\ldots a_{2h}X_h \quad (5)$$

$$PC_n = a_{n1}X_1 + a_{n2}X_2 + \ldots\ldots a_{nh}X_h$$

Where; n=number of PCs, $a_{n1}…a_{nh}$ =the component loading and $X_1…X_h$=perception indicators. The coefficients $a_{n1,}\ a_{n2}…a_{ih}$ will be selected such that the first PC will have as large variance possible. The second PC won't be connected to the first PC in any way and will also have as large variance as possible. This will go on up to the n^{th} PC. Kaiser-Guttman rule was used to determine the number of factors whereby it recommended to keep as many variables as sample eigenvalues bigger than one (Kaiser, 1960). To confirm the indicator's level of internal reliability, Cronbach's alpha was utilized. The Orthogonal Varimax rotational method was used, whereby low item loadings were minimized and heavy item loadings were maximized.

Statistical Analysis

Every respondent received an identification code that served as a link between them and their particular traits and responses during the data analysis process during the interview. STATA version 16.0 and the Statistical Package for Social Sciences (SPSS) Statistics for Windows, version 26, from International Business Machines (IBM), were used for the organizing and analysis of the data. To be able to identify the significant variables connected to the response variables, frequency distribution analysis and a number of chi-square tests of associations were conducted.

RESULTS AND DISCUSSION

Descriptive Statistics

Results in *Table 1* show that the majority (n=253) of respondents were male, whereas (n=131) were female. Results of the chi-square show that the gender of the respondents were statistically significant at a 10% level indicating that the distribution of gender was statistically different between Nairobi and Kisumu dog owners. The Chi-square test revealed that the association between education level and county of residence of dog owners was not significant. The chi-square results on marital status show a statistically significant difference between Nairobi and Kisumu dog owners at 10%. The Chi-square test revealed that the association between employment status and county of residence of dog owners was not significant. The Chi-square results on occupation show a statistical significance of 5% level between Nairobi and Kisumu residents. The Chi-square test revealed that the association between dog vaccination and the county of residence of dog owners was not

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significant. Results of the chi-square show that in the registration of dogs by dog owners, the responses were statistically significant at a 10% level.

Table 1: Categorical variables for dog owners' characteristics

Variable		Kisumu	Nairobi	Total	Chi^2
Gender	Male	180	73	253	52.054*
	Female	43	88	131	
Education level	Secondary	18	205	223	2.130
	Tertiary	7	154	161	
Marital status	Single	58	73	131	25.143*
	Married	160	76	236	
	Other	5	12	17	
Employment status	Unemployed	61	42	103	0.058
	Employed	162	118	280	
Occupation	Farm	28	9	37	13.105**
	Off-farm business	34	28	62	
	Salaried	153	105	258	
	Student	8	18	26	
Dog Vaccinated	Yes	216	158	374	0.600
	No	7	3	10	
Dog registered	Yes	11	47	58	42.411*
	No	210	114	324	

**, **, Significant levels at 10% and 5%, respectively*

The average age of the dog owners was 43.99 years, while they owned on average, 3 dogs. The dog owners spent an average of 9.94 kg of food per week on their dogs at an average cost of Ksh 1, 979.07 as in *Table 2.*

Table 2: Continuous variables for dog owner characteristics

	Minimum	Maximum	Mean	Std. Deviation
Age of the Respondent (Years)	19	103	43.99	19.871
Dogs Owned	1	15	2.69	2.098
Quantity per week (Kg)	1	100	9.94	7.923
Cost per week	200	21003	1979.07	1783.928

Perceived Risks and Benefits of Use of BSFL in Dog Food

The perception of dog owners towards the use of BSFL in dog feed as in Table 3 the means and standard deviations of different statements presenting dog owners perceived benefits and risks towards the use of BSFL as a component in dog food. A Likert scale {ranging from (1) strongly disagree, (2) disagree, (3) neutral, (4) agree and (5) strongly agree} was used to solicit a response from dog owners.

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Table 3: Perceived risks and benefits of the use of BSFL in dog food

Constructs		Perception statements	Mean	Std. Dev	Cronbach alpha
Perceived Benefits	PB1	BSFL is highly nutritious	4.10	0.891	0.748
	PB2	BSFL insects require less space for rearing	3.90	0.979	
	PB3	BSFL insects are easy to rear	3.49	1.161	
	PB3	Feeding with insects means less pressure on other meat sources such as cow meat	3.99	0.712	
	PB4	Insects use less water than other livestock	3.93	0.750	
	PB5	Lower cost of dog food	3.74	0.807	
	PB6	Lower dependence on imported food	3.72	0.838	
	PB7	Less greenhouse gases	3.58	0.846	
Perceived Risks	PR1	BSF can transmit diseases to dog	3.20	0.825	0.641
	PR2	It is difficult to differentiate BSF from other insects	3.20	0.855	
	PR3	There is a lack of awareness of BSF farming for dog food	4.30	0.798	
	PR4	There is little knowledge of the techniques for insect farming	3.65	0.848	
	PR5	It can accumulate hazardous substances such as pesticides, which is not healthy for my dog	3.18	0.942	

**Strongly Disagree (1), Disagree (2), Neutral (3), Agree (4), Strongly Agree (5). PB-Perceived Benefits, PR-Perceived Risks*

The strongest perceived benefits of insects in dog feed were related to the high nutrition value (mean = 4.10), feeding with insects meant less pressure on other meat sources such as cows (mean = 3.99), and insects use less water than other livestock (mean = 3.93). On the other hand, the participants of the study were least convinced that the insects are easy to rear (mean = 3.49). However, this was still a positive agreement. The total mean benefit score calculated was 3.795 and was considered significant (t=136.949; P0.000) overall. The Cronbach's alpha for benefit statements was 0.748, indicating that it is possible to add the scores for different benefit claims to produce an overall result. The overall mean benefit result computed was 3.795 and was significant (t= 136.949; P<0.000). Previous studies have indicated that BSF fat has brain health improvement, antimicrobial and intestinal health-promoting potential in pets (Kotob et al., 2022). To allow for the accumulation of more larval protein and lipids in the fatty body, the rearing circumstances of BSFL can also be scientifically improved (Hasnol et al., 2020). According to Okin (2017), the manufacture of commercial pet food results in 64 million tonnes of emissions of Nitrous oxide, methane and carbon dioxide equivalent and environmental impact of about 30% associated with animal production which includes water, land use, phosphate, biocides and fossil fuels.

The greatest perceived risk was that there was a lack of awareness of BSF farming for dog food (mean = 4.30) and that there was little knowledge of the techniques for insect farming (mean = 3.65). The remaining average risk perceptions were greater than the mid-point scale. This indicates that on average the participants in the study, neither agreed nor disagreed that the BSFL meal constitute a possible risk. The Cronbach's alpha for risk statements was 0.641, while that for benefits was 0.748indicating the various benefit statements can be summed up into an overall result. According to earlier research, BSFL may be able to lower dogs' total serum cholesterol levels (Seo et al., 2021). Despite feeding on garbage, contaminated feed, and

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manure, BSFL cannot transmit parasites or illnesses when utilized in feed (van Huis et al., 2020).

Dog owners have a substantially higher view of the advantage of BSF than they do of the risk, according to a paired sample t-test that demonstrated a significant difference between the scores (t= 8.833; P0.000). The study came to the conclusion that people's perceptions of benefits outweighed those of risks. The approval of BSFL meals among dog owners was therefore quite high among dog owners. Similarly, previous studies have also shown that insect-based diets were well tolerated by pets and appreciated by the majority of owners (Leriche et al., 2014).

Socioeconomic factors' influence on perceived benefits and perceived risks

The chi-square analysis result in *Table 4* indicates that there was a positive and significant relationship between perceived benefits and the following variables, namely: location of dog owner (χ^2=135.664; p<0.000), gender of dog owner (χ^2=81.276; p<0.000), occupation (χ^2=185.577; p<0.000), number of dogs (χ^2=1125.957; p<0.000).

Table 4: Chi-square analysis of the relationships between perceived benefits and socio-economic characteristics of dog owners

Socio-economic characteristics	Perceived benefits of BSFL		
	DF	χ^2	P
Location of dog owner	29	135.664	0.000**
Gender of dog owner	29	81.276	0.000**
Education level of dog owner	29	35.27	0.196
Occupation	87	185.577	0.000**
Number of dogs owned	348	1125.957	0.000**

*DF: Degree of Freedom; χ^2: Chi-square coefficient; P: Probability; *: p < 0.05, **: p < 0.01, ns: not significant.*

The chi-square analysis result in *Table 4* indicates that there was a positive and significant relationship between perceived benefits and the following variables, namely: location of dog owner (χ^2=135.664; p<0.000), gender of dog owner (χ^2=81.276; p<0.000), occupation (χ^2=1185.577; p<0.000), number of dogs (χ^2=1125.957; p<0.000).

Table 5: Chi-square analysis of the relationships between perceived risks and socio-economic characteristics of dog owners

Socio-economic characteristics	Perceived risks of BSFL		
	DF	χ^2	P
Location of dog owner	19	96.601	0.000**
Gender of dog owner	19	80.502	0.000**
Education level of dog owner	19	33.885	0.019*
Occupation	57	126.800	0.000**
Number of dogs owned	228	633.050	0.000**

*DF: Degree of Freedom; χ2: Chi-square coefficient; P: Probability; *: p < 0.05, **: p < 0.01, ns: not significant.*

The chi-square analysis result in Table 5 indicates that there was a positive and significant relationship between perceived risks and the following variables, namely: location of dog owner (χ^2=96.601; p<0.000), gender of dog owner (χ^2=80.502; p<0.000), education (χ^2=33.885; p<0.019), occupation (χ^2=126.80; p<0.000), number of dogs (χ^2=633.050; p<0.000).

Principal Component of Dog Owners' Perception about BSFL Based Food and their Associated Loadings

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To confirm that the data collected was adequate for factor analysis, the study tested for sampling adequacy. As shown in Table 6, the Kaiser-Meyer-Olkin Measure of Sampling Adequacy was calculated. It was 0.835 on the Kaiser-Meyer-Olkin Scale of Sampling Adequacy. As indicated by $p<0.000$, Bartlett's Test of Sphericity was extremely significant. The data collected was suitable for factor extraction, as shown by the Kaiser-Meyer-Olkin measure of 0.835, which was above 0.5. The significant result of Bartlett's Test of Sphericity indicated that Factor analysis was appropriate for this study.

Table 6: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.835
Bartlett's Test of Sphericity	Approx. Chi-Square	2439.411
	Df	78
	Sig.	.000

The Scree Plot test was employed in this work to determine how many principle components to use because unreasonably many components might be produced by applying PCA to reduce the dataset and only using eigenvalues larger than or equal to one.

Figure 2 is a scree plot with the eigenvalues on the y-axis and the number of primary components on the x-axis. The number of primary components to be generated by analysis is determined by the location where the slope transitions from being steep to being gentle. The steep slope components were extracted, reducing the original collection of perceived risks and rewards constructions into a more manageable set of three linear combinations known as main components. The remaining components were eliminated since they offered little explanation for the variation in the initial variables.

Figure 1: Principal components Scree plot

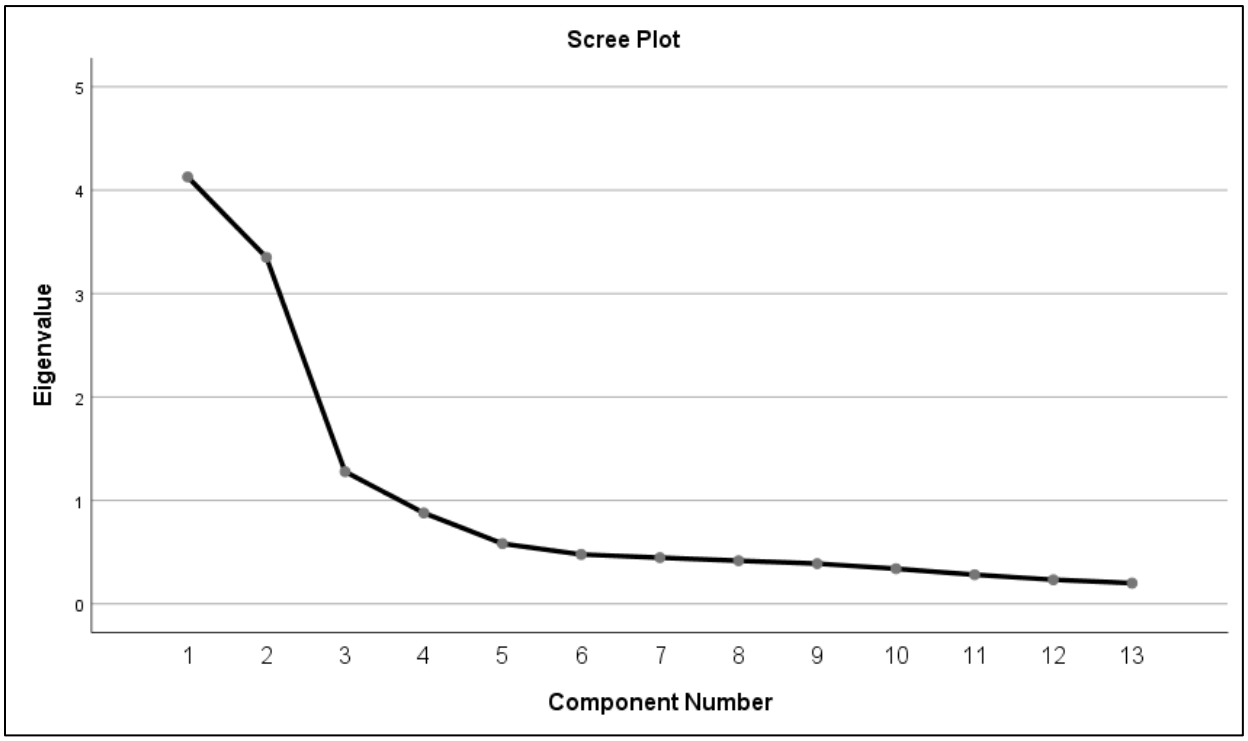

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Table 7: Rotated Component Matrix: Eigenvalues, percentage of variance, and the component loadings for the patterns retained

	Comp1	Comp2	Comp3	Communalities
BSFL is highly nutritious	0.251	0.308	0.745	0.712
BSFL insects require less space for rearing	0.224	0.507	0.707	0.808
BSFL insects are easy to rear	-0.143	0.431	0.739	0.752
Feeding with insects means less pressure on other meat sources such as cow meat	0.744	0.097	0.279	0.640
Insects use less water than other livestock	0.703	0.174	0.324	0.630
Lower cost of dog food	0.852	-0.172	-0.174	0.785
Lower dependence on imported food	0.765	-0.228	-0.151	0.660
Less greenhouse gases	0.780	-0.204	-0.078	0.656
BSF can transmit diseases to dog	-0.172	0.748	0.206	0.631
It is difficult to differentiate BSF from other insects	-0.227	0.737	0.163	0.622
There is lack of awareness of BSF farming for dog food	0.167	0.662	0.094	0.475
There is little knowledge of the techniques for insect farming	0.464	0.275	-0.666	0.735
It can accumulate hazardous substances such as pesticides which is not healthy for my dog	-0.128	0.781	0.147	0.640
Cronbach's alpha	0.841	0.792	0.507	
Eigen values	4.128	3.350	1.278	
Variance accounted for (%)	31.75	25.77	9.832	

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

Three (3) dimensions with eigenvalues of 4.128, 3.350, and 1.278 were obtained from the analysis. Cronbach alpha coefficients for dimensions 1, 2, and 3 (0.841, 0.792, and 0.507, respectively) and the overall model (0.746) were adequate. This indicates that, with the exception of one dimension with a Cronbach alpha of less than 0.600, the test for these samples of dog owners has good reliability. The remaining values were all within 0.700, which was acceptable. Moreover, each component that was examined in the analysis displayed a satisfactory loading of greater than 0.5. The PCA results effectively explain the data, as shown by the reduced dataset of 3 principle components, which explains 67.35% of the overall variability. The very first component, Environmental and economic conditions for rearing BSF, explains 31.75% variance. The second component, Lack of Knowledge of BSF insects, explains 25.77% variance, while the third component, Beneficial Properties of BSF, explains 9.83%. Each variable's total retained variance across all three components is displayed in the commonality column. According to MacCallum et al. (2001), in order to warrant running a PCA analysis, every item in the PCs must have commonalities greater than 0.60 or, for small sample sizes below 50, a commonality mean of 0.7.

CONCLUSION AND POLICY IMPLICATIONS

This study presents the first information on Kenyan dog owners' perceptions of BSFL meal as dog food, to the best of our knowledge. The location of dog owners, gender of the dog owner, education, occupation, and the number of dogs were found to significantly influence the perceived benefits and perceived risks of utilizing BSFL meal as dog food. From the study, we concluded that dog owners have a significantly greater perception of the benefits of BSFL meal than they do of the risk. A high level of acceptability of BSFL meals among dog owners can be inferred from the fact that the perception of benefits were typically higher than their perceptions of risks. The findings of this study indicated the

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need for increased consumer education about the use of BSFL as dog food to increase its awareness. We deduced from the study that dog owners see the advantage of BSFL substantially more favourably than the risk. A high level of acceptability of BSFL meals among dog owners can be inferred from the fact that advantages perceptions were typically higher than risk perceptions. The findings, which are empirically focused on Kenya, give decision-makers vital information about the existing state of affairs so they may make better choices as the policy to promote the manufacture of dog food based on BSFL develops. With positive effects projected for the pet food industry and the welfare of dog owners, the results of this investigation may encourage dog food manufacturers to satisfy consumers' wants and demands in a pet food market that is always evolving.

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Conflict of Interest

The authors affirm that they do not have any competing interests.

Ethical Approval

The research was conducted within the scope of Jaramogi Oginga Odinga University of Science and Technology (JOOUST) ethical provisions

Data Availability Statement

The data collected and used in this research, can be availed by the corresponding author upon request, the authors attest.

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