HOUSEHOLD DECISIONS ON THE CONSUMPTION OF EDIBLE TERMITES IN THE VHEMBE DISTRICT OF SOUTH AFRICA

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Abstract. This paper aims to identify factors influencing household decisions on whether to consume edible termites and the level of termite consumption in the Vhembe district of Limpopo province in South Africa. The study used secondary data sourced from the Gauteng Department of Agriculture and Rural Development and the University of Witwatersrand that was collected from 104 households in the Vhembe District in 2016. A descriptive statistical analysis was used to profile consumers' socio-economic characteristics. In addition, a logistic model and Ordinary Least Squares were used to determine the factors influencing a household's decision to consume edible termites and the level of consumption respectively. The results revealed that demographic factors (the age and gender of the household head) and religious beliefs influenced both consumption and the level of consumption. In addition, the type of termite preferred positively influenced the level of consumption, while knowledge influenced the decision to consume termites. The recommendations based on these results are that efforts should be made to promote the consumption of edible termites among the younger population, particularly males. Education programs could be designed to increase knowledge about termites and their nutritional benefits, which may increase consumption. Additionally, efforts should be made to understand and address the negative influence of religion on the consumption of edible termites.

Keywords: entomophagy, termites, consumers, logistic model

INTRODUCTION

According to the Food and Agriculture Organization (2014), current farming and agricultural food production practices are unsustainable, exacerbating food insecurity and malnutrition. The employment of measures such as conventional agriculture is meant to boost food production, but South Africa is still food insecure at the household level (Statistics South Africa, 2017). There is documentation indicating that entomophagy, which is the technical term for the consumption of edible insects, is a potential solution to the acute crisis of food insecurity (Igwe et al., 2011). Furthermore, Igwe et al. (2011) found that edible termites are rich in vital nutrients such as proteins, carbohydrates, minerals and vitamins, and therefore have the potential to meet the dietary needs of people leading an active and healthy life.

The consumption of edible termites in South Africa plays a significant role in nutrition, particularly in rural areas, where it is a livelihood strategy to combat malnutrition and food insecurity among poor households (Netshifhefhe et al., 2018). The current literature reveals

an upsurge in interest in the practice of entomophagy as a result of the benefits presented by edible insects (Imathiu, 2020; Bao and Song, 2022). In a recent study, most people eating edible insects in South Africa indicated that nutrition was the main reason for consuming them (Netshifhefhe et al. 2018). This practice ultimately bridges the gap between low-income households, which unfortunately form a major part of the population, and high-income households, which have better access to nutritious food. According to Ghaly (2009), edible termites have the ability to contribute to food security while addressing the looming protein supply crisis. The consumption of edible termites is not unique to South Africa and varies across different cultures and regions of the world. In some countries, such as Thailand and Mexico, insects are a traditional and widely accepted food source, while in others the idea of consuming insects may be met with resistance or disgust (Hlongwane et al., 2021).

The consumption of edible termites may vary depending on cultural, economic, and environmental factors. For example, in some cultures, the consumption of termites may be associated with traditional beliefs or practices, while in others, they may be a more practical and sustainable food source. Additionally, factors such as taste preferences, availability, and accessibility may also play a role in the consumption of edible termites.

To further explore these factors and better understand the drivers of insect consumption in different regions and cultures, additional research is needed. This may help identify potential barriers to the adoption of entomophagy as a way of accessing a more sustainable food source and inform efforts to promote its adoption. To fill this gap, this study used secondary data collected by the Gauteng Department of Agriculture and Rural Development and the University of Witwatersrand from 104 households to identify and examine factors influencing the consumption of edible termites.

Researchers around the Sub-Saharan region have made an effort to document factors influencing the consumption of edible insects. A study by Anankware (2017) on the factors affecting entomophagical practices in Ghana used a combination of Chi-square measuring the statistical significance between indepent variables. The findings revealed that there are socio-economic factors that influence consumption, including the demographic characteristics of the respondents, such as gender, age and educational status. However, the reviewed literature does not conclusively demonstrate how socio-economic

factors influence this phenomenon. In another study, Anankware (2017) elucidated the factors influencing the consumption of edible insects, revealing that males practiced entomophagy more than females. In terms of age, the study revealed that a greater proportion of older people were willing to practice entomophagy than their younger counterparts; this was because the younger generation have generally had a wider variety of meat sources to choose from, unlike older people, who grew up with limited choices.

Kenis et al. (2007) describe the influence of western civilization, which had a negative impact on research regarding edible insects in Africa. However, Defoliart (1999) cautioned against dismissive attitudes towards entomophagy, as they hamper the use of fundamental sources of protein without providing any significant substitute. In an effort to research this phenomenon, Igwe et al. (2011) conducted a qualitative study in Nigeria. The aim of the study was to analyse the nutritional composition of edible termites, including the micronutrients, macronutrients, vitamins and fatty acids. The results indicate that edible termites are a potentially rich source of nutrients, vitamins, minerals and unsaturated fatty acids, thus contributing to food security. As a result, entomophagy has gained a great deal of prominence. According to Van Huis (2015), there has been an upsurge in interest in the practice, which has led to campaigns to use edible insects as food in western countries.

In South Africa, particularly in Limpopo Province, the practice of entomophagy serves as an alternative source of protein. A study by Netshifhefhe et al. (2018) revealed the reasons for the consumption of termites, showing that nutrition was the main factor influencing the practice. Such findings suggest that edible termites are a potential solution to food insecurity and poverty, contributing to global food security. However, the reviewed literature does not address the socio-economic factors influencing the decisions of households to consume edible termites. This knowledge gap necessitate a quantitative research approach, which this study adopted to document the reality that underlies the decisions of households to consume edible termites.

MATERIALS AND METHODS

Data, study area, and sampling
The study used secondary data sourced from the Gauteng Department of Agriculture and Rural Development

and the University of Witwatersrand. Data was collected from 104 households in the Vhembe District of Limpopo Province in 2016 using simple random sampling. The research team were granted permission to use the data.

Analytical techniques

Descriptive analysis including percentages, means and standard deviations was used to describe the characteristics of the households in the study area. In addition, a logistic model was used to determine the probability of a household deciding to consume edible termites. The logistic model was the preferred choice, as the dependent variable is the household's decision to consume edible termites, whereby 1 represents the decision to consume them and 0 the decision not to consume them. Marginal effects were also used to interpret the effect of independent variables on the probability of the decision to consume edible termites. Marginal effects measure the expected change in the probability of a particular outcome with respect to a unit change in an independent variable (Mdlulwa et al., 2021). The Ordinary Least Squares (OLS) linear multiple regression method was used to determine the consumption level, as the dependent variable is the daily intake of edible termites, which is a continuous variable.

The models' specifications are shown below:

Logistic regression:

$$\log\left(\frac{\pi}{1-\pi}\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + {} \\ + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \epsilon_i$$

where

π is the probability that a household consumes termites, 0 otherwise

$\beta_1 \ldots \beta_8$ are the coefficients

$X_1 \ldots X_8$ are the explanatory variables, and

ϵ_i is the error term.

Ordinary least squares:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots \ldots + \beta_8 X_8 + \epsilon_i \qquad (1)$$

where

Y is the daily intake of termites

β_0 is the constant term

$\beta_1 \ldots \beta_8$ are the regression parameters to be estimated,

$X_1, X_2 \ldots X_8$, are independent variables and

ϵ_i is the independent random error (Melembe et al., 2021).

Table 1 shows the variables used to determine the factors influencing the decision to consume termites and the level of consumption.

Table 1. Definitions of variables in the analysis of the logistic model and OLS

Variable	Description	Unit
Dependent variable		
CONSUMPTION	1 if the household consumes termites, 0 otherwise	Binary
DAINTAK	Daily intake on termites consumption	Grams
Independent variable		
X_1 – LOCATION	1 if household is based in Thulamela municipality, 0 otherwise	Binary
X_2 – GENDER	1 if female, 0 otherwise	Binary
X_3 – AGE	1 if 60+, 0 otherwise	Binary
X_4 – EDUCATION	1 if household head had no formal education, 0 otherwise	Binary
X_5 – RELIGION	1 if households are influenced by religion to consume edible termites, 0 otherwise	Binary
X_6 – CONSUMPTIONREASON	1 if households consumption reason is nutrition, 0 otherwise	Binary
X_7 – PREFERENCE	1 if households preferred soldiers, 0 otherwise	Binary
X_8 – KNOWLEDGE	1 if households know edible termites, 0 otherwise	Binary

Source: own elaboration.

RESULTS AND DISCUSSION

Descriptive statistics of consumers and non-consumers of termites

Table 2 shows the descriptive statistics of edible termite consumers and non-consumers in the Vhembe District. The results reveal that most of the participants in the study were females (83.7%) and 44.4% of them were consumers of termites. Furthermore, most of the consumers (44.4%) were young adults between the age of 25 and 39 years. The results further illustrate that 19.44% of the consumers had received primary schooling only, 55.56% had received secondary schooling and 25% had received tertiary education, located in Thulamela municipality (44.4%).

Table 2. Statistics describing edible termite consumers (%)

Variables	Category	Consumers *n* (36)	Non-consumers *n* (68)	Total *N* (104)
LOCATION	Makhado	27.8	32.4	30.8
	Collins Chabane	27.8	13.2	18.3
	Thulamela	44.4	54.4	51
GENDER	Male	44.4	1.3	16.4
	Female	55.5	98.5	83.7
AGE	18–24	2.8	0	1
	25–39	44.4	8.8	21.2
	40–49	25.0	11.8	16.4
	50–59	22.2	25.0	24.0
	60+	5.6	54.4	37.5
EDUCATION	No formal education	0	53	34.6
	Primary schooling	19.4	17.7	18.3
	Secondary schooling	55.6	27.9	37.5
	Tertiary education	25.0	1.5	9.6
RELIGION	No	25.0	16.1	19.2
	Yes	75.0	83.8	80.8
CONSUMPTION REASON	Nutrition	44.4	0	44.4
	Poverty	36.1	0	36.1
	Custom	2.8	0	2.8
	Flavours	2.8	0	2.8
	Curiosity	5.5	0	0
PREFFERENCE	Alates	41.7	0	41.7
	Soldiers	58.3	0	58.3
KNOWLEDGE	Yes	83.3	96	91.4
	No	16.7	4.4	8.7

Source: own elaboration.

With regard to the respondents' knowledge of edible termites, the results show that 83% were aware of them. Nutrition was the main reason for consuming edible termites, accounting for 44.4% of consumers, followed by poverty at 36.11%. This corroborates the findings of Wendin and Nyberg (2021) and Hlongwane et al. (2021), who also found that nutrition was the main reason for entomophagy. Soldiers were the most preferred termite caste at 58.8%, followed by Alates at 41.7%.

Factors influencing the decision to consume termites and the level of edible termite consumption

Table 3 shows the logistic model, marginal effects and OLS multiple linear regression model of the decisions of households to consume edible termites. The value of the log-likelihood (-39.061) and the LR Chi^2 (significant at the 1% level) indicate that the specifications of the models provide a good fit to the data. The results show that out of the five significant factors, three factors influenced both the decision to consume termites and the level of consumption. The two remaining factors either influences only the consumption of edible termites or the level of consumption, not both.

The results reveal that the gender and age of the respondents influenced both the decision to consume termites and the level of termite consumption. Specifically, females were more likely to consume edible termites than males, suggesting that females' daily per capita intake of edible termites is likely to increase. The marginal effects indicate that if you are female, the possibility of consuming edible termites increases by 65%. These results concur with the findings of Hlongwane et al. (2021), who found that females are more likely to consume edible insects in Limpopo Province. With regard to the age of the respondents, the results revealed that age had a positive effect on the decision to consume termites which was statistically significant at the $P = 0.001$ level. Age was also associated with the level of consumption. These results imply that the older generation are more likely to consume edible termites. The marginal effects indicate that the possibility of consuming edible termites increases by 51.2% among the older generation. This result is consistent with the findings of Liu et al. (2019), who found that age had a positive and statistically significant effect on the practice of entomophagy in China.

Table 3. Factors influencing the decision to consume termites and the level of termite consumption

Variable	Consumption			Marginal effect	Consumption level		
	coef.	std. err.	Z	dy/dx	coef.	std. err.	t
LOCATION	–0.734	0.576	–	–0.082	2.153	1.748	1.24
GENDER	4.274***	1.583	3.84	–0.650	3.132*	1.856	–1.27
AGE	3.175***	0.931	3.15	–0.512	5.203**	2.523	–2.11
EDUCATION	0.399	0.679	0.59	0.079	–2.016	1.981	–1.55
RELIGION	–0.584*	0.953	1.67	–0.085	–3.871*	2.380	–1.74
CONSUMPTIONREASON	–0.992	0.783	–1.62	–0.197	1.231	1.856	0.67
PREFERENCE	0.069	0.697	0.10	0.013	3.421*	1.781	1.96
KNOWLEDGE	1.935*	0.994	1.93	0.453	1.537	3.086	0.45
_cons	7.353	3.541	3.98		29.161	5.156	7.95
Number of obs =104	Pseudo R^2 = 0,667				Prob > F = 0.0076		
LR chi^2(11) =61.46	Prob >chi^2 = 0.000				R-squared = 0.215		
Log likelihood = -39.061					Adj R-squared = 0.122		
					Root MSE = 9.756		

Significant at: *$P = 0.1$; **$P = 0.05$; ***$P = 0.001$.
Source: own elaboration.

The variable "religion" had negative effects on the decision to consume termites and the level of termite consumption that were significant at the $P = 0.1$ level. This implies that households influenced by religion are less likely to consume edible termites. Moreover, the daily per capita intake of edible termites is more likely to be low in such households. These results agree with the findings of Moripe (1996), who found that the practice of entomophagy was prohibited among other Christians in Limpopo Province.

The results reveal that consumer preference had a positive effect and was statistically significant at the $P = 0.1$ level, only determining the level of consumption. This implies that the daily per capita intake of households preferring soldiers was likely to be high. The results concur with the findings of Liu et al. (2019), who reported that insect preference had a significant positive effect on consumption, indicating that a higher preference level for edible insects led to a higher level of consumption.

Lastly, the variable "knowledge" revealed that a household's knowledge of termites had a positive effect on the decision to consume edible termites that was statistically significant at the $P = 0.1$ level. This implies that households whose members know about edible termites were more likely to consume them compared to their counterparts who didn't share this knowledge. The marginal effects indicate that if a household has knowledge of edible termites, its possibility of consuming edible termites increases by 45.3%. These results concur with the findings of Liu et al. (2019), who found that knowledge had a positive, statistically significant effect on consumption.

CONCLUSION AND RECOMMENDATIONS

The study revealed that the socio-economic factors influencing the decisions of households to consume edible termites are gender, age, religion, preference, and knowledge. These findings suggest that the practice of entomophagy is not equally distributed across socio-economic groups, which ultimately stifles the growth of the phenomenon. The factors influencing participation in edible insect consumption reveal the extent of its acceptability. Furthermore, they provide hints about the future adoption of entomophagy.

Based on the results of the study, it is recommended that efforts be made to increase awareness and education on the benefits of entomophagy, especially in communities where the practice is not widespread. This could be achieved through targeted education campaigns and collaborations with local organizations and leaders to promote the benefits of edible insect consumption. One effective avenue for education and awareness can be found in community and SABC (South African Broadcasting Corporation) radio stations. These radio stations often have programs that reach a wide audience, making them an ideal platform for disseminating information about the nutritional value, sustainability, and culinary diversity of edible insects. By partnering with these stations, experts and organizations could conduct interviews, host discussions, and provide informative content to educate people about the benefits and potential of edible insects as food.

Additionally, leveraging events such as heritage month, celebrated in September every year, could be another way to raise awareness about edible insects. Heritage month is a time when communities come together to celebrate their cultural traditions and practices. Incorporating educational activities, workshops, or food festivals centered on edible insects into the celebrations during this month could attract public attention and provide a platform to showcase the cultural significance and nutritional value of these traditional food sources.

Additionally, interventions aimed at reducing the socio-economic disparities that exist in the consumption of edible insects should be developed. This could include initiatives that promote the cultivation and harvesting of edible insects in communities where they are not traditionally consumed, or initiatives that provide incentives for households to consume edible insects. Furthermore, there is a need for further research into the nutritional and environmental benefits of entomophagy. This would help to provide a more comprehensive understanding of the practice and could encourage more widespread adoption.

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