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ANALYSIS OF MUSHROOM CONSUMPTION AND ITS DETERMINANTS IN GHANA

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Abstract. Mushroom cultivation in Ghana has gained some modest success due to increased consumption especially by urban dwellers. However, commercial cultivation is still low in the country. The conception of this study is that higher levels of mushroom consumption will boost production in the country. The study analysed mushroom consumption and its influencing factors in Ghana. A multi stage sampling technique was used to collect data from 550 households. The data was collected using a well-structured questionnaire. Descriptive statistics and ordered probit model were used to analyze the frequency of mushroom consumption and the determinants of mushroom consumption respectively. The results on mushroom consumption based on the descriptive statistics show that majority of households consume mushrooms 1-2 times a month. The results on the factors influencing mushroom consumption based on the ordered probit model showed a significant influence of age (0.0156), tertiary education (0.3632), own price (-0.2393), availability (0.2443), nutritional value (0.2938), easy-to-prepare (0.3503), and regional location (Ashanti region) (-0.3054). The study recommends that mushroom producers and their collaborators should target the youth and persons with low levels of education and provide them with information on the beneficial uses of mushroom to boost consumption. They should also adopt good marketing and distribution channels to increase the availability of mushrooms in major local and super markets in the country, especially Ashanti and Greater Accra regions.

Keywords: mushroom, consumption, frequency, and determinants

INTRODUCTION

Mushrooms are an alternative source of good protein (Kakon et al., 2012), whose cultivation and consumption are increasing worldwide (Shahi et al., 2018). The cultivation is increasing at an annual rate of 6–7% and more than 100 countries are engaged in it (Singh et al., 2011). The increased popularity is a result of its nutritional and health benefits, as well as its unique flavour (Shahi et al., 2018). The proteins of edible mushrooms contain all nine amino acids essential for humans (Gupta et al., 2018). They are low in calories, gluten, and sodium (Gupta et al., 2018). They are also good sources of several vitamins and minerals. They include vitamins such as thiamine (vitamin B_1), riboflavin (vitamin B_2), biotin, niacin, and ascorbic acid (vitamin C) (Chang and Miles,

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2004). Wasser (2014) reported that mushrooms have numerous health benefits which includes antitumor activity, antioxidant, immunomodulatory, antifungal, antiviral and antidiabetic properties.

In Ghana, mushrooms are consumed by many households (Apetorgbor et al., 2005). Rural people in forest areas engage in the picking of wild mushrooms when the season has arrived for their consumption, and also sell some for extra income (Apetorgbor et al., 2005). Mushroom picking is usually done between early March and April and September and October (Dzomeku et al., 2014). Mushroom cultivation in Ghana started in the early 1990's when some exotic species were introduced. The species included oyster mushroom (*Pleurotus spp*.), milky mushroom (*Calocybe indica*), straw mushroom (*Volvariella volvacea*) and *Ganoderma* mushroom (Obodai, 2000). The cultivation has gained some modest success due to increased consumption, especially by urban dwellers. However, commercial cultivation is still low in the country. Meanwhile, Ghana has a favourable climatic condition for mushroom cultivation, especially for oyster mushrooms, and has an abundance of agricultural and wood waste that can be used as a substrate (Obodai, 2000).

Mushroom consumption and its influencing factors have been widely researched (Boin and Nunes, 2018; Lucier et al., 2003; Mayett et al., 2008; Min and Oh, 2006; Oguntoye et al., 2022; Oh et al., 2002; Osemwegie et al., 2010). Reviewing the literature to date, few studies have investigated mushroom consumption in Ghana (Apetorgbor et al., 2005; Kortei et al., 2018). Whilst the contribution of these studies is highly remarkable, the studies did not describe the pattern of mushroom consumption and the factors influencing the consumption, which is important for policy and marketing purposes. This study was conceived based on the idea that a higher level of mushroom consumption will boost production in the country. Therefore, the objective of this study is to examine mushroom consumption and its influencing factors in Ghana.

LITERATURE REVIEW

Some studies have examined mushroom consumption and its influencing factors. For instance, Oh et al. (2002) studied the consumption and perception of mushrooms and mushroom dishes among Koreans. They collected data from 2,777 respondents. The study reported that the majority of people consume mushrooms 1–2 times/day, with a mean and standard deviation of 4.14 ± 1.04, followed by 3–4 times/week (4.07 ± 0.82), 1–2 times/week (3.94 ± 0.87), 1–2 times/month (2.31 ± 1.12), and few or never (3.38 ± 1.20). Mayett et al. (2008) studied consumption trends of mushrooms in Mexico. They collected data from 540 respondents and analysed the data using descriptive statistics and ANOVA. The results of the study revealed that 49.4% of the respondents consume mushrooms 1–4 times per week, followed by 1–2 times per month (41.6%) and the lowest figure accounted for those who consume mushrooms occasionally (3.7%). Boin and Nunes (2018) studied mushroom consumption among a sample of the Portuguese population. They collected data from 925 respondents and analysed it using descriptive statistics and ordered logistic regression. The results of the study revealed that most people (41.1%) consume mushrooms at least once a week, followed by those who consume mushrooms at least once a month (23.7%), and the lowest figure accounted for those who consume mushrooms more than once a week (17.1%). The study identified factors such as gender, household size and education as factors influencing mushroom consumption.

Jiang et al. (2017) conducted a study on mushroom consumption in the United States using the zero-inflated ordered probit model approach. They collected data from 674 respondents through an online survey. The dependent variables in their model were frequency of fresh mushroom consumption and frequency of processed mushroom consumption. The results of the study identified factors such as age, gender, income, ethnicity and awareness of health benefits of mushrooms as factors influencing fresh mushroom consumption. In Nigeria, Oguntoye et al. (2022) examined mushroom consumption patterns among residents of Ibadan Metropolis. They collected data from 250 respondents and analysed it using descriptive statistics and multiple regression. The results of the study revealed that 50.8% of the people consume mushrooms occasionally, 43.2% consume mushrooms monthly, and 6% consume mushrooms fortnightly. The study identified factors such as age, educational level, monthly income and availability as factors influencing mushroom consumption. In a related study, Adegbenjo et al. (2020) examined the factors influencing the consumption of wild and cultivated mushrooms in south-western Nigeria. They collected data from 400 respondents. They analysed the data using descriptive statistics and the logit regression model. The study identified factors such as age, household size, income,

mushroom price, prices of related goods, season, nutritional benefits and medicinal benefits as factors influencing mushroom consumption. Similarly, Adejo and Ademu (2018), conducted a study on mushroom consumption among farm households in Dekina local government area, Nigeria. They collected data from 160 respondents. The data was analysed using descriptive statistics and binary logit regression model. The study identified factors such as age, education, gender, awareness of mushrooms and years of consumption of mushrooms as factors influencing mushroom consumption.

MATERIALS AND METHODS

Study area

The study was carried out in three regions of Ghana; Greater Accra, Ashanti and Bono-East region. The regions were selected because they are the regions where the bulk of mushrooms are produced in the country and, invariably, the regions with the highest number of mushroom consumers. According to data from the Mushroom Growers and Exporters Association of Ghana (MUGREAG), Bono-East region is the largest producer, followed by Greater Accra and Ashanti region. The Greater Accra region is the seat of government and the regional capital city is Accra, which is also the capital of Ghana. The region has 29 districts. It is the most populated region with a population size of 5,455, 692 (GSS, 2021). It is also the most urbanised region in the country, with 87.4% of its population living in urban areas (Songsore, 2009). Ashanti region is the second most populous region, with a population size of 5,440,463 (GSS, 2021). The region is the second most urbanised region in the country after Greater Accra region. The region has a total of 43 districts. Bono East region is one of the newly created regions. The capital of the region is Techiman. The region has a total population size of 1,203,400 (GSS, 2021). The region has eleven districts. Agriculture is the main economic activity in the region. The main crops grown include yam, cassava, cocoyam, beans, rice and plantain. Fig. 1 shows the map of the study areas where the respondents were sampled.

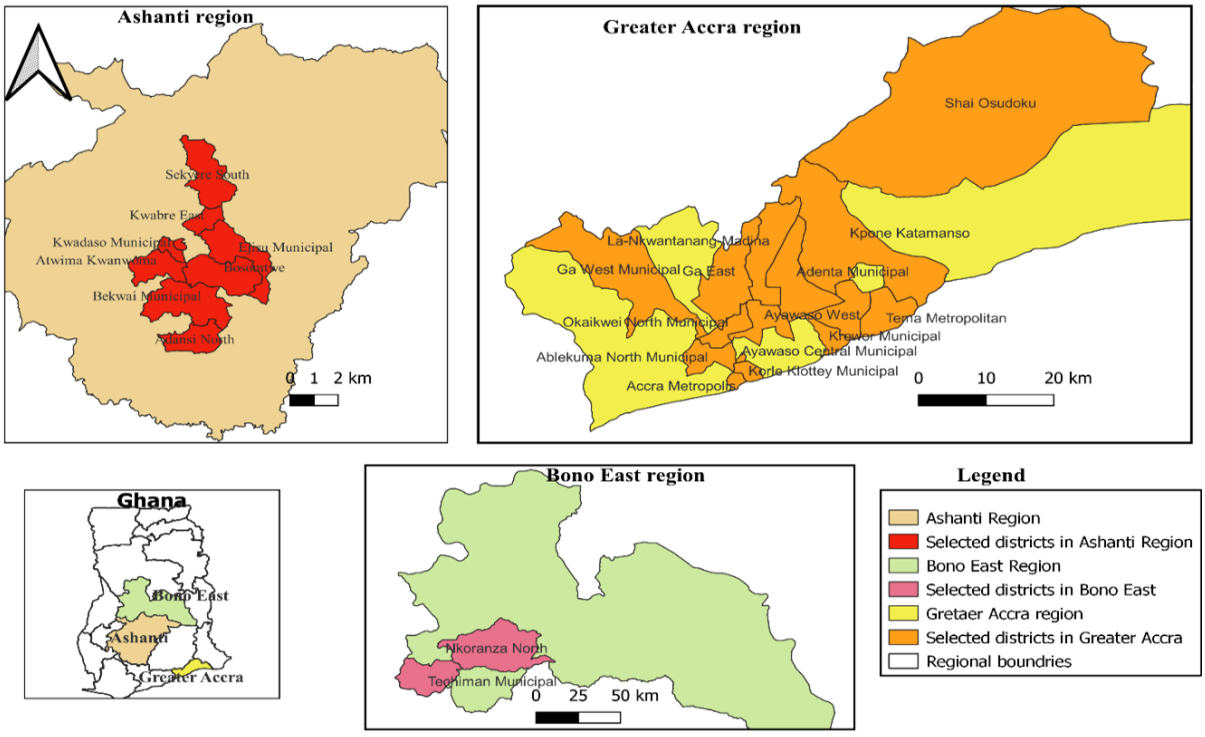

Fig. 1. Map of the study area
Source: Centre for Remote Sensing and Geographic Information Services, University of Ghana (2022).

Research design

The target population were mushroom consumers in Greater Accra, Ashanti and Bono East regions. The data was collected using a well-structured questionnaire through Computer Assisted Personal Interview (CAPI). A Multistage sampling technique was used to select the respondents. First, a purposive sampling of the three regions were made because they are the highest mushroom producing regions in the country and, invariably, with the highest number of consumers too. According to MUGREAG, Bono East region has the highest number of mushroom farmers, followed by Greater Accra region and Ashanti region. Hence, it is expected that a lot of mushroom consumers will be in these regions. Also, Greater Accra and Ashanti regions were selected because they are the most urbanised regions in the country, and studies have noted that urbanisation drives demand for processed foods (Andam et al., 2015). Two approaches were used to select the respondents for the interviews. The first approach was to directly contact mushroom farmers in these regions to get the list of their clients, if available, and select them at random for the interviews. A list of contacts of consumers were obtained from some of the farmers in the three regions. The respondents were selected at random and contacted. A few responded positively, while others did not. Even for those who responded positively, it was difficult booking appointments with most of them for the interviews. In all, less than 10% of the contacts were booked and interviewed.

The second approach was to station enumerators at mushroom sales points, in various local shops and supermarkets, in order to collect contact details of shoppers and book appointments with them for interviews later. Shoprite, in Accra Mall and Koala, as well as ten local markets were selected in the Greater Accra region and visited. The local markets included Malam Ata market, Agbogboloshie market, Makola market, Tema community one market, Kaneshie market, Madina market, Adenta shopping centre, Nima market, Dodowa market and Dome Kwabenya market. Unfortunately, mushrooms were sold in only four local markets (Madina market, Adenta shopping center, Dodowa market and Dome Kwabenya market) at the time of the data being collected. The information we gathered from the other six markets was that the traders were selling only wild mushrooms, and wild mushrooms were out of season at the time of the data collection. Kumasi City Mall as well as six local markets were identified and visited in the Ashanti region. The local markets included Kejetia market, Asafo market, Ayiga market, Bantama market, Suame market and Ejisu market. At the time of the data collection, mushrooms were sold in three (Kejetia market, Asafo market and Ejisu market) out of the six markets. The information gathered was that the traders in the other three markets were selling only wild mushrooms, which were out of season at the time of the data collection. Kejetia market is the biggest market in the Ashanti region, where people from different parts of the region come to shop. In the Bono-East region, two local markets were identified and visited, namely Nkoranza South market and Techiman Municipal market. We could not identify supermarkets where mushrooms were sold. Hence, we were stationed at the local markets only. The snowball sampling technique was also employed to locate other respondents in the region.

Sample size

The population of mushroom consumers in the three regions are unknown, therefore the standard sample size determination formula, for unknown population, was used to determine the sample size for households. The standard sample size determination formula is specified as in equation (1).

$$n = \frac{[Z^2 \cdot p(1-p)]}{e^2} \quad (1)$$

where n is the sample size, Z is the confidence level (1.96 for a confidence level (α) of 95%), p is the expected proportion of interest to be studied (50% = 0.5 for unknown population) and e is the percentage error margin (0.05). Based on the formula, the minimum sample size of 384.2 is expected for the study. A total sample size of 550 respondents (Greater Accra 220, Ashanti region 180, Bono-East region 150) was used for the study.

Econometric model

Two types of information are usually gathered from food consumption studies: consumption or not and consumption frequency (Jiang et al., 2017). The study considered only mushroom consumers. Non-consumers of mushrooms were not interviewed. Therefore, the information gathered was mushroom consumption frequency. The consumption frequencies were scaled from zero to three, with a higher number indicating more frequent consumption (i.e., 0 = occasional (at least once a year),

1 = 1–2 times a month, 2 = at least once a week, 3 = more than once a week). The frequency of consumption was analysed using descriptive statistics. Given the categorical nature of the dependent variable i.e., consumption frequency, the factors influencing mushroom consumption frequency could be analysed using ordered probit model or ordered logit model. Ordered probit model was used in this study. Several studies have used the ordered probit model in the analysis of factors influencing consumption frequency (Abusin et al., 2022; Akbay et al., 2007; Asante-Addo and Weible, 2020; Lee and Nam, 2019; Nguyen et al., 2015; Terin, 2019). The latent regression model or random utility model serves as the basis for the ordered probit model (Greene and Hensher, 2009), which is specified as in equation (2).

$$n = \frac{[Z^2 \cdot p(1-p)]}{e^2} \tag{2}$$

where y^* is the unobserved or the latent variable, which describes the underlying continuous consumption of mushrooms. x_i is the selective explanatory variables, β is the coefficient vector and is the error term. The latent variable y* can be observed in a discrete form through a censoring mechanism, which is specified in equations (3) to (6).

$$y_i = 0 \text{ if } \mu_{-1} < y^* \leq \mu_0 \tag{3}$$

$$y_i = 1 \text{ if } \mu_0 < y^* \leq \mu_1 \tag{4}$$

$$y_i = 2 \text{ if } \mu_1 < y^* \leq \mu_2 \tag{5}$$

$$\vdots$$

$$y_i = j \text{ if } \mu_{j-1} < y^* \leq \mu_j \tag{6}$$

where $\mu_0 < \mu_1 < \cdots < \mu_j$ = unknown threshold parameters to be estimated using a sample of n observations. The dependent variable used in the model is $y = 0$, $y = 1$, $y = 2$, $y = 3$ representing a households mushroom consumption frequency equal to at least once a year, 1–2 times a month, at least once a week and more than once a week, respectively. Following Greene and Hensher, (2010), the probability of a respondent selecting one of the frequencies is given as in equation (7) to (8).

$$\text{Prob}(y = 0|x) = F(-x'\beta) \tag{7}$$

$$\text{Prob}(y = 1|x) = F(\mu_1 - x'\beta) - F(-x'\beta) \tag{8}$$

$$\text{Prob}(y = 2|x) = F(\mu_2 - x'\beta) - F(\mu_1 - x'\beta) \tag{9}$$

$$\text{Prob}(y = 3|x) = 1 - F(\mu_2 - x'\beta) \tag{10}$$

where F (.) is the cumulative distribution of ε_i. For the ordered probit model, F (.) is represented by the cumulative probability function of the univariate normal distribution. The specifications of the likelihood function and log likelihood functions are given in equation (11) and (12), respectively.

$$L = \prod_{i=1}^{N} \prod_{j=0}^{N} y_{ij} \left\{ F\left(\mu_j - x_i'\beta\right) - F\left(\mu_{j-1} - x_i'\beta\right) \right\} y_{ij} \tag{11}$$

$$LogL = \prod_{i=1}^{N} \prod_{j=0}^{N} y_{ij} \log \left\{ F\left(\mu_j - x_i'\beta\right) - F\left(\mu_{j-1} - x_i'\beta\right) \right\} \tag{12}$$

where y_{ij} is a binary variable that takes the value of 1 when a respondent i chooses consumption frequency j, and 0 when otherwise. The log-likelihood function in equation (12) is maximised with respect to the parameters of β along with the thresholds μ_0, μ_1, μ_2, μ_{j-1}, by an iterative procedure to give maximum likelihood estimates (MLEs) of both sets of parameters (Greene and Hensher, 2009). The parameters of β are interpreted as the effect of the explanatory variables on the frequency of consumption (Asante-Addo and Weible, 2020).

Empirical specification of the ordered Probit model

Theoretical and empirical studies on factors influencing food consumption revealed that food consumption is influenced by several factors including individual characteristics, product characteristics and institutional or environmental factors (Gama et al., 2018; Pallegedara, 2017; Randall and Sanjur, 1981; Shepherd, 2007). Socio-economic variables that are often included in empirical studies on determinants of food consumption are age, gender, marital status, education, occupation, income and household size. Product characteristics that are often included in empirical studies on determinants of food consumption are price, nutritional value, taste and ease of preparation. Environmental factors that are often included in empirical studies on food consumption are availability, location and degree of urbanisation. Following studies by Boin and Nunes (2018), Oguntoye et al. (2022) and Adegbenjo et al. (2020), the factors hypothesised to influence mushroom consumption frequency in this study included gender, level of education, marital status, age, occupation, income, household size, regional location, availability, taste, price, nutritional value and ease of preparation. The specification of the ordered

probit model with the explanatory variables is specified in equation 13.

$$\begin{aligned} \text{freq}_{mc} = {} & \beta_1 Age + \beta_2 Marstat + \beta_3 Gen + \\ & \beta_4 Edu + \beta_5 Incom + \beta_6 Occu + \beta_7 HHS + \\ & \beta_8 Loc + \beta_9 Avail + \beta_{10} Taste + \beta_{11} Price + \\ & \beta_{12} NutriValue + \beta_{13} EasePre + \varepsilon_i \end{aligned} \quad (13)$$

where $freq_{mc}$ is the dependent variable representing individual i mushroom consumption frequency, β – are the parameters to be estimated and ε_i – represents the error term. The description and measurement of the individual explanatory variables with their expected signs are presented in Table 1.

Table 1. Explanatory variables of determinant of mushroom consumption

Variable	Description	Measurement	A priori expectation
Age	Age of respondent in years	Continuous (years)	(+)
Marital status	Marital status of respondent	Dummy (1 = married 0 = otherwise)	(+)
Gender	Sex of respondent	Dummy (1 = female, 0 = male)	(+)
Education	Level of education of respondent	Categorical	
		1 = no formal education	(–)
		2 = basic level	(–)
		3 = secondary level	(+)
		4 = tertiary education	(+)
Income	Average monthly income of respondent	Continuous (GHS/month)	(+)
Occupation	Employment status of respondent	Categorical	
		1 = formal sector	(+)
		2 = informal sector	(+)
		3 = unemployed	(–)
Household size	Number of people living in respondent household	Continuous (Number)	(–)
Region	Region of respondent	Categorical	
		1 = Greater Accra region	(–)
		2 = Ashanti region	(–)
		3 = Bono East region	(+)
Availability	Consumer perception of availability on mushroom consumption	1–5 Likert scale	(+/–)
Taste	Consumer perception of taste on mushroom consumption	1–5 Likert scale	(+/–)
Price	Consumer perception of price on mushroom consumption	1–5 Likert scale	(+/–)
Nutritional value	Consumer perception of nutritional value on mushroom consumption	1–5 Likert scale	(+/–)
Easy-to prepare	Consumer perception of ease of preparation on mushroom consumption	1–5 Likert scale	(+/–)

*Likert scale: 1 = not very important, 2 = somewhat important, 3 = moderately important, 4 = important, 5 = very important.
Note: positive signs imply the variables have a positive influence on consumption or use, and the opposite is true for negative signs.
Source: own elaboration.

RESULTS AND DISCUSSIONS

Demographic characteristics of respondents

The demographic characteristics of respondents are presented in Table 2.

Table 2. Demographic characteristics of respondents

Variable	Frequency	Percentage	Mean
Age			40.3 ±13.14
18–25 years	54	9.82	
26–40 years	278	50.55	
41–50 years	112	20.36	
51–60 years	56	10.18	
Above 60 years	50	9.09	
Gender			0.64 ±0.48
Female	351	63.82	
Male	199	36.18	
Marital status			0.64 ±0.4
Married	353	64.18	
Single	197	35.82	
Education			
No formal education	44	8.00	0.35 ±0.48
Basic education	134	24.36	0.28 ±0.45
Secondary education	178	32.36	0.29±0.46
Tertiary education	194	35.27	0.08 ±0.27
Occupation			
Formal sector employee	149	27.09	0.27 ±0.19
Informal sector employee	335	60.91	0.60 ±0.21
Unemployed	66	12.00	0.12 ±0.14
Average monthly income			1 129.06 ±61.57
< GHS 2,000.00	439	79.82	
GHS 2,000.00–2,999.00	56	10.18	
GHS 3,000.00–3,999.00	25	4.55	
GHS 4,000.00–4,999.00	8	1.45	
GHS 5,000.00 and above	22	4.00	
Household size			4.97 ±4.37
1–5 HHS	379	68.90	
6–10 HHS	154	28.00	
11–15 HHS	11	2.00	
Above 15	6	1.10	

Source: own estimation based on field survey (2022).

The mean age of respondents is 40 ± 13.14 years. This indicates that the majority of respondents are still active and energetic. The majority of the respondents are females (63.82%). This could result from the fact that women are generally in charge of food preparation in the household. The majority of the respondents are married (64.18%). This indicates that married people consume mushrooms more than those who are not married. The reason for this could be that married people live a healthier lifestyle and consume a more healthy diet than people who are not married. The majority of the respondents have tertiary education (35.27%). This could be as a result of the fact that mushrooms are consumed for its nutritional and health benefits, and it might be the case that higher education enhances nutritional knowledge. The majority of the respondents (60.9%) are employed in the informal sector. The mean monthly income is GHS1129.06±61.57. This means that mushroom consumption is not associated with people with high income levels. The mean household size is 5±4.37. This means that mushroom consumption is associated with smaller household size.

Frequency of mushroom consumption

The frequency of mushroom consumption by households is presented in Table 3. The results show that the majority (40.18%) of households consume mushrooms 1-2 times a month. This finding is consistent with Predanócyová et al. (2023), who also found in Slovakia that the majority of consumers consume mushrooms 1–2 times a month. A few households (8.36%) consume mushrooms occasionally, for example, once a year.

Table 3. Frequency of mushroom consumption

Frequency	Frequency	Percentage
Occasional/seasonal (ones a year)	46	8.36
1–2 times a month	221	40.18
At least once a week	99	18.00
More than once a week	184	33.45
Total	550	100

Source: own estimation based on field survey (2022).

Factors influencing households' mushroom consumption frequency

The factors influencing a household's mushroom consumption frequency was analysed using the ordered probit model. The result is presented in Table 4.

Table 4. Factors influencing households' mushroom consumption frequency

Variable	Coefficient	Standard error
Age	0.0145***	0.0043
Gender	–0.1565	0.1045
Marital status	0.0519	0.1095
Basic education	–0.5060	0.2356
Secondary education	–0.3285	0.8697
Tertiary education	0.3632**	0.1168
Formal sector employee	0.0589	0.1728
Informal sector employee	–0.0449	0.1457
Monthly income	–0.0174	0.0185
Household size	–0.0087	0.0155
Taste	0.1333	0.1325
Price	–0.2393*	0.1371
Availability	0.2443*	0.1354
Nutritional value	0.2938**	0.1055
Easy-to- prepare	0.3503*	0.1554
Greater Accra region	–0.1572	0.1357
Ashanti Region	–0.3054*	0.1406
Threshold 1	–0.9638	0.2374
Threshold 2	0.4913	0.2359
Threshold 3	0.9808	0.2388
Wald $chi^2(16) = 58.34$ Prob > $chi^2 = 0.0000$		
Pseudo $R^2 = 0.0460$ Log likelihood = –655.3099		
Number of observations = 550		

***, **, * indicates significance at 1% level, 5% level and 10% level, respectively.
Source: own estimation based on survey data (2022).

Age is significant at the 1% level and is positive, which means that mushroom consumption increases with age. This finding is consistent with previous studies by Boin et al. (2018) and Oguntoye et al. (2022), who reported a similar relationship between age and mushroom consumption. Tertiary education is significant at the 5% level and is positive. This means that higher education enhances nutritional knowledge by identifying mushrooms as a nutritious and healthy food item. This finding is consistent with previous studies by Boin and Nunes (2018) and Oguntoye et al. (2022), who found a similar relationship between education and mushroom consumption. The variables 'price', 'availability', 'nutritional value' and 'easy to prepare' are all significant at the 10% level and indicate the perception of importance to mushroom consumption. The coefficient of price is negative, determining a lower likelihood of consuming mushrooms more frequently. The variables 'availability', 'nutritional value' and 'easy-to-prepare' are all positive, determining a higher likelihood of consuming mushrooms more frequently. The coefficient of regional location (Ashanti region) is significant at the 10% level and is negative. This means that respondents in the Ashanti region have a lower likelihood of consuming mushrooms more frequently compared to respondents in the Bono-East region.

Predicted probabilities and marginal effects from the ordered probit model

The marginal effects of the ordered probit model are presented in Table 5. According to Greene and Hensher (2010), the marginal effects, rather than the estimated coefficients from the ordered probit model, are informative. The marginal effect shows how a change in an explanatory variable affects the expected frequency of mushroom consumption. For ordered probit, estimated marginal effects for each variable across the categories of consumption frequency is not statistically different from zero (Greene and Hensher, 2010). The likelihood that a person will choose at least one category must therefore be weighed against the likelihood that they won't choose any other categories (Kumar et al., 2008). With increasing consumption, a shift in the marginal effect sign from negative to positive indicates an increase in marginal utility, whereas a shift from positive to negative indicates a decrease in marginal utility (Kumar et al. 2008).

The results of the marginal effects show that a one-year increase in the age of a respondent is negatively associated with a higher likelihood of consuming mushrooms at least once a year and 1–2 times a month. This means that an increase in age increases the likelihood

Table 5. Marginal effects from the ordered probit model

Variable	At least once a year	1–2 times a month	At least once a week	More than once a week
Predicted prob.	0.0670	0.4206	0.1897	0.3226
Age	–0.0019**	–0.0039**	0.0006*	0.0052**
Gender	0.0200	0.0423	–0.0055	–0.0567
Marital status	–0.0069	–0.0138	0.0022	0.0186
Basic education	0.0907*	0.1058**	–0.0365	–0.1598*
Secondary education	0.0545	0.7482	–0.2146	–0.1079
Tertiary education	–0.0427**	–0.1005**	0.0088*	0.1344**
Formal sector employee	–0.0076	–0.0158	0.0022	0.0213
Informal sector employee	0.0059	0.0120	–0.0017	–0.0162
Monthly income	0.0023	0.0046	–0.0007	–0.0063
Household size	0.0012	0.0023	–0.0003	–0.0031
Taste	–0.0169	–0.0361	0.0046	0.0484
Price	0.0344	0.0608*	–0.0117	–0.0835*
Availability	–0.0304*	–0.0666*	0.0078*	0.0892*
Nutritional value	–0.0394*	–0.0774*	0.0118*	0.1049**
Easy-to-prepare	–0.0379**	–0.0993*	0.0051	0.1320*
Greater accra region	0.0213	0.0414	–0.0066	–0.0560
Ashanti region	0.0437*	0.0776*	–0.0146*	–0.1067*

***, **, * indicates significance at 1% level, 5% level and 10% level, respectively.
Source: own estimation based on survey data (2022).

of consuming mushrooms more frequently. This finding could be due to the fact that older people are more health conscious and tend to consume less energy dense foods and more vegetables. This finding is consistent with previous studies by Boin et al. (2018) and Oguntoye et al. (2022), who found a positive relationship between age and mushroom consumption frequency. Tertiary education is negatively associated with a higher likelihood of consuming mushrooms at least once a year and 1-2 times a month. This means that respondents with tertiary education have a higher likelihood of consuming mushrooms more frequently. This finding could be due to the fact that most people consume mushrooms for their nutritional and health benefits and higher education enriches nutritional knowledge. This finding is consistent with previous studies by Boin and Nunes (2018) and Oguntoye et al. (2022), who also found a positive relationship between education and frequency of mushroom consumption.

Price is perceived as being negatively associated with a higher likelihood of consuming mushrooms more than once a week and at least once a week. This finding could be due to the fact that most people perceive mushrooms to be expensive relative to its close substitutes like meat and fish. This finding is consistent with a previous study by Jiang et al. (2017), who reported that mushrooms with a reasonable price increases consumption frequency. Perceptions of 'availability' and 'nutritional value' are all positively associated with a higher likelihood of consuming mushrooms more than once a week and at least once a week. This finding is consistent with previous findings by Oguntoye et al. (2022). The perception of 'easy-to-prepare' is negatively associated with a higher likelihood of consuming mushrooms

at least once a year and 1-2 times a month. This means that a perception of 'easy-to-prepare' increases the likelihood of consuming mushrooms more frequently. This finding is consistent with previous findings by Oh et al. (2002). Regional location (Ashanti region) is negatively associated with a higher likelihood of consuming mushrooms more than once a week and at least once a week, compared to respondents in Bono-East region, which is a major mushroom producing area.

CONCLUSIONS AND RECOMMENDATIONS

Commercial mushroom cultivation in Ghana is still very low. The reason behind this study is based on the view that a higher level of mushroom consumption will boost production in the country. This study employed descriptive statistics and the ordered probit model to examine mushroom consumption and its determinants in Ghana. The results of the study revealed that the majority of households in Ghana consume mushrooms 1–2 times a month. The significant factors influencing a household's mushroom consumption frequency are; being older with tertiary education, having a perception of low price and high nutritional value, a ready availability of mushrooms, an easy-to-prepare outlook and a location in the Ashanti region. Based on the results, the study recommends four key actions for mushroom producers and their collaborators (government and non-governmental organisations): i) engage in sensitization and promotional activities on mushroom consumption especially in Ashanti region, which is farther from the major producing region (Bono-East); ii) target the youth and persons with low levels of education, who should all be provided with information on the beneficial uses of mushroom to boost consumption; iii) encourage producers and traders to adopt good marketing and distribution channels to increase the availability of mushrooms in major local markets and supermarkets in the country, especially in the Ashanti and Greater Accra regions; and iv) train producers and traders in good pricing strategies to target people of all income levels.

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REFERENCES

Abusin, S., Mandikiana, B.W., Al Emadi, N., Al-Boinin, F. (2022). Socioeconomic drivers of fish consumption in Qatar. Sustainability (Switzerland), 14(17), 1–12. https://doi.org/10.3390/su141710921

Adegbenjo, A.E., Adedokun, M.O., Oluwalana, S.A. (2020). Factors influencing the consumption of wild and cultivated mushroom species in Southwestern. J. Forest Env. Sci., 36(4), 311–317. https://doi.org/10.7747/JFES.2020.36.4.311

Adejo, P.E., Ademu, H. (2018). Attitude of rural farming household towards the consumption of edible mushrooms in Dekina Local Government Area, Kogi State, Nigeria. Nutr. Food Sci. Int. J., 5(3), 1–6. https://doi.org/10.19080/nfsij.2018.05.555661

Akbay, C., Tiryaki, G.Y., Gul, A. (2007). Consumer characteristics influencing fast food consumption in Turkey. Food Control, 18(8), 904–913. https://doi.org/10.1016/j.foodcont.2006.05.007

Andam, K., Al-Hassan, R.M., Asante, S.B., Diao, X. (2015). Is Ghana making progress in agro- processing ? Evidence From an Inventory of Processed Food Products in Retail Shops in Accra. In IFPRI Working Paper 41 (Issue December).

Apetorgbor, M.M., Apetorgbor, A.K., Nutakor, E. (2005). Utilization and cultivation of edible mushrooms for rural livelihood in Southern Ghana. 17th Commonwealth Forestry Conference 2005-Colombo, Sri Lanka, 1–22.

Asante-Addo, C., Weible, D. (2019). Is there hope for domestically produced poultry meat? A choice experiment of consumers in Ghana. Agribus. Willy, 36(2), 281–298. https://doi.org/10.1002/agr.21626

Asante-Addo, C., Weible, D. (2020). Imported versus domestic chicken consumption in Ghana: Do attitudes and perceptions matter? J. Int. Food Agribus. Market., 32(5), 503–526. https://doi.org/10.1080/08974438.2020.1751767

Boin, E., Nunes, J. (2018). Mushroom consumption behavior and influencing factors in a sample of the Portuguese population. J. Int. Food Agribus. Market., 30(1), 35–48. https://doi.org/10.1080/08974438.2017.1382420

Chang, S., Miles, P.G. (2004). Mushrooms cultivation, nutritional value, medicinal effect, and environmental impact. Second Edition. CRS PRESS LLC.

Dzomeku, M., Apetorgbor, A.K., Apetorgbor, M.M., Obodai, M. (2014). Ailments and application of pleurotus tuber-regium (ptr) Among indigenes of two regions in |Ghana. Scientia Agric., 3(3), 9–12. https://doi.org/10.15192/pscp.sa.2014.3.3.129132

Gama, A.P., Adhikari, K., Hoisington, D.A. (2018). Factors influencing food choices of Malawian consumers : A food choice questionnaire approach. J. Sens. Stud., 1–9. https://doi.org/10.1111/joss.12442

Ghana Statistical Service (2021). Ghana population and housing census, general report. Volume 3c.

Greene, W.H., Hensher, D.A. (2009). Modeling ordered choices. https://doi.org/10.1017/CBO9780511845062

Greene, W.H., Hensher, D.A. (2010). Ordered choices and heterogeneity in attribute processing. J. Trans. Econ. Polic., 44(3), 331–364.

Gupta, S., Summuna, B., Gupta, M. (2018). Edible Mushrooms : Cultivation, Bioactive Molecules, and Health Benefits. https://doi.org/10.1007/978-3-319-54528-8

Jiang, Y., House, L.A., Kim, H., Percival, S.S. (2017). Zero-inflated ordered probit approach to modeling mushroom consumption in the United States. Int. Food Agribus. Manag. Rev., 20(5), 655–672. https://doi.org/10.22434/IFAMR2017.0006

Kakon, A., Choudhury, M.B.K., Saha, S. (2012). Mushroom is an ideal food supplement. J. Dhaka Nat. Med. Coll. Hospit., 18(1), 58–62. https://doi.org/10.3329/jdnmch.v18i1.12243

Kortei, N.K., Odamtten, G.T., Obodai, M., Kwagyan, M.W., Prempeh, J. (2018). Survey of mushroom consumption and the possible use of gamma irradiation for sterilization of compost for its cultivation in Southern Ghana. Agric. Food Sec., 7 (83), 1–7. https://doi.org/10.1186/s40066-018-0235-8

Kumar, G., Quagrainie, K., Engle, C. (2008). Factors that influence frequency of purchase of catfish by U.S. households in selected cities. Aquacult. Econ. Manag., 12(4), 252–267. https://doi.org/10.1080/13657300802494297

Lee, M.K., Nam, J. (2019). The determinants of live fish consumption frequency in South Korea. Food Res. Int., 120(February), 382–388. https://doi.org/10.1016/j.foodres.2019.03.005

Liu, H., Parton, K.A., Cox, R., Zhou, Z. (2006). Food consumption dynamics in China: The case of beef. 18th ACESA International Conference: "Emerging China: Internal Challenges and Global Implications", Victoria University, Melbourne, Australia, 13–14 July 2006, 1–16.

Lucier, G., Allshouse, J., Lin, B. (2003). Factors affecting U. S. Mushroom Consumption. In: Electronic outlook report from Economic Research Service, United States Department of Agriculture. https://www.cabdirect.org/cabdirect/abstract/20033083033

Mayett, Y., Martinez-Carrera, D., Sinchez, M., Antonio, M., Mora, S., Estrada-Torres, A. (2008). Consumption trends of edible mushrooms in developing countries: The case of Mexico. J. Int. Food Agribus. Market., 4438. https://doi.org/10.1300/J047v18n01

Min, S.-H., Oh, H.-S. (2006). A survey on the consumption and the perception of mushroom among Korean Housewives. Korea. J. Food Cult., 21(2), 116–123. Retrieved from: https://www.researchgate.net/publication/264113732_A_Survey_on_the_Consumption_and_the_Perception_of_Mushroom_among_Korean_Housewives

Nguyen, T.T., Haider, W., Solgaard, H.S., Ravn-Jonsen, L., Roth, E. (2015). Consumer willingness to pay for quality attributes of fresh seafood: A labeled latent class model. Food Qual. Prefer., 41, 225–236. https://doi.org/10.1016/j.foodqual.2014.12.007

Obodai, M. (2000). Mushroom cultivation in Ghana. Council for Scientific and Industrial Research, Food Research Institute, Mass Media Popularization, FAO Global Network on Mushrooms News Letter Number 3, CSIR_FRI/M, 1–8.

Oguntoye, T.O., Adesope, A.A., Fatoki, O.A., Arowolo, O.V., Olawale, O.O., Oyetoki, A.O. (2022). Mushroom consumption pattern among residents of Ibadan Metropolis in Oyo State, Nigeria. Agro-Science, 21(1), 34–38. https://doi.org/10.4314/as.v21i1.6

Oh, H.-S., Park, H.- O., Yoon, S. (2002). A survey on the consumption and the perception of mushrooms and mushroom dishes among Koreans. Korea. J. Commun. Nutr., 7(2), 245–256.

Osemwegie, O.O., Oghenekaro, A.O., Ihayere, C.A., Sule, E. (2010). Folk uses of mushrooms by the Akoko-Edo people of Nigeria. Asia. J. Microbiol. Biotech. Env. Sci., 12(4), 701–706.

Pallegedara, A. (2017). Food consumption choice and demand by the Sri Lankan households. https://doi.org/10.1108/JADEE-01-2019-0014

Predanócyová, K., Árvay, J., Šnirc, M. (2023). Exploring consumer behavior and preferences towards edible mushrooms in Slovakia. Foods, 12(3), 1–18. https://doi.org/10.3390/foods12030657

Randall, E., Sanjur, D. (1981). Food preferences – their conceptualization and relationship to consumption and relationship to consumption. Ecol. Food Nutr., 0244. https://doi.org/10.1080/03670244.1981.9990671

Shahi, V., Shahi, B., Kumar, V., Singh, K.M., Kumari, P. (2018). Impact study on mushroom cultivation for micro entrepreneurship development and women empowerment. J. Pharmac. Phytochem., 01–04. Retrieved from: https://

www.phytojournal.com/archives/2018/vol7issue4S/PartA/SP-7-4-1-608.pdf

Shepherd, R. (2007). The psychology of food choice.

Singh, M., Vijay, B. Kamal, S.W.G.C. (2011). Mushrooms cultivation, marketing and consumption. Mushroom Research.

Songsore, J. (2009). The urban transition in Ghana: Urbanization, national development and poverty reduction. Africa, 1–71. http://pubs.iied.org/pubs/pdfs/G02540.pdf

Terin, M. (2019). Household characteristics influencing fish consumption in Van Province, Turkey. Ital. J. Food Sci., 31(3), 416–426. https://doi.org/10.14674/IJFS-1448

Wasser, S.P. (2014). Medicinal mushroom science: Current perspectives, advances, evidences, and challenges. Biomed. J., 37(6), 345–356. https://doi.org/10.4103/2319-4170.138318