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GENDER DYNAMICS IN CONSUMER PREFERENCES AND WILLINGNESS TO PAY FOR EDIBLE MUSHROOMS IN GHANA

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Abstract: *This study uses choice experiment to investigate men and women consumers' preferences and willingness to pay for edible mushrooms in Ghana. We used a mixed logit model to examine preference heterogeneity. The econometric modelling revealed that men consumers have a negative utility for oyster mushrooms compared to straw mushrooms. They also have preference for cheap and locally cultivated mushrooms compared to expensive and imported mushrooms. However, women consumers have preferences for the shiitake mushroom variety compared to the straw mushroom variety. They also prefer cheap mushrooms irrespective of their location and such mushrooms must be frozen and not fresh. The findings highlight variation between men and women in preferences for mushroom variety, however, both have preferences for low prices, suggesting that both genders are economically rational and obey the law of demand.*

Keywords: *edible mushrooms, gender, preferences, choice experiment, mixed logit*
(JEL Classification: B21, D12)

INTRODUCTION

Mushroom, often considered as vegetable in the food market is cultivated and consumed globally because of its nutritional, medicinal and economic benefits. Nutritionally, mushroom helps to boost the immune system and reduces the risk associated with obesity, cancer and heart diseases. Economically, mushroom production plays an important role in most economies by serving as an alternative source of livelihood for most citizens and generating income for producers. Mushroom production and per capita consumption have increased significantly worldwide, especially since the 1990s (Royse, 2014). Research shows that world trade in mushrooms and mushroom based products is estimated at USD 35billion (Chang, 2006). Out of this value, Africa contributes just 1% (Geoffrey, 2012). The low contribution of Africa's mushroom market to the global trade has mainly been assigned to lack of information on the nutritional benefits of mushrooms in addition to poor market organisation and linkages.

Improving the marketing aspect of mushroom production requires an understanding of consumer preferences. Specifically, what are consumers' preferences for different mushroom varieties including straw, white button, oyster and milky mushrooms, among others. The quest to understand consumer preferences has attracted attention among researchers in recent times. For instance, Mahantesh, Ahlawat, and Manikandan (2014) conducted a study on mushroom consumption and purchasing behaviour in India and found that out of 258 respondents, 206 respondents preferred the white button mushroom variety to oyster mushroom, while the shiitake and milky mushrooms were preferred by few consumers. In a related study, Boin and Nunes (2018) found among a sample of Portuguese consumers that 81.9% preferred mushrooms, out of which 41% consumed mushrooms weekly. The findings also showed that the consumers frequently consumed the white button mushroom compared to the other types of mushrooms. Contrary to their findings, a survey conducted by Kortei et al. (2018) on mushroom consumption and the possible use of gamma

irradiation for sterilization of compost for its cultivation in Southern Ghana revealed that 72% of consumers preferred oyster mushroom to the termite and straw mushrooms.

Although previous studies have revealed consumer preferences for different mushroom varieties (Kotei et al., 2018; Boin & Nunes, 2018; Mahantesh et al., 2014), the following limitations are identified. Firstly, the studies employed a revealed preference approach to examine consumer preferences ignoring potential unobserved heterogeneity. Secondly, the studies ignored gender dynamics in consumer preferences by assuming that both men and women have equal preferences for mushroom varieties. However, research has shown that men and women have varying preferences (Gough & Conner, 2006; Roos, Prättälä, & Koski, 2001), which need to be accounted for. The present study addresses the limitations by adopting a stated preference approach that allows one to model unobserved heterogeneity for preferences and to account for substitution trade off among a bundle of goods, in this instance, mushrooms.

Although there are different types of stated preference techniques such as contingent valuation and discrete choice experiment, the latter is adopted in this study because it affords the opportunity to examine multiple attributes of mushrooms, and to also compute consumers' willingness to pay. The only known study that has modelled consumer preferences for mushrooms using choice experiment is Chakrabarti, Campbell, and Shonkwiler (2019a). Chakrabarti et al. (2019a) investigated consumer preference and willingness to pay for mushrooms in Connecticut in the United States and found that there were different segments of consumers with preferences for different mushroom attributes. However, there is a point of departure of this study from Chakrabarti et al. (2019a), and that is accounting for potential gender variation in preferences.

The specific choice experiment model adopted in the study is mixed logit model, which is an advanced discrete choice model (Hole & Kolstad, 2012). The mixed logit model is preferred to the conditional logit model because it has the flexibility of accounting for unobserved heterogeneity among consumers. The study was conducted among consumers in the Cape Coast metropolis of the Central region of Ghana. The Cape Coast metropolis was selected for the study because it is one of the key areas earmarked for mushroom production in Ghana. Using a sample of 190 consumers, the econometric modelling revealed that men mushroom consumers prefer oyster mushroom to straw mushroom. They also have preferences for mushrooms that have been locally produced compared to the imported ones. The women mushroom consumers on the other hand preferred shiitake mushrooms to straw mushrooms. Like the men consumers, the women consumers also preferred local mushrooms to imported mushrooms.

The rest of the paper is organised as follows. Section 2 presents the literature review of the study followed by section 3 on the methods. Section 4 presents the results and discussion, and section 5 concludes the paper with policy implications.

LITERATURE REVIEW

Consumer behavior in the mushroom market has been of interest to researchers over the years. For instance, Patterson (2003) conducted a study among mushroom consumers in the United States and found that 94% of the sampled consumers preferred white button mushrooms to portabella and others. Mayett et al. (2006) also examined consumption trends of edible mushrooms in Mexico and found that about one-half (49.4%) of the urban consumers do not buy mushrooms, independently of their social level. The other half (50.6%) do not buy mushrooms for several reasons such as feeling of dislike (75.5%), unawareness (18.3%), and 6.2% constituted other various reasons.

Mahantesh et al. (2014) study of mushroom consumption and purchasing behavior in India showed that all the 285 respondents responded on the frequency of consuming three different mushroom recipes: mushroom curry, mushroom salad or pickle and other recipes. The results further showed that colour, price and shape were the factors that influenced consumers' purchasing behavior of mushrooms. Gürgen, Yildiz, and Yildiz (2018) conducted a study on consumer preference of mushrooms using fuzzy analytic hierarchy process in Turkey and found that consumers preferred to buy well packaged mushrooms from market because of higher confidence in the market. Also, the consumers perceived that packaged mushrooms are healthier than the unpackaged ones in the market. The findings also revealed that consumers preferred mushrooms that are cultivated to those from the wild because of fear of poisoning.

Also, Linde et al. (2014) study on mushroom acceptability and consumption intention in Brazil revealed that the most accepted mushrooms in Brazil are the white button mushroom, followed by oyster mushroom, almond mushroom and shiitake mushroom because of its aroma, flavor, and fibre. Boin and Nunes (2018) study on the consumption behavior and influencing factors in a sample of Portuguese population revealed that 81.9% of the respondents consumed mushrooms, out of which 41% consumed mushrooms once a week. The white button mushroom was the most frequently consumed mushroom compared to the brown and shiitake mushrooms. Also, canned mushrooms were frequently consumed in comparison to the fresh ones. A similar study conducted by Chakrabarti et al. (2019a) on eliciting consumer preference and willingness to pay for mushrooms in the United States revealed a segmentation among mushroom consumers. Chakrabarti et al. (2019a) is the only known study of the mushroom market using discrete choice experiment techniques.

MATERIALS AND METHODS

Choice experiment design

Identification of attributes and their levels represent the starting point of choice experiment studies. With thorough literature search and experts' interviews, we identified the following attributes: mushroom variety, mushroom form, label, location and price per kilogram as the attributes for the study. The mushroom variety attribute was of three levels-straw, shiitake and oyster. There were also four levels to the mushroom form attribute-fresh, frozen, dried and canned.

The label and the location attributes were of two levels: wild and cultivated for the label attribute, local and imported for the location attribute. The price attribute had three levels (GH¢15, GH¢ 30 and GH¢50). Table 1 shows the description of the attributes and the levels used in the choice experiment.







Table 1: Attribute description and levels

Attributes	Descriptions	Levels
Mushroom variety	The common mushroom varieties present in the Ghanaian market	Straw Shiitake Oyster
Form of mushroom	Nature of mushrooms presented for sale in the Ghanaian market	Fresh Frozen Dried Canned
Label	Mode of obtaining mushrooms for the Ghanaian market	Wild Cultivated
Location	Origin of mushrooms	Local Imported
Price/kg	Price per kg of mushrooms presented for sale	GH¢ 10 GH¢ 15 GH¢ 30

Note: GH-Ghana

After identifying the attributes and their corresponding levels, an efficient choice experiment design was generated in STATA 14 with priors obtained from a pilot study conducted in the University of Cape Coast. Efficient design is more suitable because it is cost effective and increases sampling (Bliemer & Rose, 2010). The final design had 30 paired choice sets that were randomly grouped into 10 scenarios. Each choice set was composed of two alternatives (A and B), and a third alternative, that represented none of the options. Figure 1 shows a sample choice set.

Figure 1: sample choice set

Attributes	Option A	Option B	Option C
Mushroom variety	 oyster	 shiitake	Opt out
Mushroom form	Dried	Frozen	
Label	 wild	 Cultivated	
Location	Local	Imported	
Purchase Price (1kg)	 GHS50.00	 GHS15.00	
I would prefer to buy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

The target population included consumers in the Central region of Ghana. Respondents were selected using a multistage sampling technique. In the first stage, Cape Coast metropolis, was purposively selected. This was followed by the selection of the communities within the metropolis-Duakor, Amamoma, Cape Vars, and Ayensu. The overall sample for the study comprised 190 respondents, with 30 from Duakor, 50 from Ayensu, 60 from Cape Vars and 50 from Amamoma. The data collection was conducted between September and October 2019. The survey comprised information on the socio-economic characteristics of the respondents, and the choice experiment. Each respondent was asked to choose his/her preferred edible mushroom alternative in 10 choice situations.

ECONOMETRIC FRAMEWORK

The discrete choice experiment technique is based on Lancaster's characteristic theory of value, which states that an individual obtain utility from the characteristics of the good rather than the good itself. Its econometric basis is enshrined in the random utility theory.

The attributes of alternative j in choice occasion t faced by consumer n could be labelled as vector X_{njt} . The utility obtained by consumer n from alternative j in choice occasion t is specified as:

$$U_{njt} = \beta_n X_{njt} + \varepsilon_{njt} \quad (1)$$

where the coefficients of β_n is unobserved and varies in the population with a density function $f(\beta_n/\theta)$ while θ are parameters to be estimated. ε_{njt} is an unobserved random term that is identically and independently distributed. The unconditional probability of the sequence of choices made by an individual is expressed as:

$$P_{njt}(\theta) = \int L_{nj}(\beta_n) f(\beta_n/\theta) d\beta_n \quad (2)$$

The mixed logit specified in eq. (2) accounts for only unconditional heterogeneity but not conditional heterogeneity (explain the sources of heterogeneity). To account for conditional heterogeneity, model expansion is required to incorporate socio-economic characteristics of respondents. This process enables the model to pick up both random and conditional heterogeneity and further improves the model fit (Birol et al. 2006). Including respondents' socio-economic characteristics as S_n , results in eq. (3):

$$P_{njt} = \int \frac{e^{\beta_n' x_{nj} + S_n}}{\sum_{j=1}^J e^{\beta_n' x_{nj} + S_n}} f(\beta_n/\theta) d\beta_n \quad (3)$$

where all parameters are as earlier defined.

Maximum likelihood (ML) is often employed in accounting for preference heterogeneity. The ML works on the principle of searching for a solution by simulating n draws from distributions with given means and standard deviations (Birol et al., 2006). Joint simulated distribution integration is used to obtain probabilities.

The standard approach to simulation estimation is based on random draws. However, with large samples and complex models, this can be very time consuming. The Halton draw, therefore, serve as an alternative to the random draw with the advantage of speed gains and no degradation in simulation performance (Revelt & Train, 1998).

Estimating willingness to pay

The consistency of choice experiment with consumer theory makes it suitable in estimating welfare effects such as the willingness to pay. Willingness to pay (WTP) is a measure of the trade-off between non-price attributes and a price attribute. In the choice experiment literature, two approaches have been proposed in estimating WTP: the indirect ratio method and the direct method (Owusu Coffie, Burton, Gibson, & Hailu, 2016). The indirect approach, also called preference space model has received lots of criticisms in the literature because of the biases it introduces into the WTP values (Hole & Kolstad, 2012). Hensher (2006) therefore advances that individual level parameters of the preference space model be used to compute the willingness to pay values. In this paper, the individual level parameters were simulated in Stata using 10 000 draws, followed by the calculation of the willingness to pay values as the ratio of non-price attributes to the price attribute.

RESULTS AND DISCUSSION

Descriptive statistics

The descriptive statistics of respondents are presented in Table 2. From the table, the average age of the sampled consumers is 26, indicating a youthful population. The gender variable, which was measured as a dummy (0,1) has an average of 0.3, indicating that most of the sample are men compared to women. The educational level also measured as a dummy (where educated =1) has a mean of 0.98, suggesting that almost all the sampled consumers have some form of education. The average monthly income for the sample was 759 Ghana cedis. For the men and women specific characteristics, we observe that both are about equal age. The men in the sample seem to earn more than their female counterparts, however, a t-test shows no significant differences in the income of both men and women. The results in the table also show all the men in the sample are educated compared to the women where some are not educated, although those educated are in the majority.

Table 2: Sample descriptive statistics

Variable	Pooled sample		Men		Women	
	Mean	SD	Mean	SD	Mean	SD
Age	26	8.9	26	8	27	11
Gender	0.311	0.464	-	-	-	-
Educational level	0.98	0.12	1	0	0.94	0.22
Average monthly income (Ghana cedis)	759	618	790	667	698	488

Note: SD-standard deviation

Standard mixlogit model

The correlated mixed logit model estimates are presented in Table 3. Consistent with economic theory, the price coefficient for men mushroom consumers is negative and significant, indicating that consumers prefer a lower priced mushroom to a higher priced mushroom. The utility coefficient in Table 3 also show that men consumers have a disutility for the oyster mushroom compared to the straw mushroom. They are, however, indifferent towards shiitake mushroom. Men mushroom consumers are also indifferent towards mushroom forms such as frozen, dried or canned as shown in the insignificant coefficient of those attributes. The location attribute is also negative and significant showing that men consumers prefer locally produced mushrooms to imported mushrooms. The women mushroom consumers also have preference for shiitake mushroom compared to straw mushroom. They also have a utility for frozen mushrooms compared to fresh mushrooms. Like the men, women consumers prefer locally produced mushrooms to imported mushrooms. Their demand also follows the law of demand where more is demanded at a lower price and vice versa. The significance of most of the standard deviations (heterogeneity in the mean) show that unobserved heterogeneity exists in the preferences of consumers for mushrooms.

Table 3: Correlated mixlogit model estimates

	Men-ML correlated		Women-ML correlated	
	Mean	SE	Mean	SE
Taste parameters				
Oyster mushroom variety	-0.35***	0.16	-0.40	0.37
Shiitake mushroom variety	-0.16	0.14	0.89***	0.37
Frozen mushroom	-0.22	0.19	0.90**	0.45
Dried mushroom	0.05	0.18	0.61	0.43
Canned mushroom	-0.39	0.25	0.19	0.61
Mushroom label	0.04	0.13	-0.53	0.40
Location	-1.38***	0.21	-1.95***	0.52
Price	-0.04***	0.01	-0.11***	0.02
Status quo	-4.53***	0.54	-1.77*	1.04
Heterogeneity in mean				
Oyster mushroom variety	0.70***	0.34	1.38***	0.45
Shiitake mushroom variety	0.48*	0.26	2.32***	0.48
Frozen mushroom	0.97***	0.28	1.03***	0.48
Dried mushroom	0.80***	0.25	1.01***	0.50
Canned mushroom	1.14***	0.36	2.38***	0.72
Mushroom label	0.13	0.16	1.91***	0.47
Location	1.72***	0.22	6.11***	1.16
Price	0.06***	0.01	0.18***	0.04
Status quo	7.85***	1.05	24.67***	5.12
LL	-196.00		-278.57	
BIC	2278.93		960.99	
N	3930		1770	

N=LL-Log likelihood, BIC-Bayesian information criteria, N-Number of observations

Mixed logit model with interaction

To explain the sources of heterogeneity among respondents, the attributes were interacted with some socioeconomic variables including age, income level and educational status.

The results are presented in Table 4. From the table, we observe that older men consumers of mushroom prefer mushrooms that are cultivated compared to mushrooms from the wild as indicated by the negative and significant interaction between label and age (-0.02). This finding is consistent with Gurgen et al., (2018) study that found sampled consumers preference for cultivated mushrooms compared to the wild. The men consumers' preference for the cultivated mushroom in comparison to the wild is likely rising out of the fear of poisoning from consuming mushrooms from the wild.

The older men consumers also prefer mushrooms that have been cultivated locally compared to imported mushrooms. However, educated men mushroom consumers prefer to consume imported mushrooms to local mushrooms. Of the interaction for the women mushroom consumers, only the age with location interaction is significant and the result show that the older women prefer local mushrooms to imported mushrooms. When conditional heterogeneity has been accounted for, we observe that several attributes in the men consumers model are significant indicating that conditional heterogeneity is important in accounting for preferences.

Table 4: Mixed logit model with interaction estimates

	Men-ML correlated		Women-ML correlated	
	Mean	SE	Mean	SE
Taste parameters				
Oyster mushroom variety	-0.19	0.46	-0.75	1.48
Shiitake mushroom variety	-0.45**	0.18	-0.38	0.41
Frozen mushroom	-0.30	0.19	0.59	0.58
Dried mushroom	-0.28	0.19	0.31	0.58
Canned mushroom	-0.69**	0.28	-1.12	0.73
Mushroom label	-0.52	0.39	-2.23*	1.23
Location	-3.29***	1.14	0.49	2.95
Price	-0.05***	0.01	-0.09***	0.02
Status quo	-6.32***	0.67	-12.97***	4.04
Conditional heterogeneity				
Oyster *Age	-0.02	0.02	-0.03	-0.06
Label*Age	0.02***	0.02	0.02	0.05
Label* Income	0.00	0.00	0.00	0.00
Location*Age	-0.07***	0.02	-0.21***	0.07
Location *Education	0.22***	0.07	0.09	0.16
Heterogeneity in mean				
Oyster mushroom variety	0.88***	0.22	1.66***	0.45
Shiitake mushroom variety	1.48*	0.21	2.29***	0.57
Frozen mushroom	0.76***	0.27	2.33***	0.69
Dried mushroom	0.70***	0.23	2.65***	0.89
Canned mushroom	1.39***	0.29	1.86***	0.61
Mushroom label	0.50	0.14	1.51***	0.39
Location	2.02***	0.25	4.99***	1.01
Price	0.07***	0.01	1.54***	0.03
Status quo	7.82***	0.86	66.02***	26.36
LL	-896		-256.54	
BIC	2280		954.33	
N	3930		1770	

Note: LL-Log likelihood, BIC-Bayesian Information Criteria, N-Number of observations

Willingness to pay

The willingness to pay values are represented in Table 5. The results show that both men and women consumers are willing to pay a premium of GH¢32 and GH¢24, respectively for mushrooms with a location attribute, suggesting that location is an important factor that consumers of mushroom consider before purchasing them. The men consumers are also willing to pay about GH¢11 for the oyster mushroom variety. The women consumers on the other hand have discounted the shiitake mushroom variety and mushrooms that are frozen. Specifically, they discounted shiitake mushroom variety by about GH¢8 and GH¢22 for frozen mushrooms.

Table 5: Willingness to pay estimates

	Men-ML correlated		Women-ML correlated	
	Mean	SD	Mean	SD
Oyster mushroom variety	10.91***	64.00	5.92	78.09
Shiitake mushroom variety	-6.06	74.94	-8.22***	151.36
Frozen mushroom	10.04	42.04	-21.71**	178.68
Dried mushroom	19.28	265.80	-17.84	140.69
Canned mushroom	20.71	84.71	-13.65	121.16
Mushroom label	2.57	62.02	-7.74	94.10
Location	31.55***	1104.58	24.38***	727.30

Note: SD-standard deviation

CONCLUSION

This paper investigated sampled consumers preferences and willingness to pay for mushrooms in Ghana on gender basis. Using the mixed logit modelling technique, we found that men consumers have negative utility towards oyster mushroom compared to straw mushroom. They also preferred locally produced mushrooms that are cheap compared to locally produced mushrooms that are expensive. The women consumers also had preferences for shiitake mushrooms that are sold frozen compared to fresh mushrooms. The findings further revealed that the older men and women mushroom consumers prefer locally produced mushrooms to imported mushrooms. The findings suggest that there is ready market for locally cultivated mushrooms in Ghana, however, the mushrooms must be affordable. It is therefore recommended that government invests in cost effective cultivation techniques for the mushroom industry in Ghana. It is also recommended that the value chain for the mushroom industry be developed to ensure that mushrooms would be readily available to consumers. Furthermore, there should be awareness creation on the various types of mushrooms available on the Ghanaian market and their nutritional value.

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