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Consumers' preferred purchasing outlet of safer vegetables in Ouagadougou, Burkina Faso

Adinan Bahahudeen Shafiwu[1]*, Samuel A. Donkoh[2] and Hamdiyah Alhassan[2]

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*Corresponding author: Adinan Bahahudeen Shafiwu, Department of Mathematics, Faculty of Mathematical Sciences, University for Development Studies, Tamale, Ghana
E-mail: shafiwu@uds.edu.gh

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Fatih Yildiz, Middle East Technical University, Turkey

Additional information is available at the end of the article

Abstract: This study assesses consumers' preferred purchasing outlet of safer vegetables in Ouagadougou, Burkina Faso using Multinomial Logit. A semi-structured questionnaire was administered on 350 consumers of vegetables (cabbage, lettuce and tomatoes) selected through a multistage random sampling procedure from 10 districts of the capital city, Ouagadougou. Descriptive statistics was used in describing consumers' socio-economic characteristics. Multinomial logit was used to estimate how consumers' socio-economic characteristics affect their preference for purchasing point/outlets for safer vegetables. The Garrett's ranking technique was then used to rank the constraints to accessing safe vegetables. The result revealed that 52.57% of the consumers preferred to buy safer vegetables from the roadside market, 31.43% preferred to buy from the supermarket, while the remaining 16.00% preferred to buy from the farm gate. From the estimation results, the supermarket was a preferred choice for the following categories of consumers: the married; the formally educated; the salaried workers; the relatively rich; and those who purchased vegetables much more frequently. With respect to the constraints to accessing safe vegetables, inadequate supply of safe vegetables was ranked first while cultural barriers was the least ranked. Based on the findings, the study recommends that stakeholders should

Adinan Bahahudeen Shafiwu

ABOUT THE AUTHORS

Adinan Bahahudeen Shafiwu (Ch.E) is an Assistant Lecturer at the Department of Mathematics, Faculty of Mathematical Sciences, University for Development Studies (UDS). His research is in the area of financial economics, food security and development economics that uses econometric techniques and principles such as contingent Valuation method in the analysis.

Samuel Arkoh Donkoh (PhD) is an Associate Professor and Vice Dean of the Faculty of Agribusiness and Communication Sciences (FACS), UDS. His research work falls in the domain of adoption, efficiency studies, and poverty analysis and also issues of economics and agriculture that require the application of econometric techniques and principles.

Hamdiyah Alhassan (Ms) is a Senior Lecturer at the Department of Agricultural and Resource Economics, UDS. Her research interests include agricultural economics, waste management, energy and food security.

PUBLIC INTEREST STATEMENT

Vegetables are rich sources of vitamins, minerals, proteins, carbohydrates and dietary fibres necessary for a healthy growth. This research was carried out to investigate the socio-economic factors that influenced consumers' preferred choice of the purchasing outlets of three vegetables, namely, cabbage, lettuce and tomatoes in Ouagadougou, Burkina Faso. Using a multistage sampling procedure, 350 consumers were selected. We found that the roadside was the most preferred choice, followed by the supermarket. The least preferred was the farm gate. It turned out that those willing to buy from the supermarket are the affluent consumers (the relatively rich, the salaried workers and the formally educated). This means that there is a potentially viable market for safer vegetables if production is scaled up. All hands must be on deck to promote the production, certification and sale of safe vegetables in the supermarket since it promises a win-win situation for farmers, supermarkets, consumers and even government, since it would get the opportunity to tax the produce.

work at scaling up the production of safer vegetables and the marketing of same via the supermarkets. This is against the backdrop of the existence of a potentially huge market among the affluent society of Ouagadougou.

Subjects: Agriculture & Environmental Sciences; Agriculture and Food; Food Analysis; Food; Food and Beverage Management; Food Safety Management

Keywords: safer vegetables; multinomial logit; garret ranking; Ouagadougou; Burkina Faso

1. Introduction

In Africa, vegetables are part of the daily diets and are found especially in soups and sauces accompanied by carbohydrate staples (Smith & Eyzaguirre, 2007). From the World Health Organization's initiative on consumption of vegetables and fruits, a framework that serves as a guide in the development of a cost-efficient and effective intervention for the promotion of sufficient consumption of vegetables both at the national and sub-regional levels (World Health Organization [WHO], 2006) was developed. With the notion of food sufficiency, there is a major concern for safer food (vegetables). Thus, the term food safety is also inextricably linked to the nutritional qualities of food, a wider range of concerns about the properties of unfamiliar foods and the tendency of not contracting a disease due to the consumption of certain foods (Ngigi, Okello, Lagerkvist, Karanja, & Mburu, 2011). The term was also emphasized by Wang, Moustier, and Loc (2014) to be a quality characteristic that cannot be easily observed and measured. Food safety can be distinguished from objective and subjective views. Objective view of food safety is a concept based on assessment of the risk of consuming a certain food by scientists or food experts while subjective view of food safety is in the mind of the consumer (Ngigi et al., 2011).

The potential to achieve food safety exists because recent studies have confirmed that with increasing per capita incomes in countries, and as cities become more urbanized, dietary needs change and people become more health conscious, so they tend to demand safer foods (Annan-Peprah Mensah, Akorli, Asare, & Kumi-Die, 2012; Mergenthaler, Weinberger, & Qaim, 2009). Smallholder vegetable farmers are normally not well-organized, hence their prices vary depending on the purchasing point/outlets. However, the literature gap that exists in this area is the lack of empirical evidence to deepen understanding of how consumers' socio-economic characteristics affect their preference for purchasing point/outlets for safer vegetables.

The objectives of this study was, therefore, to identify the factors influencing vegetable consumers' choice of purchasing outlets of safer vegetables and the constraints consumers face in accessing safe vegetables in Ouguadougou, Burkina Faso.

2. Literature review

2.1. Consumers' buying behaviour of vegetables

Consumer's buying behaviour from the view point of Lancast er (2001) is made up of activities that involve buying and using a product or service for personal and household use. Both external and internal attributes are used by consumers to perceive a product quality. These attributes are described to have influence on consumers' purchasing motive. A study by Obuobie et al. (2006) in Ghana revealed that, during the buying of vegetables, consumers look for certain characteristics such as freshness, colour and spotless leaves. In Vietnam, supermarkets expansion had impact on consumers' demand for fruits and vegetables. The demand for products from modern supply chains, especially modern retailers and non-traditional imports is highly income elastic (Bhattacharya, Black, Christensen, & Mergenthaler, 2007). According to Kovacic, Radman, and Kolega (2002), the most important characteristic when buying vegetables in Croatia is its freshness, sensory intrinsic attributes such as taste influence consumers' buying behaviour. Pinto,

Barreiro, Fragata, Combris, & Giraud-Heraud, (2007), in trying to get answers to whether taste beats food safety, found that food safety instantly influenced consumers' willingness to pay.

Individuals' values are developed through socialization and these differ from one culture to the other, thus making specific cultural values to reflect on the specific consumer behaviour (Reuters et al., 2006).

2.2. Socio-economic determinants' of choice of purchasing outlets/point

In recent times, fresh vegetable retailing in many developing countries has largely been limited to on-farm and roadside markets. According to Neven and Reardon (2004) and Minten and Reardon (2008) however, the last decade has seen the emergence and fast growing of non-traditional outlets for retailing fresh vegetables in some of these countries. These non-traditional outlets include supermarkets and specialty stores.The expansion of these non-traditional fresh vegetables' retail outlets stems from the fact that there is an increased demand for fresh vegetables. The increase in demand for such vegetables is, on the other hand, driven by a number of factors. One of such factors is increase in incomes in many developing countries' urban centers making consumers more discriminating of quality and source of food (King & Venturini, 2005; Reardon et al., 2005; Regmi & Gehlhar, 2005). These consumers thus source their supplies from outlets they consider safe or perceive to offer quality food. Also, the widespread food safety issues involving deadly pathogens and unclean water especially in developed countries have led some classes of developing-country consumers to be more discerning about the sources of food they purchase (Okello & Swinton, 2007). Again, the increase in awareness among developing-country urban consumers, of the medical health dangers of consuming foods grown using unsafe practices and lastly, the general belief among consumers that, vegetables sold through certain outlets (e.g. supermarkets and specialty stores) are produced using safer production practices (Ngigi et al., 2011). Despite the changing nature of fresh vegetable retailing in developing-country urban centers, the traditional outlets, roadside markets and the farm gate purchases have remained as significant points of purchase for many city consumers in developing countries and still serve majority of the urban consumers in developing countries (Tshirley & Ayieko, 2008). Although there has been rapid expansion of non-traditional fresh vegetables' retail outlets, many urban consumers still buy at the traditional markets (roadside and farm gate). The preference of a consumer to use a given retail outlet is driven by some factors, which this study sought to identify. Many researches outlined below have made efforts to identify drivers of preferred purchasing outlets of vegetables in all parts of the world at different places. Several socio-demographic and economic factors were explored in determining the main drivers of the choice of preferred outlets/points. Demographic factors often highlighted include educational status, households' size, sex, age and marital status, while economic factors include income, asset and farm size. Trobe (2001) also conducted a study on consumers' attitudes and shopping behaviour for organic produce and genetically modified (GM) foods from farmers' markets in the UK. However, his study did not consider consumers' confidence and did not mention consumers' Willingness to pay

(WTP) for organic and GM foods. Similarly, a survey by Wolf, Spittler, and Ahern (2005) on 336 consumers about the demographic profile of farmers' market suggested that the average market consumer was female, married and had a post-graduate degree. Furthermore, Govindasamy and Italia (2002) examined consumers' shopping habits and venues for fruits and vegetables are in farmers' markets. However, they did little research on consumers' WTP for organic fresh produce in different purchasing venues. Kyureghian and Nayga (2013) studied the effect of access to supermarkets and grocery stores, convenience stores, specialty food stores, full-service restaurants and limited-service eating places on consumers' purchase of fresh produce, and their findings suggested that there was a significant interaction effect of income and densities of supermarkets and other purchasing outlets in urban areas on consumers' purchase of fruits and vegetables. Also, other studies have been conducted on consumers' buying preferences (Bond & Thilmany, 2006; Huang & Lin, 2007; Volve & Lavoie, 2005. Volpe and Lavoie (2005) found that national brand commodity price reduced by 6 to 7% and private-labelled item price decreased by 3 to 8%.

Consumers' willingness to pay for products was associated with their perceptions towards the products. Thilmany and Bond (2006) study indicated that 76% of participants preferred shopping at supermarkets, followed by 19% for supercentres and 2% for health food stores

2.3. Consumers' constraints in accessing safe vegetables

The high volatile nature of the local commodity markets makes it a bigger challenge in accessing safe foods. However, literature reveals some other factors to serve as bottlenecks in accessing safer foods. Studies by Nandi et al. (2016) revealed that high price, lack of availability, scarcity of product category and poor product appearance can be seen as the overall challenges to organic food purchase. The authors also revealed that lack of taste, difficulties in cooking, and lack of information could constrain the purchase of vegetable products coming from organic agriculture. Reports by Davies, Titterington, and Cochrane (1995) also indicated that about 81% of the respondents in their study agreed that price is an important indicator for them in making their vegetable buying decisions. High proportions of the respondents are not willing to pay a premium price for organic products although organic products are healthier and do contribute to their health (Piyasiri & Ariyawardana, 2002). A review of some past studies (e.g. Byrne, Toensmeyer, German, & Muller, 1991; Davies et al., 1995; Dimitri & Richman, 2000; German & Muller, 1991; Gil, Gracia, & Sanchez, 2000; Govindasamy & Italia, 2002; Nandi et al., 2016; Piyasiri & Ariyawardana, 2011) shows inadequate empirical results on the challenges confronting vegetable consumers in their buying behaviour. Meanwhile not much has also been done in terms of offering a comprehensive strategy in resolving those challenges identified. This gap in the literature is covered by this study as it seeks not only to identify but also to rank the challenges and suggest possible solutions that would inform policy prescriptions. The solutions may also be considered as marketing strategies for safer vegetable producers.

3. Methodology

3.1. Study area

Ouagadougou is the administrative, communications, cultural and economic center of the Burkina Faso. It is also the country's largest city and has a population of 1,475,223 as of 2006. The inhabitants are called ouagalais. Geographically, Ouagadougou is situated on the central plateau (12.4° N 1.5° W), growing around the imperial palace of the Mogho Naaba. The climate of Ouagadougou is hot semi-arid (BSh)under Köppen-Geiger classification, that is, closely bordered with tropical wet and dry (Aw). The city is a part of the Sudano-Sahelian area, with a rainfall of about 800 mm (31 in) per year. The rainy season stretches from May to October, with a mean average temperature of 28°C (82°F). The cold season runs from December to January, with a minimum average temperature of 16°C (61°F). The maximum temperature during the hot season, which runs from March to May, can be as high as 43°C (109°F). Ouagadougou's climate is mainly determined by harmattan and the monsoon wind. The economy of Ouagadougou is based on industry and commerce. Some industrial facilities have relocated from other towns like Bobo-Dioulasso to Ouagadougou, which has made the city an important industrial center of Burkina Faso. The industrial areas of Kossodo and Gounghin are home to several processing plants and factories. The industry of Ouagadougou is a sector that fuels urban growth, as people move to the city from the countryside to find employment in the industries. The economy is dominated by the informal sector and characterized by petty commodity production, with a few workers earning salaries. Figure 1, shows the map of Ouagadougou, Bukina Faso.

3.2. Data collection and sampling technique

Primary data were used for the study. The data were gathered through a household survey by the use of a semi-structured questionnaire aided by a face-to-face interview of consumers of tomatoes, cabbage and lettuce. A sample size of 350 consumers of vegetables was used for the study. The sample size was determined with the formula:

$$n = \frac{t^2 * p(1-p)}{m^2} \quad (1)$$

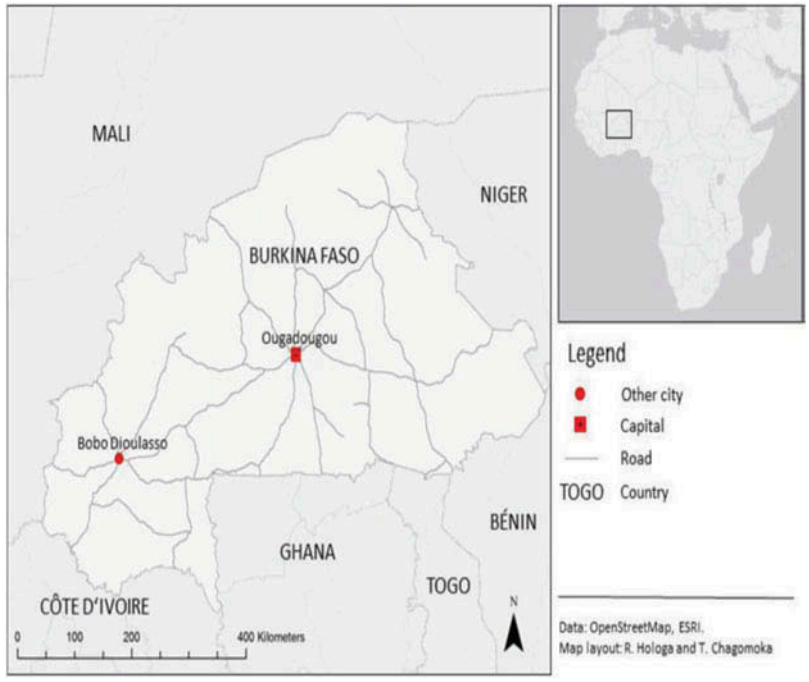

Figure 1. A map of Burkina Faso showing the capital city (Ouagadougou) and the surrounding countries with international borders, major cities and roads.

Source: Chagomoka et al. (2009)

Where n = the required sample size, t = the confidence level at 95% (standard value of 1.96), p = estimated population percentage under study (35%) (INSD, 2013) and m^2 = margin of error at 5% (standard value of 0.005). Multistage sampling technique was used to identify respondents. At the first stage, a random sampling technique was employed to select 10 districts in the major tomatoes-, cabbage- and lettuce-growing areas of the capital city, Ouagadougou. The second stage entailed the use of stratified sampling using income level based on housing structure to select one sector in each District. The third stage was the selection of 35 households from each stractum with the systematic sampling technique. Finally, fourth stage was the selection of a respondent from each household who is responsible for buying, cooking or the head of the household. A multinomial logit model was estimated to determine the factors influencing consumers' choice of preferred purchasing outlets.

3.3. Empirical specifications of models

Three preferred purchasing points/outlet were identified for the study as follows: shopping at the roadside (open market) (1); shopping at the farm gate (2); and shopping at the supermarkets (3). The three markets predetermined for the study are assumed to be mutually exclusive with roadside being the least prioritized (bottom) and supermarket the most (extreme). This prioritization is based on the hygienic nature of the vegetables as they move from the farm gate to either the roadside or the supermarket. We assume that vegetables sold at the supermarket is the most hygienic because they would have properly sorted them out, packed and stored them, as opposed to those sold at the roadside. Vegetables sold at the farm gate is also fresher and more hygienic than the ones sold at the roadside, but they may not be as hygienic as the ones sold at the supermarket. It should be noted that the emphasis is on consumers' preference (first choice) and not necessarily where they actually buy safe vegetables from. A rational consumer of safer vegetables choses among the different shopping outlets that yield maximum utility. Greene and Martins (2013) indicate that the utility obtained can be decomposed into observed and unobserved components expressed as:

$$U_{ij}(X_{ij};Z_{ij}) = V_j(X_{ij};\beta) + \varepsilon \quad (2)$$

Where $U_{ij}(X_{ij};Z_{ij})$ denotes the utility of i^{th}individual choosing alternative, j; $V_{ij}(X_{ij;}Z_{ij})$ denotes the deterministic component of the utility.

The deterministic part is modelled using the multinomial logit. Following from Greene and Martins (2013); Cameron and Trivedi (2005); Mpuga (2008); Eneyew (2012), the conditional probability of the multinomial logit model is specified as:

$$prob(Y_i = j/X_i)\frac{\exp(x_i\beta_j)}{\sum_{j=0}^{k}\exp(x_i\beta_j)} \tag{3}$$

Where j = 1, 2…k. The base category is used to compare other choices by restricting the parameters of the base category to all zero ($\beta = 0$). The first choice category is consumers who buy safer vegetables from the roadside markets. The estimation of the multinomial logit is by maximum likelihood method. The log likelihood function is

$$\ln[(wm/n(X_i)] = X_i(\beta_m - \beta_n) \tag{4}$$

Equation (4) gives the effect of X on the logit of outcome m against outcome n. Also the partial derivatives of Equation (4) gives the marginal effects expressed as:

$$\frac{\partial \ln[wm/n(X_i)]}{\partial X_k} = \frac{\partial X_i(\beta_m - \beta_n)}{\partial X_k} = \beta_{km} - \beta_{kn} \tag{5}$$

where $\beta_{km} - \beta_{kn}$ means, for a unit change in x_K the logit of outcome m versus outcome n is expected to change by $\beta_{km} - \beta_{kn}$ units.

Empirically, the multinomial logit is specified as:

$$\begin{aligned} PPO = {} & \beta_0 + \beta_1 sex + \beta_2 hhsize + \beta_3 appearance + \beta_4 freqofpurc \\ & + \beta_5 dis\tan ce + \beta_6 occup + +\beta_7 marritalstatus + \beta_8 income \\ & + \beta_9 educ + \beta_{10} knowveg + e_i \end{aligned} \tag{6}$$

The description and *a priori* expectations of the variables used in the estimation of the multinomial probit model are shown in Table 1.

The Henry Garrett's ranking technique is used to identify and rank the constraints of consumers in accessing safe vegetables (cabbage, lettuce and tomatoes), in Ouagadougou, Burkina Faso. This technique of ranking was chosen over the Kendall's because of the heterogeneous nature of the selected districts. The process of operationalizing the ranking procedure started with respondents ranking the identified problems in order from the most pressing to the least pressing. Numerical values were used to give weights to the problems with (1) being the most pressing, (2) the second most pressing, in that order to the i^{th} problem representing the least pressing to the j^{th} respondent, (Garrett & Woolworth, 1973).The orders of ranking by consumers of safer vegetables representing the assigned ranks were transformed into percentages with the formula:

$$\text{Percentage position} = 100\left(\frac{R_{ij}-0.5}{N_{ij}}\right) \tag{7}$$

where R_{ij} is the rank given for the i^{th} factor by the j^{th} individual and N_{ij} is the number of factors ranked by the j^{th} individual. The percentage position of each rank obtained was converted into scores by the Garrett's conversion score table. The scores for each constraint were summed up, and the average score was then calculated by summing up the score of each constraint and dividing the summed scores by the total number of individuals who ranked that particular constraint. The average/mean scores determined the order of the constraints. The constraint with the highest (lowest) mean score was regarded as the most (least) pressing and the constraint with the lowest (highest) mean score regarded as the least (highest) pressing constraint (Garrett &

Table 1. Description of variables and *a priori* expectations

Explanatory variables	Description	Measurement	Slope coefficient	*Apriori*
Sex	Sex of the respondent who does the purchasing of vegetables	1 if female, 0 if male	$\theta 1$	±
Household size	Number of household members	Number	$\theta 2$	+/-
Appearance	Appearance of vegetables(colour, texture, size)	1 if considered in buying safer vegetables 0 otherwise	$\theta 3$	+
Frequency of purchase	Respondents' frequency of purchasing vegetables	1 if daily purchase, 0 otherwise	$\theta 4$	+
Distance	Distance to safer vegetables market	Kilometres	$\theta 5$	+/-
Occupation	Type of work	1 if salary earning worker, 0 otherwise	$\theta 6$	+/-
Marital status	The marital status of vegetable consumers	1 if married, 0 otherwise	$\theta 7$	+
Income	Income level of the respondent	France CFA	$\theta 8$	+
Education	Respondents' level of education	1 if educated, 0 otherwise	$\theta 9$	+/-
Knowledge of vegetables market	Consumers knowledge of the availability of vegetables market	1 has knowledge of availability of vegetables market, 0 otherwise	$\theta 10$	+/-

Woolworth, 1969). The following constraint were ranked: prices of safer vegetables; lack of availability of safer vegetable; inadequate information on safer vegetables; distance to the market; and lack of trust in market vendors and cultural barriers.

4. Results and discussion

4.1. Descriptive statistics

The result from Table 2 indicates that 96.57% of the respondents are female, with the remaining 3.43% being male. The mean age is 36.67 years and falls within the youthful age bracket with majority of the respondents, representing 62.0% being within the age brackets of 21–40 years. Futhermore, majority of the households (83.71%) are married while the remaining 16.29% are unmarried distributed into single respondents (11.71%) and divorced (4.57%). The mean household size of the sampled urban consumers of vegetables in the city of Ouaga is five members, while the minimum and maximum numbers are 1 and 13 members, respectively. This average size is slightly below the city's average of 6.2 members in a household (INSD, 2013)

The highest percentage of the respondents (30.57%) has obtained primary education, followed by 19.71% who also obtained Junior High School education. The least is a respondent with non-formal education representing 0.29%. The mean years of education also show that on average the highest level of education attained by a respondent is primary education (approximately primary 4).

Table 2. Socio-demographic characteristics of vegetable consumers in Ouagadougou

Variable	Category/Description	Frequency (n = 350) (%)
Sex		
	Female	338 (96.57)
	Male	12 (3.43)
Age		
	Less/equal 20	21 (6.00)
	21–40	217 (62.00)
	41–60	90 (25.71)
	60+	22 (6.29)
Marital status		
	Married	293 (83.71)
	Single	41 (11.71)
	Divorced	16 (4.57)
HH size		
	Less/equal 5 people	205 (58.57)
	6–10 people	144 (41.14)
	More than 10 people	1 (0.29)
Educational level		
	None	79 (22.57)
	Arabic school	11 (3.14)
	Non formal	1 (0.29)
	Primary	107 (30.57)
	Junior High School	69 (19.71)
	S.H.S/Vocational/Technical	58 (16.57)
	Tertiary	25 (7.14)

Source: Computed from Household Survey Data, 2016.
Note: Values in parenthesis represent percentages.

Table 3. Socio-economic characteristics of vegetable consumers

Variable	Category/Description	Frequency
Main Economic Occupations		**(N = 350) (%)**
	Own farm	3.00 (0.86)
	Daily wage labour	33.0 (9.43)
	Salaried worker	52.0 (14.86)
	Petty trader	157 (44.86)
	Craftsman	47.0 (13.43)
	Student	44.0 (12.57)
	None	7.00 (2.00)
Monthly Earnings/Income of respondents		
	Less/equal CFA 50,000	49.0 (16.39)
	CFA50001–150,000	86.0 (28.76)
	CFA150001–250,000	52.0 (17.39)
	Above CFA 250,000	39.0 (13.04)

Source: Computed from Household Survey Data, 2016
Note: Values in parenthesis represent percentages.

Results from Table 3 show that most of the respondents are engaged in petty trading, accounting for 44.86% of the occupation of the respondents. This is followed by salary workers 14.86% and the least being farming representing 0.86%. The mean monthly households' income is CFA 47,002.00 and ranges between CFA3,000.00 and CFA300,000.00. Majority of the household respondents earn income between CFA3,000.00 and CFA50, 000.00 representing 72.86%, with fewer households earning above CFA250,000.00 also representing 1.14%.

4.2. Knowledge of the availability of vegetable markets

To determine the level of awareness of the respondents on the availability of vegetable markets, the survey explored three major purchasing outlet/points: supermarket, farm gate and the roadside market. Consumers were then asked of their knowledge on the availability of vegetables at the above markets. A number of respondents, representing 85.43% for supermarket, 81.79% for farm gate and 77.14% for roadside market indicated, not having knowledge of the existence of vegetables in the specified markets. Consequently, they had not bought vegetables from any of these markets. However, a few respondents indicated that they were aware of the availability of vegetables at the various markets, representing 14.57% for supermarket, 18.21% for farm gate and 22.86% for the roadside market.

4.3. Preferred purchasing outlets/points for safer vegetables

Prior to investigating the factors that influence consumers' preferred purchasing outlet, consumers were asked to indicate their most preferred outlet for buying safer vegetables. The results from Table 4 reveal that 52.6% prefer buying safe vegetables from the roadside market, 31.4% prefer buying the safe vegetables from the supermarket, while the remaining 16.0% prefer buying from the farm gate.

4.4. Determinants-of-consumers' preferred purchasing outlets/points

A multinomial logit was estimated to determine the factors, which influence consumers' preferred market. Assuming mutual exclusiveness of the markets, with roadside being the least prioritized (bottom) and supermarket the most (extreme), roadside market is assumed to be least prioritized because the researchers thinks that it is where vegetables can easily be contaminated. For instance, at the farm gate, the vegetables may not have passed through several hands and at the supermarket, care would have been taken to sort out, clean and store the vegetables. The regression model is run with roadside as the base category to determine the relative effect of each particular predictor on the preferred purchasing outlets/point. Table 5 shows the coefficients and marginal effects from the multinomial logit of urban consumers of vegetables choosing a particular type of market relative to the base category. The likelihood ratio is statistically significant at 1% and implies that at least one of the explanatory variables in the model contributes to explaining the variation in the preferred purchasing outlet/points. Out of 10 predictors used in the estimation, seven were found to be significant and influenced consumers' preference for buying at the supermarket over the roadside market, four variables were also found to have some influence on consumers' preference for buying at the farm gate over the roadside market.

Table 4. Preferred purchasing outlet for safer vegetables

Preferred purchasing outlet/ point	Frequency (*N* = 350)	Percentage (%)
Roadside	184	52.6
Supermarket	110	31.4
Farm gate	56	16.0
Total	350	100.0

Source: Computed from Household Survey Data, 2016.

Table 5. The determinants of consumers' preferred purchasing outlets/points of safer vegetables

Variable	SuperMarket		Farm gate Market		Roadside Market
	Coefficient	Marginal Effect	Coefficient	Marginal Effect	Marginal Effect
Sex	1.1631	0.1850*	0.2278	−0.0097	−0.1754
Marital status	1.1492***	0.1845***	0.6999	0.0445	−0.2289***
Education	0.8595**	0.1585***	0.1711	−0.0135	−0.1450**
Occupation	0.2291**	0.0388**	0.2070*	0.0163	−0.0552**
HH size	−0.2400***	−0.0390***	−0.2517***	−0.0217**	0.0607***
Income	4.6006*	9.4407**	7.8606	−1.2007	−8.2407
Appearance	−0.3846	−0.0794	−0.1387	0.0026	0.0768
Distance to markets	0.0902	0.0168	0.0498	0.0022	−0.0191
Frequency of purchasing	0.3116***	0.0461***	0.4201***	0.0406***	−0.0867***
Knowledge of vegetable market	−0.9184**	−0.1402***	−1.0622***	−0.0881**	0.2283***
Constant	−3.2252**		−1.9921		
Model fitness		**Supermarket/Farm gate**			
Number of observations		350			
LR chi(20)		66.23			
Prob > chi2		0.0000			
Pseudo R^2		0.0951			
Log likelihood		−315.1404			

***Significant at 10%, ** = significant at 5% and *** = significant at 1%**
Source: Authors' estimation from field Survey, 2016.

Result from the analysis reveals that holding all other factors constant, when a selected sampled respondent is a female, the probability of preferring to shop at the supermarket increases by 0.19 as opposed to a male counterpart.

A respondent being a married person is also observed to positively influence consumers' choice of preferring to shop at the supermarket to the roadside market at a significant level of 1%. Similarly, the marginal effect estimates indicate that the married had a greater probability of buying safe vegetables from supermarkets than the single. This confirms the *a priori* expectation of the study.

Also being formally educated was found to positively influence one's preference for buying at the supermarket over the roadside market. The marginal value of supermarket indicates a higher probability of a formally educated consumer preferring to shop at the supermarket to illiterate non-educated by 0.16. While the probability of preferring to buy at the roadside market is lower by 0.15.

Salary-earning job is observed to be statistically significant at 5% and 10% for the preference of buying at the supermarket and the farm gate. This suggests that, being in a salary-earning occupation increases preference for buying at both the supermarket and farm gate as opposed to the roadside market. The marginal effects show that the probability of a salary worker preferring to buy at the supermarket and farm gate is greater.

Household size was observed to negatively influence consumers' preference in buying both at the supermarket and the farm gate over the roadside market at a significant level of 1%.. Similarly, the marginal effect shows that an increase in household size by one member increases the

Table 6. Ranked potential constraints to accessing safer vegetables

No	Potential constraints	Mean Garrett Score				Ranks			
		Cabbage	Lettuce	Tomatoes	Pooled	Cabbage	Lettuce	Tomatoes	Pooled
1	Inadequate-supply of safe vegetables	60.48	62.76	49.28	57.50	1	1	1	1
2	Lack of trust in market vendors	50.62	49.00	47.15	48.92	4	2	4	2
3	Distance to the purchasing outlet/point of safe vegetables	52.49	42.63	47.69	47.60	3	4	3	3
4	Price of safe vegetables	45.16	47.83	47.96	46.98	5	3	2	4
5	Lack of information on safe vegetables	55.57	41.64	39.02	45.41	2	5	6	5
6	Cultural barriers	36.93	40.91	40.21	39.35	6	6	5	6

Source: Authors estimation from field Survey, 2016.

probability of preference for buying at the roadside by 0.06, holding other determinants constant. However, the marginal values of supermarket and farm gate mean that an increase in household size by a member decreases the probability of preference for buying at the supermarket and the farm gate by 0.04 and 0.02, respectively.

Income was also found to positively influence consumer preference for buying at the supermarket over the roadside market at a significant level of 10%. This implies that an increase in consumers' income by one CFA results in an increase in preference for buying at the supermarket over the roadside market. Similarly, the marginal effect of income shows that increases in consumers' income by one CFA increases the probability of preferring to buy at the supermarket by 1%.

Frequency of purchase was measured as a dummy variable where 1 is assigned if a consumer purchases vegetables daily, and 0 otherwise. It has positive influence on consumer preference for buying both at the supermarket and the farm gate over the roadside market and was statistically significant at 1%. In addition, the marginal effect showed that frequent shoppers have greater probabilities of buying from the supermarket (0.05) and farm gate (0.04) than the roadside (−0.09).

Knowledge of vegetable markets was observed to negatively influence preference for buying both at the supermarket and the farm gate to the roadside market at significant levels of 5% and 1%, respectively. This suggests that an increase in consumers' knowledge of the availability of safe vegetable markets decreases the preference for buying at both the supermarket and the farm gate, compared with roadside market. Also the marginal effect values show that the probability of shopping at the roadside (0.23) by those who have knowledge about existing markets is greater than that of the supermarkets (−0.14) and farm gate (−0.09).

4.5. Ranked constraints to accessing safe vegetables

Constraints consumers face in accessing safe vegetables were ranked using Garrett's ranking technique. The identification of these constraints to accessing safe vegetables was done through a review of existing literature on willingness to pay for safe, organic and inorganic foods in West Africa. Six major constraints were identified and presented for ranking. To allow for in-built test of agreement, the constraints were presented to each respondent to identify the one that affects him or her before ranking it. The mean scores are found for those who rank a particular constraint and then used for policy recommendations for a diverse population. The discussion of the constraint was done using the aggregated (pooled) constraints in a decreasing order of merit and the result display in Table 6.

With a Garrett's mean score of 57.50, in table 6, inadequate supply of safe vegetables was the most pressing constraint in accessing safe vegetables in Ouagadougou.

Also, with a mean score of 48.92, lack of trust in market vendors was the second-ranked constraint. Consumers perceive that vegetable vendors are driven by profit motives; consequently, they charge high prices for vegetables under the pretense that the vegetables are safe.

The third most pressing constraint ranked was distance to the purchasing outlet/point of safe vegetables and has a mean score of 47.60.

Furthermore, with a Garrett's mean score of 46.98, higher prices were the fourth pressing constraint in accessing safe vegetables. The consumers complained that the relatively safe vegetables were much more expensive than the conventional ones. Thus, not all of them are able to buy them.

The fifth ranked constraint is the lack of adequate information on safe vegetables and has a Garrett's mean score of 45.41. Although many respondents expressed WTP for safer vegetables, they complained about inadequate information on safe vegetables in general.

The least-ranked constraint is cultural barrier with a mean score of 39.35. This constraint was community-specific and was ranked by only three communities out of the 10 randomly selected communities, namely, Sandogo, Tanguin and Wayalgiun where cultural issues are paramount.

5. Conclusions and policy recommendations

Smallholder farmers are faced with the challenge of significant exclusion from international market supply chains and, thus, rely on the domestic market for the sale of their farm produce. These smallholder farmers (vegetable producers and/or marketers) are not very well organized and, therefore, vary their prices based on the purchasing point/outlets. The literature gap that exists in this area in our view is the inadequate empirical evidence on what consumers' socio-economic indicators affect their preference for purchasing point/outlets for safe vegetables and its implications for market targeting. The specific objectives of the study were as follows: determining the factors that influence consumers' preferred purchasing outlet/points in Ouagadougou, Burkina Faso; and identifying the constraints to accessing safe vegetables in the study area.

A semi-structured questionnaire was administered on 350 consumers of cabbage, lettuce and tomatoes selected through a multistage random sampling procedure from 10 districts of the capital city, Ouagadougou. The method of analysis involved an estimation of a multinomial logit to determine and analyse the first objective and the use of a Garrett's ranking technique for the second objective.

The commonest purchasing outlet was the roadside preferred by more than 50% of the consumers, followed by the supermarket, also preferred by about 32% of the consumers. The least patronized outlet was the farm gate, which was the first point of purchase by only 16% of the respondents.

From the estimation results, the supermarket was a preferred choice for the following categories of consumers: the married; the formally educated; the salaried workers; the relatively rich; and those who purchased vegetables much more frequently. On the other hand, the roadside appealed to consumers with large families and consumers who claimed to have knowledge in the existence of many vegetable markets.

In order of importance, the constraints to accessing safe vegetables were inadequate supply of the product, lack of trust in vegetable vendors, long distances to purchasing points, high price, inadequate information regarding safe vegetables and some cultural barriers.

The main policy implication of the findings of this study is the fact that there are prospects in the sale of safe vegetables at the supermarkets in Ouagadougou. This is against the backdrop that the affluent consumers are those who prefer to buy their vegetables from this type of purchasing outlet. The sale of vegetables via supermarket is a win-win situation for both vendors and consumers because the former would have good markets while the latter can be assured of relatively hygienic vegetables. The government also benefits through taxes imposed on the supermarkets as opposed to the farm gate and the roadside where vendors are difficult to locate and often hide from revenue officials. If the market for safe vegetables is going to be widened through the establishment of more supermarket, then it is important that production is scaled up by farmers. This would require support from government and civil society in the form of loans and the establishment of certification institutions to put confidence in consumers for the produce. When supply is increased, the commodity would be more affordable to consumers and many of the other challenges shall be surmounted.

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Author details
Adinan Bahahudeen Shafiwu[1]
E-mail: shafiwu@uds.edu.gh
Samuel A. Donkoh[2]
E-mail: sdonkoh@uds.edu.gh
Hamdiyah Alhassan[2]
E-mail: abena567@yahoo.co.uk
[1] Department of Mathematics, Faculty of Mathematical Sciences, University for Development Studies, Tamale, Ghana.
[2] Department of Agricultural and Resource Economics, Faculty of Agribusiness and Communication Sciences, University for Development Studies, Tamale, Ghana.

Competing interests
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