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Consumer Choice of Dry Common Beans in Malawi

The Case of Lilongwe City

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ABSTRACT

Grain legumes play a critical role in smallholder's economic growth in Malawi. Despite their importance, empirical research has mostly concentrated on yield enhancement and factors affecting the production of common bean (*Phaseolus vulgaris*). Considering the potential of grain legumes for reducing hunger and malnutrition, this paper aims at identifying factors shaping demand for and consumption of dry common bean from a consumer's perspective. Understanding and addressing these factors has potential to increase common bean consumption by enabling breeders to breed common beans with attributes that are preferred by consumers. The study employed a quantitative approach to assess various aspects of household common bean consumption from primary data collected in Lilongwe city. The study results suggest that socio-economic factors such as household size, education, gender, income, and number of children under the age of five years in the household play an important role in a household's decision to consume common beans and the respective quantities consumed. Various product attributes such as grain size, gravy quality, and cooking time also influenced a household's decision to consume common beans. Even though common beans are important for food and nutrition security, the study results show that an additional child under 5 years in the household is associated with a reduction in quantity of common beans consumed. It is therefore important for future research to understand the dynamics of household common bean consumption and under-five nutrition.

1. INTRODUCTION

Grain legumes play a critical role in smallholder agricultural economics in Africa as well as in several other regions in the world. Grain legumes contribute to food and nutrition security and help to mitigate poverty through in-creased incomes for bean-producing agricultural households (Zylberberg 2013). Additionally, grain legumes are an important source of dietary protein, containing between 16 and 33 percent protein, two to three times the amount found in cereals. In many developing countries, the prevalence of protein energy malnutrition (PEM) is high, thereby making this level of protein content nutritionally potentially very important (Van Heerden & Schönfeldt 2004). Furthermore, high concentrations of a variety of micronutrients, including calcium, iron, zinc, and most of the B-vitamins are contained in grain legumes. This makes grain legumes an important food for women of reproductive age and young children, both of whom are prone to micronutrient deficiencies (Larochelle et al. 2015).

According to FAO (2014), Malawi has since 2005 experienced a decline in food insufficiency and hunger following successive agricultural seasons of increased maize production. While the rate of undernourishment has declined over the same period, malnutrition still remains an important problem with approximately 42 and 17 percent of under five children being stunted and underweight, respectively (NSO 2014). The prevalence of stunted and underweight children highlights significant shortages of vitamins, proteins, and other essential nutrients in their diets. This is to some extent attributed to the fact that most households rely on starchy staples, i.e., maize, for their household food security and nutrition. The country's annual per capita consumption of maize is 163 kg, with approximately 40 percent of household funds allocated to staple foods (FAO, IFAD, and WFP 2014).

Due to their high protein content, dry common beans have potential to contribute to food security and diet quality. Since common beans (Phaseolus vulgaris) are rich in quality proteins, energy (32 percent), fiber (56 percent) and micronutrients such as zinc (33 mg/kg), iron (70 mg/kg) and vitamin A, they have the potential to alleviate malnutrition and hunger related problems. Regular bean consumption can provide considerable amounts of calories, proteins, and micronutrients which are important to avoid the consequences of malnutrition and hunger (Tryphone and Nichumbi-Msolla 2010). Yet, despite their potential

to increase household food security and nutritional outcomes, a study by Verduzco-Gallo et al. (2014) show that consumption of common beans has actually declined in Malawi in recent years, based on analysis of the Malawi Integrated Household Surveys (IHS) undertaken in 2004/05 and 2010/11. Per capita consumption of pulses has declined by12.2 percent in absolute terms between 2004/05 and 2010/11. Consumption of common beans, in particular, has declined from 23.7 grams per day to 20.1 grams per day, contributing to a considerable decline in household intake of protein, zinc, iron and calories in average diets.

Investments in common bean breeding programs have increased over the years, resulting in improved varieties. Since 1994, the common bean breeding approach in Malawi was adjusted from focusing solely on yield enhancement to incorporating farmers' production systems, i.e., through breeding for drought, disease, and pest resistance varieties, as well as consumer preferences (Chirwa 2014). Most of these programs, however, still focus heavily on yield enhancement. Part of the emphasis on productivity is the desire to reduce the risk of food insecurity and to increase tradable surpluses of common bean (Katungi et al. 2009). For farmers to obtain the highest benefits from production of common beans, information on consumer preferences is vital, since farmers, with awareness of what sorts of varieties consumers demand, will produce according to that demand (Gelli et al. 2015). Urbanization in Malawi's cities has led to changes in people's diets due to the availability of a wide range of food choices, including more animal sources of proteins, highly milled grains and oils (Satterthwaite et al. 2010). Consequently, this has brought changes as to how farmers and other food suppliers can meet demand. Despite the wider food choices, most urban areas continue to face high poverty levels and food security challenges (Satterthwaite et al. 2010). Increasingly, overreliance on energy-dense foods, such as maize, has resulted in high rates of malnutrition, whereas increased consumption of meat and oils has led to more cases of non-communicable diseases (Verduzco-Gallo et al. (2014); FAO, IFAD, and WFP 2014).

Most studies conducted on consumer preferences for common beans in Malawi do not emphasize the socio economic and demographic influencers of consumption (Chirwa and Phiri 2007; Muthoni et al. 2009). While these studies give insights into consumer preferences for common beans, they were conducted at a time when the common bean market was dominated by only three varieties, Phalombe, Nanyati, and Napilira. Since then, there has been a remarkable expansion in breeding of common bean which has resulted in increased availability of a greater number of varieties of common beans in markets. Furthermore, in these earlier studies, consumer preferences for common beans were drawn from interviews with traders, and, as such, reflected traders' perceptions of consumer preferences (Chirwa and Phiri 2007). As a result, there was no consensus amongst the traders for example on which varieties had a shorter cooking time, despite this particular trait being cited as an important factor influencing consumer choice. Understanding consumer preferences regarding common beans is vital, as these influence their consumption decisions (Brumfield et al. 1993).

Improving food security and nutrition status at household level is an important objective under several policy documents of the government of Malawi, including the Agriculture Sector Wide Approach (ASWAp) and the Malawi Growth and Development Strategy (MGDS), USAID's Feed the Future initiative in Malawi, and other donor-funded activities in the country. A better understanding of the preferred characteristics in common beans has the potential to increase the quantities of beans consumed and, thus, improve diet quality. Hence, the present study contributes to this knowledge by assessing socioeconomic and demographic factors and common bean attributes that influence choices around the consumption of common beans from a consumer's perspective. Knowledge of the demanded common bean varieties will enable farmers to produce and sell a surplus, hence ensuring the availability of demanded varieties on the market. However, although the supply of common bean in Malawi has received considerable attention from researchers, relatively less has been published about consumer demand and choice. The present study therefore extends the knowledge on common bean consumption by analyzing separately factors influencing common bean consumption and later the extent to which these factors influence household common bean consumption.

2. METHODS AND DATA SOURCES

2.1 Data and sampling

Being more populated and diverse than other cities in Malawi, Lilongwe city was purposively selected for this study as it represents a potential viable market for dry common beans and bean products (NSO 2008). A multistage sampling procedure was employed to select areas and households to form the sample for the study. The first stage involved stratifying Lilongwe city into high, medium, and low density areas. These strata are demarcated in terms of income levels with households residing in low density households having high incomes, middle incomes for households residing in medium density and low incomes for those residing in high density areas. This was done to ensure that a range of welfare categories were represented in the sample. The second stage involved randomly selecting clusters (areas) within the strata. From each stratum, the following clusters were selected; high density areas: Areas 8, 18, 21, 23, 36 and 49; medium density areas: Areas 6, 12, 14 and 47; and low density areas: Areas 3, 9, 10 and 43. The final stage involved randomly selecting households in the selected clusters to form the sample.

A survey questionnaire with discrete choice experiment components was administered to collect primary data from Lilongwe residents through face to face interviews. The questionnaire collected information on socioeconomic and demographic factors of the respondents, including age, education, marital status, household size, and income. In addition, information was collected on household consumption decisions, i.e., the types of food products consumed in the past seven days and the quantities of different types of beans consumed, food expenditures, and who influences food decisions in the house. The last section of the questionnaire collected information on consumer choices. Respondents were presented with a sequence of choice sets from which preferred alternatives were selected. Each choice set contained several alternatives defined by a set of attributes and attributes levels. The choices of the respondents were then revealed by their selections. Analysis of the data involved using the Craggit double hurdle model and was done using the Stata statistical software package.

A sample size of 684 households was employed in the study. This sample size was determined based on the formula from De Bekker-Grob et al. (2015):

$$n \geq 500 \times \frac{L^{max}}{JS} \quad (1)$$

Where L^{max} is highest attribute level (in our case, this is three: small, medium, and large); J is the number of alternatives (the experiment involved four dry common bean varieties); and S is the number of choice tasks[1] for each respondent (eight), which implied the need for minimum of 276 respondents for the choice experiment.

According to Pearmain et al. (1991), a study with a sample size of more than 100 respondents is adequate to model choice experiment data. Lancsar and Louviere et al. (2008) recommend larger sample sizes when carrying out further analysis to identify and estimate the effects of the independent variables on the dependent variable. The final sample employed in the current study therefore consists of 684 respondents. To arrive at this number, 10 percent was added to 276 obtained from the sample size calculation, to take into account non-response, bringing the sample size to 303. Furthermore, considering the design effect associated with a multistage cluster sampling design, the sample size was doubled, bringing the sample size to 606. An additional 78 respondents were added to the sample to have adequate questionnaires to replace uncompleted questionnaires, ending up with a sample size of 684. The sample size was then proportionally distributed to the strata and clusters according to their size. The total numbers of people residing in the selected clusters were obtained from the Population and Housing Census which was conducted in 2008 by the National Statistics Office of Malawi (NSO).

[1] Choice task represents a combination of attributes of a particular alternative of which a respondent was asked whether or not they would buy.

2.2 Theoretical framework

The analytical technique employed in this study to assess consumer preference and choice for common beans is based on discrete choice methods. These methods are based on Lancastrian consumer theory and random utility theory (Lancaster 1966). The new Lancastrian consumer theory proposes that the utility of a good can be split into different utilities based on the good's specific attributes. This is consistent with a shift in behavioral sciences to focusing on product attributes, rather than analyzing the product as a whole, as supported in the Lancaster's hedonic price model and characteristics models (Lancaster 1971; Wang et al. 2008). The assumptions in the new approach are summarized as follows:

- It is the characteristics of the good that give rise to utility and not the good per se.
- Generally, there are more than one characteristic within a good and these characteristics can be found in other goods.
- Goods in combination may have characteristics different from the characteristics of individual goods.

The random utility theory relies on the assumptions that individuals are rational and select the highest utility yielding alternative (Hall et al. 2004). As a result, the probability of selecting a particular alternative will be higher if the utility provided by the alternative is highest among the different choices. Thus, we can represent an individual *i*'s utility associated with the choice of an alternative *j* as;

$$U_{ij} = V_{ij} + \varepsilon_{ij} \quad (2)$$

where V_{ij} is the deterministic indirect utility function and ε_{ij} is the stochastic portion and assumed to be independently and identically distributed (iid) according to the extreme value distribution[2].

The deterministic portion is assumed to be a linear function of independent variables and expressed as:

$$V_{ij} = X'_{ij}\beta_i \text{ , i = 1, 2,..., n; j = 1, 2, ..., J} \quad (3)$$

where X_{ij} are observable variables relating to the alternative *j* for consumer *I*; β_i is a vector representing coefficients of the observable variables for consumer *i's* tastes; and ε_{ij} is an unobserved random error term.

The probability of consumer *i* choosing alternative *j* in a choice task with *k* alternatives is expressed as;

$$\Pr(j) = \text{Prob}\left(U_{ij} > U_{ik}\right) \ \forall j \neq k \ = \text{Prob}\left(V_{ij} + \varepsilon_{ij} > V_{ik} + \varepsilon_{ik}\right) \ \forall j \neq k \quad (4)$$

where *Pr (j)* and *Prob* represent the probability of consumer *i* of selecting alternative *j*, with the rest of the elements as already discussed.

The utility that consumers derive from a good is not observed directly and neither can it be measured. Instead, a consumer's choice (whether they choose a particular alternative or not) = (0,1) and quantities consumed can easily be observed from data. Therefore, it can be assumed that the condition in equation 4 is met if $P_{ij} = 1$ and $Y_{ij} > 0$, which implies that consumer *i* derives the highest utility from consuming alternative *j* than any other alternative. As a result, a consumer's choice to consume a particular good in relation to alternatives can be modeled as a function of the product's attributes and individual characteristics (Thilmany et al. 2008).

[2] An extreme value variable X $(-\infty < X < \infty)$ has the cumulative distribution function $F(X) = \exp[-\exp(-X)]$

2.3 Empirical strategy

We adopt a two-stage regression approach to assess consumer choice and preferences for common beans. We take into account in our modelling approach that using consumption data to model quantities consumed may be difficult particularly when the dependent variable has zeros for some observations. In such cases, biased results can be obtained when econometric estimators like Ordinary Least Squares are employed. It is also not an option and neither is it acceptable to exclude the zeros when doing such analyses, as important information may be lost in the process (Pindyck and Rubenfeld 1998; Kennedy 2003). Usually, whenever there is a case of a "corner solution", a Tobit model (Tobin 1958) is employed. According to Wooldridge (2015), one restriction about the Tobit model lies in its assumption that the same set of parameters determine both the probability of a positive choice and the actual quantities consumed. This implies that effects of the independent variables on consumption and the extent of consumption should have equal or similar signs (Burke 2009). This is not a realistic assumption when trying to model consumers' consumption decisions and their extent of consumption. For instance, consider the following hypothetical scenario in which we consider the time taken to walk to the market as an independent variable and the amount of money spent at the market as a dependent variable. The time taken to get to the market can negatively affect the probability of a consumer shopping from that market (amount of money being more than zero). Despite the fact that time could negatively affect the probability of shopping at a market, it could positively affect the amount of money the consumer spends if one decided to buy from this particular market. This implies that the longer the time taken to get to the market the less likely the consumer will buy from that market, but if they decide to buy from it, they are likely going to use more money or buy more whenever they go to this market (Ross et al. 2010).

A number of considerations may influence the decision to consume a particular dry common bean variety. These factors may include consumer background, education level, household size, number of children under the age of five years in the house, income, and dry common bean attributes preferred by the consumers, such as grain size, cooking time, and the quality of gravy the variety provides. The influence that these factors have on the decision on whether to consume or not to consume a particular bean variety may vary from how they influence the decision of how much of that particular dry common bean variety to consume. Therefore, to model consumption of dry common beans, there is a need for models that are flexible enough to separately determine the decision to consume and the respective quantities to consume. The current study employed a Craggit double-hurdle model, as it allows factors to influence the decision to consume and the quantities consumed differently. This model is also appropriate when the data has a large number of cases with zeros in the dependent variable.

In the double-hurdle model, participation and consumption decisions are assumed to arise from two separate individual choices whose determinants are allowed to differ. Originally proposed by Cragg (1971), the double-hurdle model assumes that a positive level of consumption is observed once two separate hurdles are passed. In the context of common bean consumption, the first hurdle involves the decision about whether to consume a particular dry common bean variety (selection equation). The decision on the quantities to consume is represented in the second hurdle (consumption equation).

In the following, the first hurdle is represented by the latent variable d_i^* and is observed to be chosen if and only if $d_i^* > 0$, i.e., if a household is a potential consumer of a particular dry common bean variety. For potential consumers, the latent variable y_i^{**} in the second hurdle assesses whether the consumption amount is zero or positive (Kumar 2013). The equation that determines y_i^{**} is similar to a Tobit model. If we define y_i^* to be the observed quantities of common beans consumed (positive) and also include "no consumption" cases as taking on the value zero, then:

$$y_i^* = \max\{y_i^{**}, 0\} \quad (5)$$

Finally, since the data contain common bean consumption observations only when the amounts are positive, then representing this by y_i, we can take into account both the probability of passing the first hurdle and, conditional on this, the second hurdle such that

$$y_i = d_i \, . \, y_i^* \tag{6}$$

$$d_i^* = Z'\gamma + \epsilon_i \text{ (Selection equation)} \tag{7}$$

$$y_i^{**} = X'\beta + \mu_i \text{ (Consumption equation)} \tag{8}$$

Where

$$\begin{pmatrix} \epsilon \\ \mu \end{pmatrix} \sim N\left[\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} 1 & 0 \\ 0 & \sigma^2 \end{pmatrix}\right]$$

The two error terms are assumed to be independently distributed; the variance of the first term is normalized to one, while that of the second term is estimated within the model. Vectors of explanatory variables x and z are specified for the selection and consumption equations respectively (Kumar 2013). The model is then estimated by maximizing the log-likelihood to estimate the parameters γ, β and σ:

$$\ln(L) = \sum_0 ln\left[1 - \Phi(Z_i'\gamma)\, \Phi\left(\frac{X_i'\beta}{\sigma}\right)\right] + \sum_1 ln\left[\Phi\,(Z_i'\gamma)\frac{1}{\sigma}\,\phi\,\left(\frac{y_i - X_i'\beta}{\sigma}\right)\right] \tag{9}$$

2.4 Variable description

Descriptions of the variables used in the double hurdle model are presented in Table 2.1. Due to the nature of the data collected, the majority of the variables were binary, hence, the possibility of having a problem of dummy variable trap. Dummy variable trap, also known as perfect multicollinearity, occurs when all categories of one variable are included in a model as explanatory variables (Cameron 2005). For example, in the present study the variable on education had multiple categories namely, college or university, vocational training, secondary education, primary education, and no education. If all these categories were to be included in the model as explanatory variables, the dummy variable trap would have resulted. Therefore, to avoid this problem, one category was used as a reference category and as such not included in the model. This was done on all variables that had multiple categories.

Socio-economic and demographic factors such as age, gender, household size, and education have been included in the model, as they are believed to be important in explaining a consumer's food choice. This approach is consistent with a study conducted in USA by Thompson (1998) which compared different studies of consumer demand for organic food. Based on the study results, variables including age, marital status, education, and the number and age of children are important variables in describing demand for organic foods.

Age was expected to have either a positive or negative effect on consumption of dry common beans. This is so because as consumers grow, they become more conscious of excessive intestinal gas or flatulence associated with common bean consumption, which causes social embarrassment (Winham and Hutchins 2011). On the other hand, consumers may be exposed to the nutritional benefits of dry common bean consumption as they grow older thereby having a positive effect on consumption of dry common beans. According to a study conducted in Norway by Fagerli and Wandel (1999), households were more likely to eat healthier as they grew older. In Malawi, people are encouraged to eat a healthy and balanced diet which contains all the six food groups. One of these food groups is legumes, a group in which common beans belong.

Table 2.1: Descriptive statistics of variables used in the analysis

Variable	Mean	Std. Dev.	Variable	Mean	Std. Dev.
Household & individual characteristics			***Characteristics of red mottled beans***		
Age, years	36	13	Fast cooking time, 0/1	0.483	0.005
Log of income, Malawi kwacha	11.27	1	Slow cooking time, 0/1	0.228	0.004
Female respondents, 0/1	0.852	0.004	Large grain size, 0/1	0.240	0.004
Household size, number	4.91	1.78	Medium grain size, 0/1	0.263	0.004
Children under five, number	1	0.42	Small grain size, 0/1	0.208	0.004
No education, 0/1	0.044	0.002	Good gravy quality, 0/1	0.595	0.005
Primary education, 0/1	0.322	0.005	Poor gravy quality, 0/1	0.116	0.003
Secondary education, 0/1	0.373	0.005	Tradition eating red mottled, 0/1	0.086	0.003
Vocational training, 0/1	0.092	0.003	***Characteristics of white beans***		
University education, 0/1	0.168	0.004	Fast cooking time, 0/1	0.389	0.005
High density area, 0/1	0.855	0.004	Slow cooking time, 0/1	0.165	0.004
Medium density area, 0/1	0.082	0.003	Large grain size, 0/1	0.189	0.004
Low density area, 0/1	0.063	0.002	Medium grain size, 0/1	0.155	0.004
Characteristics of red kidney beans			Small grain size, 0/1	0.211	0.004
Fast cooking time, 0/1	0.525	0.005	Good gravy quality, 0/1	0.458	0.005
Slow cooking time, 0/1	0.311	0.005	Poor gravy quality, 0/1	0.097	0.003
Large grain size, 0/1	0.298	0.005	Tradition of eating white beans, 0/1	0.075	0.003
Medium grain size, 0/1	0.273	0.004	***All types***		
Small grain size, 0/1	0.265	0.004	Fast cooking time, 0/1	0.890	0.003
Good gravy quality, 0/1	0.683	0.005	Slow cooking time, 0/1	0.561	0.005
Poor gravy quality, 0/1	0.154	0.004	Large grain size, 0/1	0.741	0.004
Tradition eating red kidney, 0/1	0.247	0.004	Medium grain size, 0/1	0.735	0.004
Characteristics of cream mottled beans			Small grain size, 0/1	0.662	0.005
Fast cooking time, 0/1	0.436	0.005	Good gravy quality, 0/1	0.940	0.002
Slow cooking time, 0/1	0.154	0.004	Poor gravy quality, 0/1	0.304	0.005
Large grain size, 0/1	0.211	0.004			
Medium grain size, 0/1	0.221	0.004			
Small grain size, 0/1	0.158	0.004			
Good gravy quality, 0/1	0.503	0.005			
Poor gravy quality, 0/1	0.208	0.004			
Tradition eating cream mottled, 0/1	0.073	0.003			

Source: Survey data; Observations: 684.

Gender is also expected to have either a significant influence on consumption of dry common beans, but we cannot determine a priori whether this will be positive or negative. A study conducted in Tanzania by Berbesque (2009) highlighted gender differences in food choices between men and women. In the study, women were found to be more conscious of healthy eating behaviors and eager to learn more about nutrition compared to their male counterparts. In addition, women were more likely to consume foods that were high in fiber and low in fat content. Consistent relationships have also been reported involving gender and some food items in Western countries. In these studies, males generally had higher consumption of alcohol, red meat, and large portions of food items, while females had higher consumption of vegetables, fish and fruits (Sobal 2005; O'Doherty and Holm 1999). On the other hand, Hunt et al. (1997) found that men were more likely to consume larger quantities of common bean following advice to increase lentil and bean consumption.

Household size was expected to have a positive relationship on common bean consumption. The bigger the household, the more money is required to fulfill household food requirements. Common beans being a relatively cheap source of protein, households with more members are likely to consume more common beans than are households with fewer members.

Income of the household is likely to have either a positive or negative significant effect on consumption of dry common beans. The negative effect arises due to the substitution effect that occurs with an increase in income. As household income increases, consumers tend to substitute consumption of dry common bean with beef, for example. A study by Lucier et al. (2000) conducted in America, showed that larger quantities of common beans were consumed by households with low incomes compared to those with high incomes. The study further highlighted that 27 percent of all dry beans consumed in America was consumed by households within the lowest income bracket even though these households only account for 19 percent of the total population.

Globally, children under the age of five represent an age group that is greatly affected by malnutrition, and Malawi is no exception (Chege et al. 2015). As a result, programs on nutrition education in Malawi promote foods high in protein that are cheap and found locally, including common beans, groundnuts, and soybeans, which are processed into flour and blended with maize flour. Despite promotion of these three legumes in the diets of children under the age of five in Malawi, consumption of these legumes still remains low due to preferences for maize and other carbohydrate rich staples (Trehan et al. 2015). Consequently, an indeterminate, but significant association is expected between number of children under the age of five and common bean consumption.

3. RESULTS AND DISCUSSIONS

3.1 Consumption of common beans in Lilongwe City

Common beans are consumed by most households in Lilongwe city. Out of the 684 households that took part in the study, 96 percent reported to have consumed any type of common beans. Most of the households reported to have sourced the common beans they consume from open markets. The supermarket was the second most cited source of common bean purchases. Approximately 9 percent of the respondents reported to have sourced red mottled beans from supermarkets, 7 percent for red kidney, and 5 percent for both white and cream mottled beans. Households that sourced common beans from their own farms or gardens were 3 percent for red kidney beans, white beans, and red mottled beans, and 2 percent for cream mottled beans, as shown in Table 3.1.

Table 3.1: Sources and role or usage of common beans, percent of observations

Sources and role or usage	Red Kidney	White	Cream mottled	Red mottled	All types
Source					
Donation from church, NGO, or government	0.9	0.0	0.4	1.0	1.2
Gift from friends	0.9	4.8	3.3	2.4	2.6
Open market	87.6	87.1	88.9	84.9	85.1
Own farm or garden	3.1	2.9	2.1	2.9	3.4
Supermarket	7.6	5.3	5.3	8.8	8.2
Role or usage					
Complement to main dish, e.g., stew or soup	94.3	94.2	94.3	94.2	94.2
Main dish	3.6	3.9	3.7	3.4	3.5
Side dish	2.1	2.0	2.1	2.4	2.1
Ingredient	0.0	0.0	0.0	0.0	0.0
Observations	*589*	*209*	*244*	*205*	*656*

Source: Based on bean consumption survey data

Common beans are widely consumed with *nsima*, Malawi's preferred staple food. This is evident in the bottom panel of Table 3.1, which shows that 94 percent of respondents mentioned common beans as a complement to the main dish[3]. Furthermore, results show that many respondents did not use common beans as an ingredient. This could probably be due to lack of knowledge of other roles that common beans can play in their diets. Only 4 percent of the surveyed households responded to have consumed red kidney, white, and cream mottled beans as a main dish.

Table 3.2: Frequency of consumption of common beans and average quantities of bean consumed

	Red kidney	White beans	Cream mottled	Red mottled	All types
Frequency of consumption, %					
Did not consume	13.2	66.1	61.6	65.5	4.1
Less than once per month	4.8	20.2	9.8	8.9	30.0
Once per month	7.0	4.8	9.7	7.8	25.3
Once every two weeks	10.5	4.0	7.6	5.0	23.0
Once or more per week	64.5	5.0	11.4	12.9	75.2
Average quantity consumed in past 7 days per household (kg)	2.18	0.28	0.45	0.42	3.33
Low density areas	1.96	0.25	0.82	0.65	3.68
Medium density areas	1.83	0.36	0.41	0.86	3.46
High density areas	2.23	0.27	0.43	0.37	3.30

Source: Based on bean consumption survey data
Observations: 684.

Table 3.2 shows the frequency of consumption of common beans. Consistent with previous studies, the results indicate that red kidney beans were the most preferred and consumed bean variety with only 13 percent of respondents reporting not to have consumed red kidney beans (Chirwa and Phiri 2007). In contrast, most respondents reported not to have consumed white, cream mottled, or red mottled beans – 66 percent of the respondents did not consume white or red mottled beans, whereas 62 percent reported not to have consumed cream mottled beans. At least 64 percent of respondents reported to have consumed red kidney beans once or more per week compared to 13 percent, 11 percent, and 5 percent for red mottled, cream mottled, and white beans, respectively. White beans were the least consumed and preferred bean variety with 20 percent of the respondents reported to have consumed white beans less than once per month, whereas only 5 percent of reported to have consumed red kidney beans less than once per month.

3.2 Factors influencing choice of common beans

A Craggit double hurdle model was used to analyze factors that influenced choice as to whether to consume or not to consume common beans and the extent to which these socio-economic, demographic, and product attribute factors influenced common bean consumption. In the first stage, factors influencing choice of common bean are determined. The second stage analyzed the extent to which factors determined in the first stage influenced the quantities of common beans consumed.

Overall, the regression models for all four common bean varieties are significant at 95% confidence level. The socio-economic and demographic factors that significantly determined the choice to consume various bean varieties included gender, household size, number of children under 5 years, different levels of educational attainment, and income. Dry common bean attributes that significantly influenced common bean consumption were grain size (large and medium), fast cooking time, and good gravy quality. Table 3.3 presents regression results for the four common bean varieties used in the analysis.

[3] In the context of this study, main dish typically relates to food item that gets the largest proportion on the plate, i.e. Nsima, Malawi's main staple.

Table 3.3: Influence of socio-economic and demographic variables and bean attributes on consumption

	Small White		Red Kidney		Cream Mottled		Red Mottled	
Variables	**Selection**	**Outcome**	**Selection**	**Outcome**	**Selection**	**Outcome**	**Selection**	**Outcome**
Age, years	-0.002	-0.009	0.006	0.014	0.000	0.007	0.002	0.063
	(0.006)	(0.013)	(0.005)	(0.010)	(0.005)	(0.009)	(0.005)	(0.038)
Female, 0/1	-0.256	-0.054	0.295*	-0.774**	-0.124	-0.534*	0.413**	-3.283
	(0.167)	(0.396)	(0.163)	(0.359)	(0.171)	(0.308)	(0.190)	(2.495)
Household size, members	0.024	0.130	0.031	0.279***	0.046	0.199***	0.103***	0.539*
	(0.037)	(0.082)	(0.039)	(0.076)	(0.035)	(0.068)	(0.036)	(0.293)
Children under five, number	0.080	-0.348*	0.107	-0.424**	0.013	-0.235	-0.054	-0.879
	(0.101)	(0.178)	(0.097)	(0.185)	(0.096)	(0.179)	(0.094)	(0.958)
Has primary education, 0/1	-0.177	0.424	0.193	1.246**	-0.811***	0.543	0.065	1.948
	(0.247)	(0.346)	(0.283)	(0.565)	(0.285)	(0.426)	(0.266)	(1.378)
Has secondary education, 0/1	-0.374	0.362	0.185	1.476**	-0.573**	0.505	-0.026	3.460*
	(0.254)	(0.403)	(0.281)	(0.575)	(0.286)	(0.398)	(0.269)	(2.012)
Received vocational training, 0/1	-0.550*	1.292*	-0.242	1.585**	-0.608*	1.601***	0.234	4.031**
	(0.327)	(0.772)	(0.328)	(0.647)	(0.329)	(0.577)	(0.320)	(1.895)
Has university education, 0/1	-0.597**	-0.182	-0.149	0.751	-0.754**	0.451	0.073	5.286**
	(0.303)	(0.751)	(0.318)	(0.675)	(0.329)	(0.461)	(0.308)	(2.454)
Income sources, number	0.103	0.235	-0.023	0.304*	0.025	-0.046	-0.016	-0.045
	(0.078)	(0.175)	(0.089)	(0.156)	(0.075)	(0.133)	(0.065)	(0.560)
Medium sized grain, 0/1	0.064	0.858**	0.376**	0.416	0.129	-0.119	0.171	-1.316
	(0.177)	(0.426)	(0.169)	(0.299)	(0.172)	(0.339)	(0.158)	(0.961)
Large sized grain, 0/1	0.001	0.562*	0.053	0.072	-0.068	0.216	0.109	0.430
	(0.174)	(0.338)	(0.148)	(0.304)	(0.169)	(0.332)	(0.162)	(1.345)
Fast cooking, 0/1	0.151	-0.312	-0.136	0.326	0.242	-0.208	0.458***	-0.001
	(0.180)	(0.350)	(0.136)	(0.288)	(0.164)	(0.277)	(0.140)	(0.863)
Good quality gravy, 0/1	0.238	-0.765**	0.303**	-0.280	0.003	0.061	0.079	-0.456
	(0.180)	(0.368)	(0.146)	(0.322)	(0.187)	(0.286)	(0.167)	(0.797)
Tradition of eating variety, 0/1	1.395***	-0.074	0.679***	-0.623**	1.406***	0.201	1.381***	0.717
	(0.211)	(0.400)	(0.173)	(0.281)	(0.204)	(0.305)	(0.198)	(1.137)
Constant	-2.108**	-1.683	-0.060	-3.722**	-0.850	0.835	-2.176***	-5.174
	(0.872)	(2.049)	(0.999)	(1.868)	(0.836)	(1.544)	(0.764)	(5.602)
Chi^2	35.03	35.03	36.01	36.01	30.32	30.32	57.96	57.96
p	0.001	0.001	0.000	0.000	0.004	0.004	0.000	0.000

Observations: 684; Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Regression results from the selection equation for red kidney and red mottled beans indicates a positive association between gender and choice of the two dry common bean varieties. Female respondents were more likely to choose red kidney and red mottled beans compared to male respondents. These results indicate gender differences in the common bean attributes preferred by men and women. Literature however does not give an account of why women prefer certain varieties compared to men. However, looking at agronomic attributes of common beans in Kenya, Katungi et al. (2011) found high yielding bean varieties being preferred by men compared to women due to the "provider" role men play in households. This was due to the correlation between yield and profitability after surplus is sold. Women's preference for red kidney and red mottled beans could be a result of their good cooking properties, since women are the ones mostly involved in food preparation in the households. Despite gender not influencing the choice of whether a respondent chose cream mottled beans or not, it was found to significantly influence the quantity of cream mottled beans consumed.

Results from the outcome equation indicate that being female was associated with a decline in consumption of 0.77 kilogram for red kidney beans and 0.53 kilogram for cream mottled beans. Even though women were more likely to choose red kidney and red mottled beans, the finding of a decline in the quantities of common beans consumed is in line with the findings of Kabagambe (2005) who found that quantities of common bean consumed differed between males and females. Females were associated with a decline in quantities of common beans consumed, while men were found to consume the highest quantities of common beans. These findings are also consistent with a study by Rodríguez-Castillo and Dumani-Echandi (2002) that found women to consume less common beans due to intestinal problems associated with consumption of common beans. Additionally, women claimed that common beans were too "heavy" and caused them to gain weight when eaten at night. In addition, Lucier et al. (2000) found that men (probably due to larger energy requirements) consumed more common beans compared to women.

Results from the selection and outcome equation showed that household size was positively associated with choice to consume red mottled beans and also influenced the quantities consumed of red kidney, cream mottled, and red mottled beans. An additional household member was associated with a 0.28 kilogram increase in the consumption of red kidney beans, 0.20 kilogram increase in the consumption of cream mottled beans, and 0.54 kilogram increase in the consumption of red mottled beans. These results are in line with those of Schneider (2002) who found that consumption of common beans in Europe increased with increase in household size.

Regression results from the selection equations suggest that an additional child under the age of 5 has no influence on the choice of any of the four common bean varieties. However, results from the outcome regressions show that an additional child under the age of five reduces the quantities of white and kidney beans consumed by 0.35 and 0.42 kilogram, respectively. Empirical research has extensively documented the role of common beans on infant nutrition and weaning (Mensa-Wilmont et al. 2001; Mbithi-Mwikya et al. 2000). While common beans make an important contribution to child nutrition, the finding of a decline in bean consumption for each additional child is similar to findings from Uebersax (2006). His research on dry edible beans acknowledges the role of dry common beans in child nutrition, but emphasizes the transition from nursing to solid foods as being a complex process that reflects various socio-economic factors. Key among these factors are attributes of the beans as well as availability of other child-related foods at household level. This study, however, neither elaborated on the particular bean attributes preferred by children under five years of age nor explained in detail the influence of other child related food in the households on consumption of common beans.

In Malawi, the Food and Agriculture Organization has been working with the government under a project called "Improving Food Security and Nutrition Policies and Program Outreach (IFSN)". One component under this project is a program on nutrition education which focuses on households with children under the age of five to avoid malnutrition by improving complementary feeding practices. Under the program, a nutritious porridge is promoted for children and is composed of all food groups including: a) starch, i.e., maize flour, cassava or mashed potatoes b) protein, i.e., groundnut or bean flour, meat or fish powder, c) vegetable, i.e., any green vegetable, and d) fat, such as oils (FAO 2015). Even though the research literature suggests that common beans have potential to be included in complementary feed for children, most households still do not use bean flour, preferring instead to use maize, soybeans, and groundnuts (Trehan et al. 2015 and Patel et al 2005). Furthermore, as part of supplementary feeding program for under five children, hospitals in Malawi usually give out maize and soya bean blended flour to mothers whose children are malnourished (Patel et al. 2005). Anecdotes from the survey administration suggest that households were less likely to feed common beans (white common beans in particular) to their under five children due to the belief that feeding common beans to young children causes blindness. These beliefs were common in high density areas, usually from respondents that did not go beyond secondary education. To some extent, such beliefs indicate the role that education plays in food choices at household level.

Regression results from the selection equation for small white beans suggest that educational attainment variables denoting primary, secondary, vocational training, and university significantly influenced choice and quantities of dry common beans consumed. Results from the outcome regression showed that quantities of red kidney beans consumed increased with an increase in education level. Respondents that attended primary, secondary, and vocational training were found to consume 1.26, 1.48 and 1.59 kilogram more of red kidney beans, respectively, compared to those that did not go to school. In terms of white bean consumption, respondents that attended vocational training and university were less likely to choose white beans. However, despite the negative association between vocational training and choice of white beans, vocational training was associated with 1.29 kilogram increase in quantity of white beans consumed. Respondents that attended primary, secondary, vocational training, and university were found to be less likely to consume cream mottled beans. While all education levels were found to have a negative association with choice of cream mottled beans, vocational training was found to have a positive association with quantities of cream mottled beans consumed. Respondents that attended vocational training were associated with a 1.60 kilogram increase in quantity of cream mottled beans consumed. Just like red kidney beans, attending primary, secondary, vocational training, and university did not significantly influence the choice to consume red mottled beans. However, an increase in education level resulted into an increase in the quantities of red mottled beans consumed. Respondents that attended secondary, vocational training, and university had increased quantities of red mottled beans consumed of 3.46, 4.03 and 5.29 kilogram, respectively. These findings are consistent with our expectation of having a positive association between education and consumption of dry common beans. It is worth noting that our analysis does not focus on the overall attributes of all common beans. We rather differentiate by bean type to get a better idea of how attributes of different common bean varieties can potentially influence consumers' choices. This is also particularly important for farmers in rural area as they become more knowledgeable about consumer preferences and ultimately the farmers own common bean production choices.

Results from this study showed that people with higher levels of education were found to eat more plant based diets that included legumes compared to those with lower levels of education. This results is consistent with those of Kearney et al. (2000) who found that education was positively associated with healthy eating habits, as a larger composition of pant-based foods in the diet is recognized to have important health benefits (Lea et al. 2006). According to Worsley et al. (2004), there are three reasons why food choice may be influenced by education. First, with education, an individual may have access to a wider variety of food and health related information. Second, according to the theory of social diffusion, highly educated people are less risk averse and are more likely to adopt innovations sooner than their less educated counterparts (Rogers 1995). Third, as suggested by social epidemiologists, people can move up the social class ladder with increased education levels. Better education and higher qualification allows individuals to have more control over how their lives turn out through improved incomes (Marmot 2005).

Results from the outcome regressions indicate a positive relationship between income and quantity of red kidney beans consumed. A one percentage point increase in income was associated with a 0.30 kilogram increase in quantity of red kidney beans consumed. This result contradicts our expectation of a negative association between incomes and consumption of dry common beans. While several studies show a negative association between income and dry common bean consumption (Broughton et al. 2003; Leterme and Muñoz 2002), it is not surprising to see an increase in dry common bean consumption with income. Over the years, cases of chronic diseases, such as cancer and type two diabetes, have dramatically increased over the world and Malawi is no exception. As a result, more people are becoming increasingly cautious with what they eat and, as such, follow healthy eating habits. With health organizations advocating for plant based diets, people are now looking for healthy alternatives to animal products, such as dry common beans (Lea et al. 2006). Leterme (2002) also contends that consumers in developed countries were now more interested in common beans, chick peas, and lentils following recommendations

by health organization to increase frequency of consumption of such pulses. Hence, common bean is no longer being labeled as “poor man’s meat”. Results from descriptive statistics also indicate that 64 percent of the interviewed households reported to have consumed common beans once or more in the previous seven days. This study collected extensive information on quantities of various common beans consumed at household level, but quantities of other food items were not collected. Instead, the study focused only on expenditures on these food items. At first, while increased expenditures on other food items such as animal products may potentially imply improved diets, expenditure information alone does not give an accurate estimate of the quantities consumed at household level.

Common bean attributes, including grain size, cooking time, and gravy quality, were found to influence choice and consumption of dry common beans. Results from the selection regression indicate that respondents were more likely to consume red kidney beans if the grains were medium sized. While medium sized grains influenced consumption of red kidney beans, results from the outcome regression indicate that medium and large grains were associated with 0.86 and 0.56 kilogram increase in consumption of white beans. These results are consistent with those of a study by Mishili et al. (2009) that found that cowpea consumers in Ghana, Nigeria, and Mali preferred large grains. Additionally, Faye et al. (2006) also found that large cowpea grains were preferred in all sampled markets in Senegal. Another study conducted in Nigeria by Afolami (2002) contended that large-grained cowpea varieties were preferred by consumers.

Cooking time was also found to significantly influence choice of common beans. Respondents were more likely to choose red mottled beans that were fast cooking. These results are similar to those of Bressani and Chon (1996) and Jones et al. (2006) who found that the ease of cooking of various legumes are amongst the most important traits favored by consumers. These results were also in line with the results of Muthoni et al. (2009) that found that common bean varieties that did not take long time to cook and other visual characteristics were important traits that common bean traders looked for when making their selection on the type of common bean varieties to buy and resell. Leterme (2002) also contended that softness, which was related to cooking time, was another important factor that influenced choice of pulses in Latin America. Regression results also indicate that good gravy quality significantly influenced choice of red kidney beans. Respondents were more likely to choose red kidney beans if the gravy was of good quality.

Tradition was found to significantly influence a household’s choice to consume all common bean varieties, but influenced the quantity consumed only for red kidney beans. Respondents that grew up in families or environments that consumed dry beans were more likely to consume white, red kidney, cream mottled, and red mottled beans. Despite tradition positively influencing choice to consume red kidney beans, results from the outcome regression showed a negative relationship. Respondents that grew up in families that consumed a lot of red kidney beans were associated with a 0.62 kilogram decline in quantity of red kidney beans consumed. Some respondents reported that they ate beans too much and too often when younger, whether during their time in boarding school or the time they were living with their parents, and did not want to eat that particular bean anymore.

4. CONCLUSIONS AND RECOMMENDATIONS

This study was aimed at evaluating factors that influence choice of common bean and the extent to which these factors influence the level of consumption of preferred common bean varieties. Understanding what drives choices of beans and how to increase consumption of beans will be useful for guiding efforts to promote healthier diets among urban households in Malawi, as well as increasing the production and market availability of beans, improving the welfare and diets of smallholder farm families producing the beans as well. Using a Craggit model, the study has provided evidence to suggest that both common bean attributes and socio-economic and demographic factors influence the choice that consumers make regarding whether to consume a particular variety of common bean, as well as the quantities consumed.

Results from the present study were consistent with other studies that looked at factors influencing demand of common beans in Malawi. Fast cooking time, larger grain size, and good gravy quality was found to significantly influence choice and the quantities of common beans consumed. In addition, consumers who traditionally ate beans growing up were more likely to continue eating beans with similar qualities. Socio-economic and demographic variables also significantly influence the choice of dry common bean as well as the quantities consumed. These are factors which have not been extensively explored by other research looking at common bean consumption in Malawi considering that most common bean research in Malawi focuses on production of common beans (Chirwa and Phiri 2007; Muthoni et al. 2009, Kambewa 1997). Even though consumers regard common beans as a cheaper alternative to fulfill their food requirements, results indicated that an increase in income was associated with an increase in quantity of common beans consumed. This signifies that consumption of common beans is not only for those with low incomes. It was also interesting to note that, despite recommendations by health organizations to incorporate common beans in complementary feed for children under the age of 5 years, the number of young children in a household was found to be a factor that is negatively associated with consumption of common beans. Efforts to promote improved diets for young children are required, with increased consumption of bean being among the strategies that can be pursued.

Results from this study have shown that red kidney bean is the most preferred bean variety. In addition, generally consumers prefer common beans that cook faster, are larger in size, and which that give good gravy. Therefore, focusing breeding efforts on common beans with such superior attributes will result in higher production and increased availability of preferred beans varieties on the market, hence, translating into improved diets for urban consumers.

Even though the study has highlighted factors influencing choice and quantities of common beans consumed, there is need for more comprehensive studies that will look at the contribution of common beans to household food security and nutrition outcomes. Additionally, despite common beans being important for improved nutrition, the study results showed that an additional child under the age of 5 years in the household was associated with a reduction in the quantity of common beans consumed. Future research should seek to understand the dynamics of household common bean consumption and under-five nutrition. Moreover, the study was done in Lilongwe city, so should be replicated in the other cities of the country. Comparing findings across cities will broaden the knowledge of farmers in targeting their produce in these cities. Finally, while descriptive statistics (not included in this analysis) show that wealthier households also had higher average expenditures on other food products than common bean, such as beef and vegetables, an important shortfall of this study is that it did not focus on the quantities of other food items consumed at the household level. Future studies need to adopt a broader household food system to better understand demand for and substitutions between different foods, including common bean, by urban households in Malawi.

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