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Food security in Zimbabwe: Demand for African indigenous vegetables

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Abstract

African Indigenous Vegetables (AIVs) are mostly leafy vegetables traditionally grown throughout Africa. Since they are domesticized versions of wild plants growing naturally throughout the continent, they are excellently adapted to the climate of the region they are growing in. Furthermore, they are rich in minerals and micronutrients and have therefore a large potential for alleviating hunger and malnutrition in Africa. Although they have a significant role in the traditional diets of many countries, economic development and change of values challenges the use of these vegetables. Little is known about consumer attitudes towards AIVs. Therefore, we analyse determinants of AIVs demand based on a consumer survey in Zimbabwe. The survey was conducted in four districts of varying prevalence of food insecurity. We analyse the relationship between household income and AIVs consumption. Second, we examine the effects of the geographical location of the household as an indicator of the socio-economic environment it is living it. Third, we explore consumers' attitudes. Regions of lowest economic development and highest food insecurity show highest levels and variations in AIVs consumption. AIVs consumption rises the lower the income and the higher the age of the respondent is. Only for AIVs species play a significant role in consumption in Zimbabwe; these are Spider flower, Pumpkin, Cowpea and Okra. Socio-economic factors like age, income determine the quantities of the consumption of AIVs.

1 Introduction

African Indigenous Vegetables are plants which originate on the continent and have a long history of cultivation and domestication to African conditions and use (Ambrose-Oji, 2009: 10). They are often more resilient to adverse weather conditions than that of staple crops and exotic vegetables. As a result, African Indigenous Vegetables (AIVs) can important contributions during seasonal vegetable production gaps, poverty and food insecurity reduction and can provide a 'safety net' during periods of other food shortage caused by crop failures. Schippers (2000:4) argues AIVs can contribute to a more balanced diet and significantly improve food security for household in urban and rural communities.

Throughout history, AIVs play a significant role in the daily diet of many people in Zimbabwe. It is estimated that during rainy season, more than 75% of the population use fresh AIVs, (DFID project 2309, 2003:2) and during 4 months of the dry season. The frequency of consumption is at least twice per week (Orchard and Ngwerume, 2003:5). However, the potential of AIVs for food security and healthy nutrition is often ignored and received little recognition from the government/ local authorities/ development agencies (Maroyi, 2013:2).

In Zimbabwe, statistics from the FAO (2015:10) indicate average consumption of vegetables is about 30g per capita per day far below the recommended of 400g. The possible reason for low per capita consumption prevalent in Zimbabwe could be resultant of lack of the government initiative or raise awareness on vegetables consumption to improve people's health, food security and farmers' incomes. Government initiatives or awareness increased popularity of AIVs in Zimbabwe. One such initiative, the National Food and Nutrition

Security Policy. It is mandated to promote a multisectoral approach to address food and nutrition, especially for the most vulnerable, and the establishment and strengthening of national structures responsible for food and nutrition security. Garwe et al. (2008:25) find in the past 10 years the AIVs have become increasingly popular even in urban areas due to advocacy regarding their beneficial nutritive properties particularly in HIV and AIDS programmes. However, the success of these initiatives will depend on how effectively they can address the constraints to consumption among the consumers (WHO, 2015:4).

What are the factors that shape consumption of AIVs? WHO (2005:10), argues that consumer preferences shape the decisions that the consumers make regarding what they choose to purchase or consume. Recent studies Orchard and Ngwerume (2003:5), have revealed high demand of AIVs in Zimbabwe. Despite this study research on consumers preferences, perceptions and attitudes towards AIVs in Zimbabwe is missing. Therefore, in the current study we mainly focus on understanding the demand for AIVs, that is, consumers' preferences, perceptions and attitudes, with side focuses on food security and healthy nutrition. These determinants may support or hinder purchase of AIVs and use in their households' diets. Gathering detailed empirical information is a pre-condition for the development of appropriate policy measures for stimulating production and consumption of AIVs in Zimbabwe and across SSA in general. It also suggests that research and socio-economic interventions by national governments or international institutions aiming at improving food security and the quality of the diet may profit. The consumption of AIVs is crucial for Zimbabweans as these vegetables may grow naturally and they have high nutritional value. In addition AIVs serve as a means to increase the food security of households following the increased financial constraints that many people face in the country. This indicates that AIVs are becoming important food crops and have in recent times attracted international spotlight because of their extreme importance in human nutrition. In particular, they provide essential micronutrients, photochemical, antioxidants for a balanced diet.

AIVs are mostly cooked and consumed accompanying the staples. Maize is the staple food in Zimbabwe, however, is generally low in micronutrients. Approximately one in every three children under the age of five years in Zimbabwe is chronically malnourished (UN, 2010:40). The major causes of malnutrition are multiple but access and intake of adequate nutrients is clearly part of the problem. Micronutrient deficiencies are often referred as hidden hunger, as they can occur within the context of adequate energy intake and are a key developmental challenge (FAO et al., 2012:21). Nevertheless, Zimbabwe has high HIV/AIDS rate, with prevalence rate at 14.7 percent (UN, 2010:40). Consumption of AIVs can be therefore important to alleviate malnutrition, improve nutrition and help to alleviate HIV/AIDS (Yang and Keding, 2009:106), supplement medicinal therapy in fighting HIV/AIDS (Friis, 2006:1849). AIVs are excellent sources of vitamins A and C, and iron, as well as protein, minerals and fibre (Oluoch et al., 2009: 169), can therefore, be important for people without access to meat or other sources of protein (Schippers, 2000:14).

Poverty is a major driver influencing the country's food insecurity and nutritional situation. Currently, 72% of the population live below the national poverty line (less than USD 1.25 per day) (WFP, 2015:2). Poverty line (PDL for July at $495) represents the cost of a given standard of living that must be attained if a person is deemed not to be poor. Poverty in rural

areas has been increasing for the past decade (from 63% in 2003 to 76% in 2014). The food security situation in Zimbabwe is positioned as part of a larger economic decline, low agricultural productivity and deteriorating standards of living (Zimbabwe country analysis, 2014:59). Most of the households in rural areas buy food, because they cannot produce enough food to meet their needs. Considering food markets depend heavily on world market prices, considerable rises in world market price can threaten food security for developing countries, transferred to their poor people. As a result many people in rural areas struggle to meet their daily food needs.

There is a high variation in AIV species used in the regions of Zimbabwe. Examples are: Pigweed, Poor man's spinach, Black jack, Spider flower, Jute, and Cowpea. The most preferred AIVs include Spider flower, Pumpkin and Cowpea (Mukwereza, 2002:14). The main production period of AIVs is during rainy season (October to March). Both fresh and processed AIVs are marketed. Processed AIVs are dominating the AIV sales during dry season (April to September, we refer to it as 'off season).

This paper is structured as follows. In section 2, we described the methodology of the study. Section 3 reports the results. The final section discusses the findings and draws conclusions for the determinants of AIVs demand in Zimbabwe.

1.2 Literature review

AIVs are mostly grown in rural areas. They contribute substantially to household food security and income. In particular, people in the rural communities (Maroyi, 2011:506). Of late, it has been realised that the trade and consumption of AIVs is increasing significantly amongst the urban population (Orchard and Ngwerume, 2003:2).

Whilst there are numerous reports on the decline of traditional foods, particularly indigenous vegetables across Africa (e.g. Pasquini et al., 2009:177) these changes might be regionally differentiated. There are examples of exceptions to these general patterns. Gockowski et al. (2003:221), for instance, reported that species such as amaranth, cassava, nightshade and jute mallow are still widely produced and consumed in urban and peri-urban areas of Yaoundé – Cameroon, contrary to patterns observed in other African cities. In other African cities, the exotic vegetables are reportedly replacing the indigenous species. However, Schippers (2000:1), in his recent book, reported a rapid and significant change towards African traditional sources of food. This change reverses an earlier decline in the use of indigenous crops. This pattern of change is also reflected in Zimbabwean markets. The formal markets e.g. retail outlets, supermarkets, are now trading in AIVs (Orchard and Ngwerume, 2003:2).

The previous observed decline in demand for AIVs possibly reflects earlier reports by Pasquini et al. (2009:177). They reported rapid changes in food habit. Similarly, consumers' changes of preferences perhaps affect the AIVs consumption significantly. AIVs often have a more bitter taste, cook more time than exotic vegetables (Ambrose-Oji,2009:11). People have gradually adopt to lifestyles with less time for household work (FAO et al., 2012:25), hence, they prefer the vegetables that are quicker to cook and prepare. Some authors, e.g. Odhav et al. (2007:430) attributed the decline for AIVs to ignorance among the young generation. In particular, lack of information on the nutritional value of AIVs and the knowledge on how to

prepare them. Muhanji et al. (2011:194) reported that the middle to high income earners particularly the urban dwellers, consumed little in fear of risking their health. These consumers believed that most of the vegetables were grown with untreated sewage along open sewer lines or near sewage treatments plants. However, they reiterated that these consumers were optimistic that if AIVs were grown and handled in a cleaner way and sold in formal markets, they would definitely consume them.

Contrary to the previous view, a research conducted by Abukutsa-Onyango (2007:1) in Kenya on seed, highlighted that communities in western Kenya valued AIVs for their taste, nutritional qualities and medicinal properties. Similarly, studies focusing on AIVs in Zimbabwe, highlighted the importance of several socio economic factors in determining the AIVs consumption. These include: nutritional security, improved food security, improved health and income generation (Maroyi, 2011:508). For instance Mukwereza (2002:9) reported that nowadays the medical doctors and health centres recommend some of the patients to take AIVs in their diets. In particular, patients with HIV/AIDS and high blood pressure related illness. Probably, to manage HIV/AIDS. Zimbabwe has high HIV/AIDS prevalence rate (UN, 2010). Hence, promoting indigenous crops has been considered a crucial factor in the development of resilient and sustainable farming systems and can eliminate malnutrition and promote healthy diets particularly for Africa (Ngugi et. al., 2006:1).

The AIVs contribute significantly to improved nutrition, food security, incomes and overall livelihoods for rural and urban poor (Ngugi et al., 2006:2). A study in Tanzania, found that AIVs, on average, contributed approximately 13 percent of all household income of farmers (Weinberger and Msuya, 2004:49).

2 Methodology

2.1 Sampling strategy

The sample was drawn using a multistage sampling procedure, stratified into rural and urbanized region, the later containing the national capital, Chinhoyi-Makonde and growth points and sectors in the districts. Growth points are settlements meant to provide employment in rural areas and improve the local economy to curb rural-urban migration. The sectors are a combination of resettlement areas which are more like rural but they own more assets than people in the rural areas, commercial farming areas.

Figure 1 shows the spatial distribution of food insecure rural population among the districts of Zimbabwe as well as the geographical location of the study areas. Most of the districts show high levels of food insecurity, that is, 10 to 50 percent of the rural population in food insecure. In the north of the country and around Harare the food situation is best. Largest problems exist in Binga, Mbire, Chivi and Beitbridge. The south of Makonde district is food insecure, whereas its north, where we conducted the survey, is moderately food secure.

The survey was conducted in Binga, Mbire, Makonde and Harare districts. In the first stage, the districts were purposively selected to represent areas that are severely food insecure to highly food secure (Figure 1). Binga district is highly and perennial food insecure, followed by Mbire district, whereas Harare and the selected part of Makonde are highly food secure. Binga is characterised by highly erratic and low rainfalls (less than 450 mm/year) and poor

soils. Mbire receives 450-650 mm/year rainfall with frequent seasonal droughts and severe dry spells during the rainy season. In Harare and Makonde rainfall ranges from 750 to 1000 mm/year and is very reliable. Soils in both districts are of good quality and therefore suitable for intensive cropping and livestock production (Vincent and Thomas, 1961).
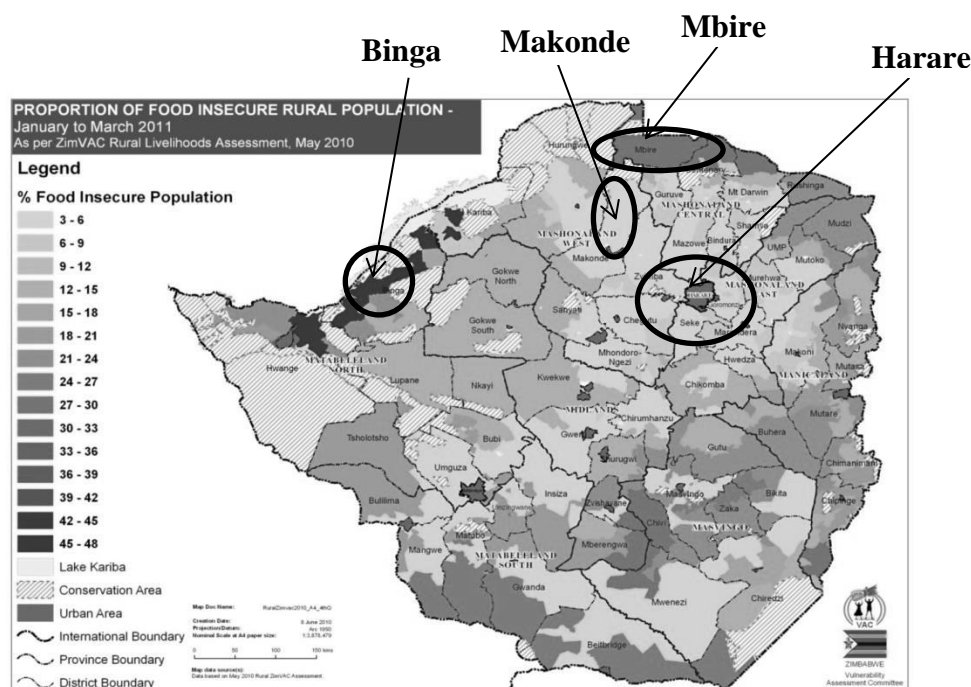
Figure 1 Rural food insecurity in Zimbabwe and the survey areas

Source: FAO (2010:30)

Table 1 shows the socio demographic data of the districts surveyed. Harare is by far most densely populated while population density is much lower in the other 3 districts. Since Harare is the capital city of Zimbabwe, people tend to migrate in search of employment. Outside Harare, the lowest incidence of household poverty is found in Makonde. The geographical pattern of poverty and therefore food insecurity is partly explained by the degree of rurality, proximity to major urban cities and influenced by rainfall patterns. Table 1 suggests that poverty is far worse in sparsely populated districts which are mostly rural. Binga has highest poverty rate, followed by Mbire. The capital has lowest prevalence of poverty among the four districts of interest. Table 1 also shows the distribution of household sizes by district. Districts with higher household sizes tend to have higher prevalence of poverty.

Table 1 Socio-economic data of the districts surveyed

Variable	Harare	Makonde	Mbire	Binga
Inhabitants	1 468 767	148 819	81 908	138 074
Average household size	4.0	4.6	4.5	4.4
Population density	2406/ km^2	25/ km^2	40/ km^2	10/ km^2
Area	960.9km^2	8 564.17 km^2	4 695.87km^2	15 000km^2
Distance to Harare (tarred)	-	157km	283km	852km (via Bulawayo)

Average monthly income	US$475.25	US$308.41	US$271.56	US$304.01
Poverty rate	31.6%	73.5%	81.0%	88.3%
Major ethnic group	Zezuru	Korekore	Korekore	Tonga
Annual precipitation (per year)	750-1000mm	750-1000mm	450-600mm	>450mm
HIV/AIDS by province	13%	15%	14%	18%

Source: Census (2010:34); Poverty and Poverty Datum line Analysis (2011/12:48)

2.2 Survey structure

Data was collected using a structured questionnaire pre-tested on both rural and urban areas in March to June, 2015. The questionnaire contained a section with 33 socio-economic questions (ethnicity, household income, wealth etc.) and a section asking 27 questions on AIV purchasing habits. Most of the questions were closed while some responses were coded using a Likert scale from 1 to 5 with 1 for strongly decrease/very unimportant/completely disagree/never and 5 strongly increase/very important/completely agree/very frequently, respectively.

2.3 Data

The survey had 500 adult respondents. In each district 125 respondents were interviewed. We conducted the survey in August and September, 2015.

2.4 Determinants of AIVs demand

In economics demand is how much of the item one is willing and able to purchase, depending on a number of different factors. For example, consumer preference can determine whether the item is purchased or not. Some consumers probably care about how much an item costs when deciding how much to purchase and so on. Consumer demand analysis is primarily aimed at finding the relationships between consumption of certain commodities expressed in quantities or expenditures and the disposable consumer incomes. The consumer demand theory can be investigated using the traditional Engels' law. This theory states that the proportion of income spent on food declines as income arises. However, economists have made important contribution to this traditional theory, with the incorporation of socio-economic aspects. This study incorporates the socio-economic aspects to the economic demand model and the consumption of AIVs can be explained by:

$$C = \beta_1 + \beta_2 X + e \quad 0 < \beta_2 < 1,$$

Where C = consumption and X = Socio-economic variables, and where β_1 and β_2 are the parameters of the model (intercept and slope coefficient) and e is the error term. Which socio-economic factors support or hinder use of AIVs in the household diets?

Consumption of AIVs can be quantified or use the frequencies of consumption or add log to C and X, then, consumption can be measured in money terms, in that case then β_2 will be an elasticity. The consumption of AIVs can be explained using the following equation: C = A, G, GR, E, I, ED, U. Where C is the quantities of AIVs consumed by household per month, A is

age of the respondent, G is gender of the head household, GR denotes the residential location of the head household, E is the head household ethnicity, I is the monthly income of household, ED denotes the years of schooling, U is the degree of urbanisation of household.

The following socio-demographic variables are hypothesised to influence AIVs monthly consumption: household income, age, gender, level of education, ethnicity- including inter marriages, degree of urbanization, geographical location. Monthly household income was defined by nine categories and we used the upper border of each category as category: US$100, US$199, US$350, US$450, US$495, US$800, US$1000, and US$1001 for above US$1000. Ethnicity was represented by Zezuru, Korekore, Manyika, Karanga, Tonga, Ndebele and others. Six dummy variables were included to indicate ethnicity (Zezuru, Korekore, Manyika, Karanga, Tonga and Ndebele). One dummy variable was also included to indicate gender (Female). Harare, Makonde, Mbire and Binga represented geographical location, three dummy variables were included to indicate (Makonde, Mbire and Binga). Urban, growth point and rural represented classical location, and had two dummy variables differentiating the degree of urbanisation (growth point and rural).

Several socio-demographic variables were also included. For instance, in order to capture the effect of age on the consumption of AIVs, age was included. It is posited by Jansen van Rensburg et al. (2004:53) that the consumption of AIVs tend to be proportional to respondent age, the young respondents are the more likely to eat less than their counterparts. In contrast, those with more years of schooling were hypothesised to consume less AIVs, because they were associated with higher incomes, hence other sources of nutrients and a variety of food.

$C =$

$\beta_1 + X_{dummyMakonde}\beta_{dummyMakonde} + X_{dummyMbire}\beta_{dummyMbire} + X_{dummyBimga}\beta_{gummyBinga} + X_{dummyMakonde*dummyUrban}\beta_{dummyMbire*dummyGrowthpoint} + X_{dummyBinga*dummygrowthpoint}\beta_{dummyBinga*dummygrowthpoint} + e$ (1)

Where C = consumption (in kg/household per month). Harare were likely to consume less than their counterparts in Mbire, Makonde and Binga, because consumers have a variety of food and other sources of nutrition. Degree of urbanization was hypothesised to affect the AIVs consumption. Respondents in Mbire and Binga, predominantly rural with growth points considered as urban were likely to consume more AIVs than their counterparts (Harare- urban and Makonde- has a combination of rural and urban characteristics). e is the disturbance term.

$C =$

$\beta_1 + X_{dummyMakonde}\beta_{dummyMakonde} + X_{dummyMbire}\beta_{gdummyMbire} + X_{dummyBimga}\beta_{gummyBinga} + X_{dummyMakonde*dummyUrban}\beta_{dummyMbire*dummyGrowthpoint} + X_{dummyBinga*dummygrowthpoint}\beta_{dummyBinga*dummygrowthpoint} + X_{income}\beta_{income} + e$

(2)

We included household income in the model. The variable income reflects the basic economic condition of the household. Incomes ranging until US$495 fall below the poverty line. Empirical study suggested that the consumption of AIVs tend to be inversely proportional to household income, the poor the households (that is low income) the more likely to eat more

AIVs than their high income counterparts (Jansen van Rensburg et al., 2007). It was therefore hypothesised that the household income would positively affect the AIVs consumption.

3 Results

Firstly, we carried a frequency analysis for the variables that we intend to include in the analysis. The results are presented in table form and box plots. Summary statistics and variables descriptions are presented in Table 2 and Figures 2 to 5.

3.1 Descriptive analysis of socio-economic characteristics of the sample

Table 2 shows descriptive statistics of the frequency of values for each variable used for the analysis. Table 2 shows respondents' age on average was 41.01 years. There were predominantly household heads (57%) and spouses (30.6%) with a mean of 11.21 years of schooling, which is equivalent to a secondary school level. These categories were responsible for decision making on shopping, amount spent on vegetables, households diet and type of vegetables the households ate. The average household size was 6 members. The mean household income was US$406.17 per month, 17.9% below poverty line. The average household monthly expenditure on AIVs is US$10.35 and each household consumes 1.1251kg of dried AIVs per month.

Table 2 Descriptive analysis of socioeconomic characteristics of the sample

Variable	Definition	Mean	Median	Min.	Max	Range	STD	CV
Age	Age of the respondent	41.01	39.00	18	85	67	12.21	0.30
Gender	1 if the head of hh is female	0.26	0.00	0	1	1	0.44	1.69
Educ-yrs	Number of years of formal schooling	11.21	11.00	0	19	19	4.66	0.42
hhsize	Household size (number)	5.59	5.00	1	24	23	2.54	0.45
Income	hh monthly income in US$	406.17	350.00	100	1001	901	302.37	0.74
Expenditure	Total monthly expenditure on AIVs in US$	10.35	8.00	0.00	80.00	80.00	9.77	0.94
AIVs consumption	Total monthly consumption in kg/hh	1.1251	0.480	0.00	21.60	21.60	2.21	1.97

Source: Authors

3.2 AIVs consumption and expenditure

The box plot in **Figure** 2 shows descriptive statistics of the consumption of AIVs in kg per household. The median is 0.48, which is equivalent to the daily consumption per person recommended of 400g. For the AIVs to be realised for food security, there is need for intensive promotion on the consumption perspective. At least 75% of the household in our study consumed at least one kilogram of AIVs per month.
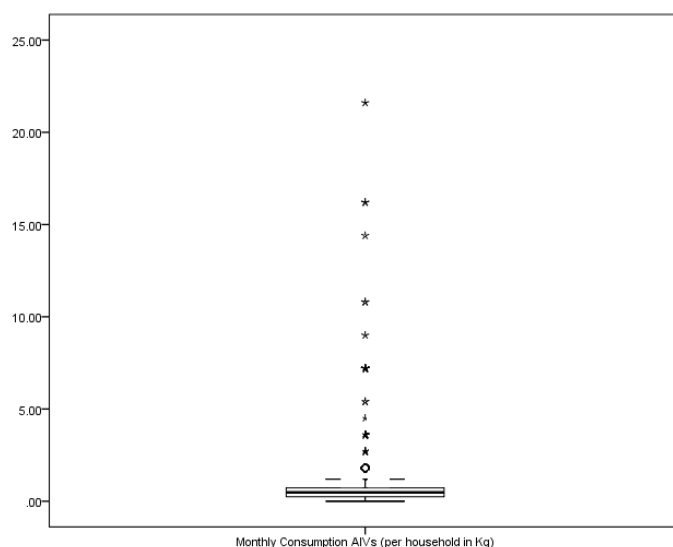
**Figure 2 Average AIVs consumption per household**

Source: Authors

Figure 3 shows the trends for the consumption of AIVs in kg/household by district. A strong difference between Harare and Makonde at the one side and Mbire and Binga on the other becomes apparent. The two poorest districts, Mbire and Binga show highest levels and variations in consumed AIVs quantities. In Mbire and Binga, more people consumed AIVs, with quantities larger than the median. The low income shown on Table 1, gives a possible explanation for high consumption of AIVs in Mbire and Binga, whereas respondents with high income can afford other alternative vegetables such spinach. Binga and Mbire receive below normal annual rainfall, as such face great challenges in food security.
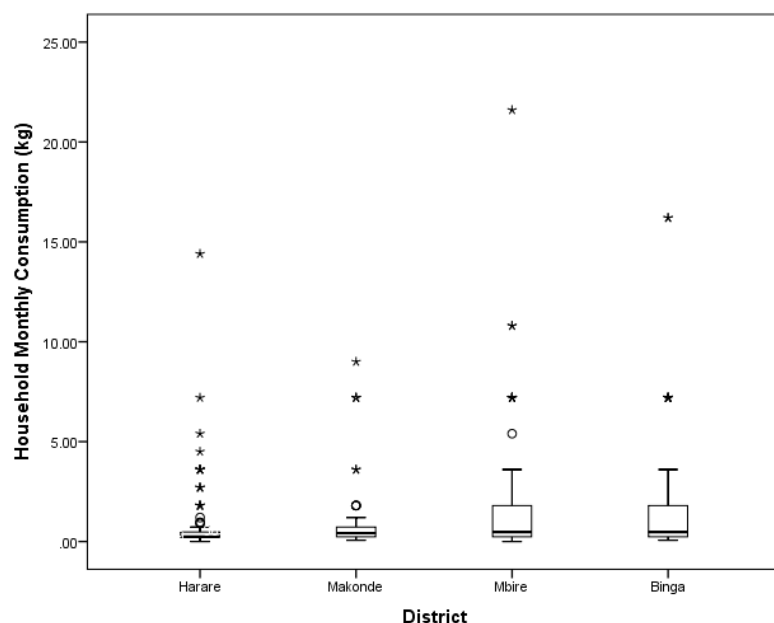
**Figure 3 Average AIVs consumption household by district**

Source: Authors

Error! Reference source not found. represents the results for the average monthly income. The median for the household monthly is US$350. On average each household has an income of US$406.17/month, which is 17.9% below the poverty line. Poverty line is presented by the line across the figure. At least 75% of the household monthly incomes are below US$600. Our results are in support of the average household incomes presented in Table 1.
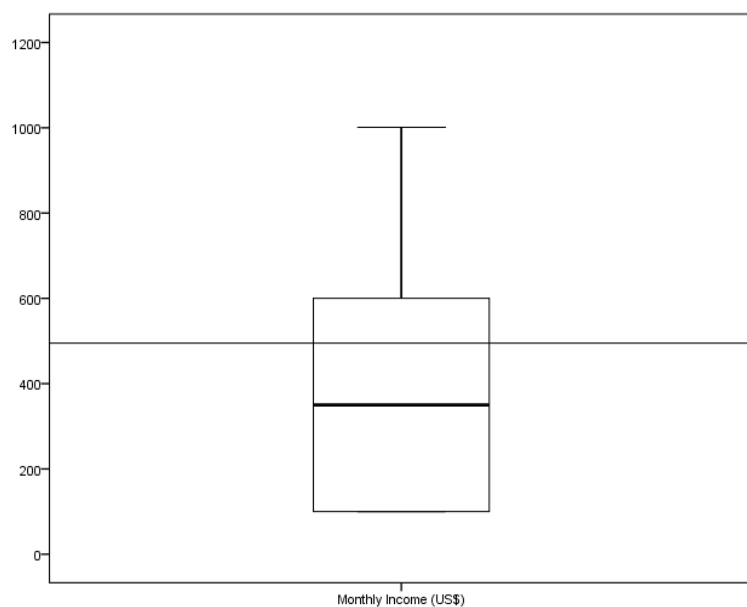
**Figure 4 Average monthly household income**

Source: Authors

The box plot in Figure 5 shows descriptive statistics of the household income by district. There is a clear progression from higher to lower household income associated with the degree of rurality, in medians. In particular, Harare, Mbire and Binga. Poverty line cuts across the graph. About 75% of the household incomes in Makonde fall below the poverty line. Almost 75% of the incomes in Harare are above the poverty line. Binga is the poorest district, show least average household incomes and highest levels and variations in incomes.
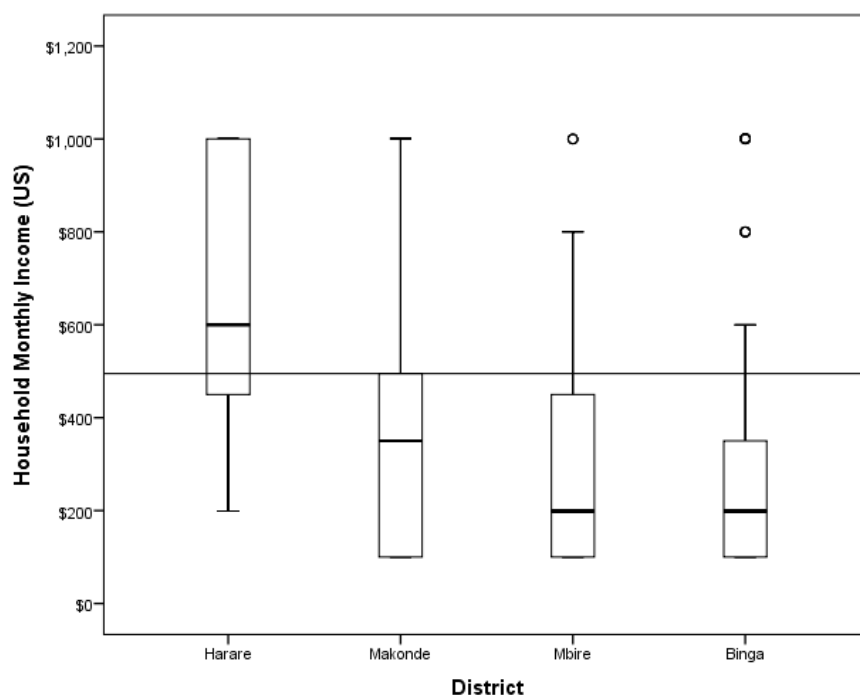
Figure 5 Household income by district

Source: Authors

Figure 6 shows the trend of monthly consumption by age of respondent. As expected, the consumption increased with age increase, except for the age 18 years. The respondents at the age of 18 were mostly dependents e.g. the children, they were not responsible for the household diet decisions. Hence, they were responding on behalf of the head household.
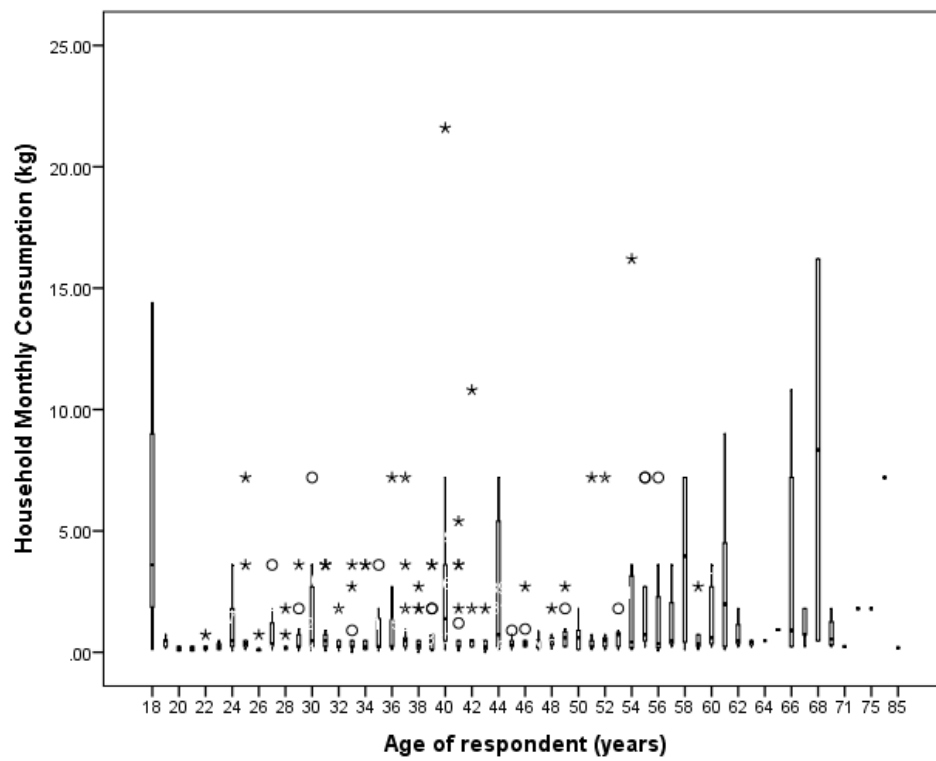
Figure 6 Mean Consumption Quantity by Age
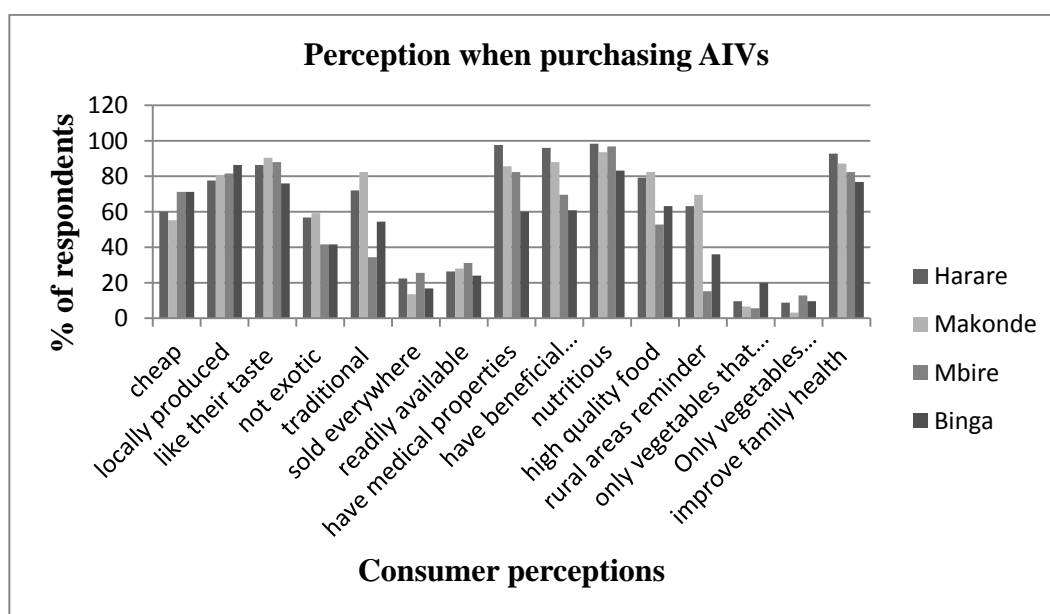
Source: Authors

3.3 Determinants of purchasing and consumption of AIVs

To provide policy recommendations that promote the consumption of AIVs and to help address micronutrients deficiency problems in Zimbabwe, it is imperative to have a clear understanding the determinants of the most important factors that influence AIVs purchasing and consumption by households.

Hence, secondly, consumers were asked to rate the characteristics based on their perceptions, attitudes and important characteristics which include price, freshness look, taste nutrition and health. The rating was based on a Likert scale ranging from completely disagree (1) to completely agree (5).

3.3.1 Consumer perceptions when purchasing AIVs

The definition of the "most important factor" was defined by the number of consumers responding to the top (4-5) scale levels, i.e., agree and strongly agree. Figure 7 shows the perceived important factors by district. A strong difference between Harare and Makonde at the one side and Mbire and Binga appears, because of income differences within the four districts. In particular, beneficial properties, improve family health, nutritious and high quality food. The two poorest districts Mbire and Binga show highest levels and variations in perceptions.


Figure 7 Consumer perceptions purchasing AIVs by district

Source: Authors

3.3.2 Consumer attitudes toward AIVs

The total percentage for freshness defined by the number of consumers responding to the top (4-5) scale levels, i.e., agree and strongly agree was around 23%, Figure 8. Less 10% respondents consumed AIVs, they did not afford to buy meat. Other attitudes towards AIVs as rated by respondents included; tenderness, health reasons, nutritional awareness, organic and if they are preferred by their households.

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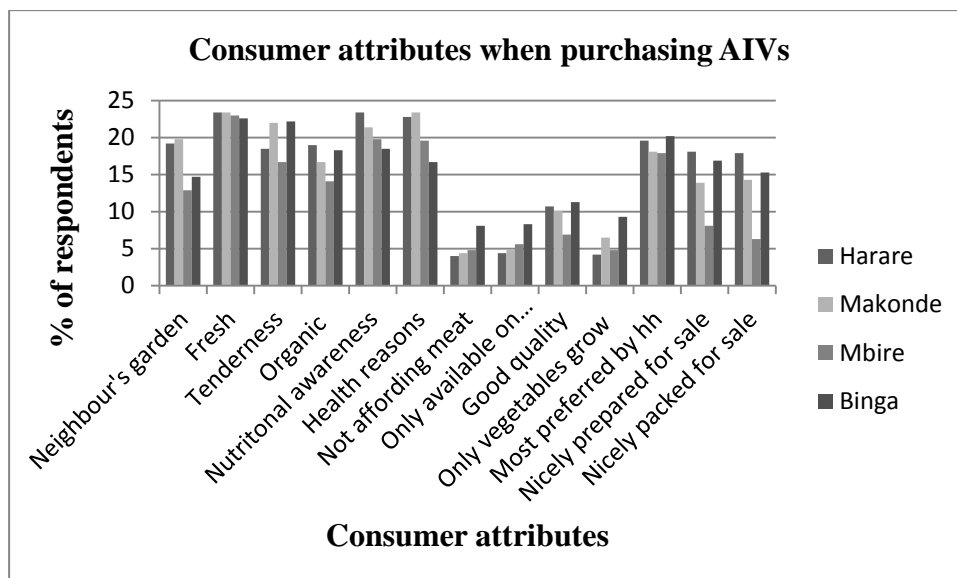
Figure 8 Consumer attitudes toward AIVs by district

Source: Authors

3.3.3 Consumer preferences on AIVs

To determine the most important factors that influence choice, consumers were given a list of AIVs and asked to choose the most preferred AIVs by their households. The results in

Figure 9 show the preferred AIVs by % respondents of the four districts. The results show that the most preferred AIVs in descending order of the mean % respondents preference are Spider flower (38%), Pumpkin (27.8%), Cowpea (14.8%) and Okra (10.2%) throughout all the districts. The results also show that Binga has the highest % respondents preferring Spider flower (52.8%), Mbire has the highest % population preferring Pumpkin (36.0%), Makonde has the highest % population preferring Cowpea (20.8%) and Harare has the highest % population preferring Okra (12.8%). Harare, Mbire and Makonde all share Spider flower as the most preferred AIV in those districts and Mbire has Pumpkin as the most preferred AIVs.
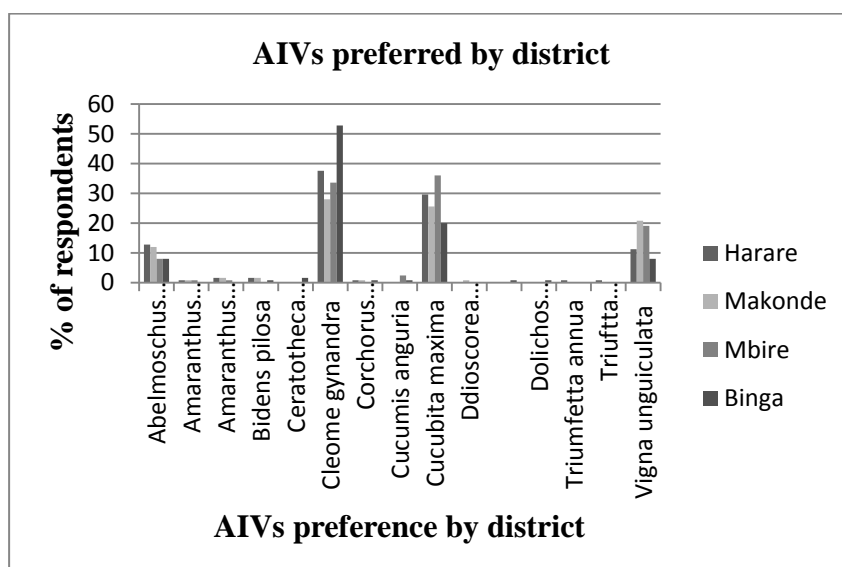
Figure 9 Preferred AIVs by district

Source: Authors

3.3.4 Consumer preferred purchasing sources of AIVs

To determine the most important preferred market channel to obtain AIVs, consumers were given a list of existing market channels including markets in their respective areas and asked to choose the most preferred market channel to obtain AIVs.

Figure 10 shows the preferred markets by district. The results show that people in Harare prefer to purchase their AIVs from Mbare Musika farmers market (approximately 43.0%) followed by Supermarkets (approximately 27.0%). For Mbire, Binga and Makonde,

Figure 10 shows that most people prefer to grow their own AIVs in their gardens (approximately 72%, 77% and 50% respectively). In addition the second highest % population bar (approximately 21%) for Makonde shows that people also prefer to purchase their AIVs from farmers markets.
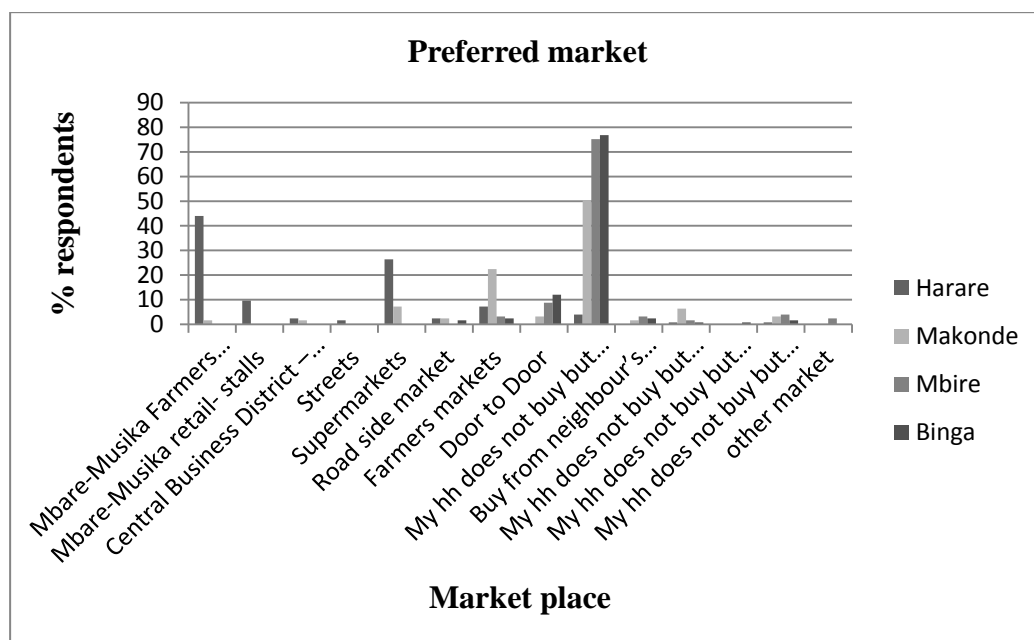

Figure 10 Preferred purchasing sources of AIVs

Source: Authors

3.4 Household income and expenditure

### 3.4.1 Average AIVs consumption household by monthly income

Figure 11 shows the consumption of AIVs by income. As the household increased, the consumption of AIVs decreased. Households with higher incomes consume less AIVs than lower incomes. The possible reason, the households with higher incomes can afford purchasing a variety of vegetables.
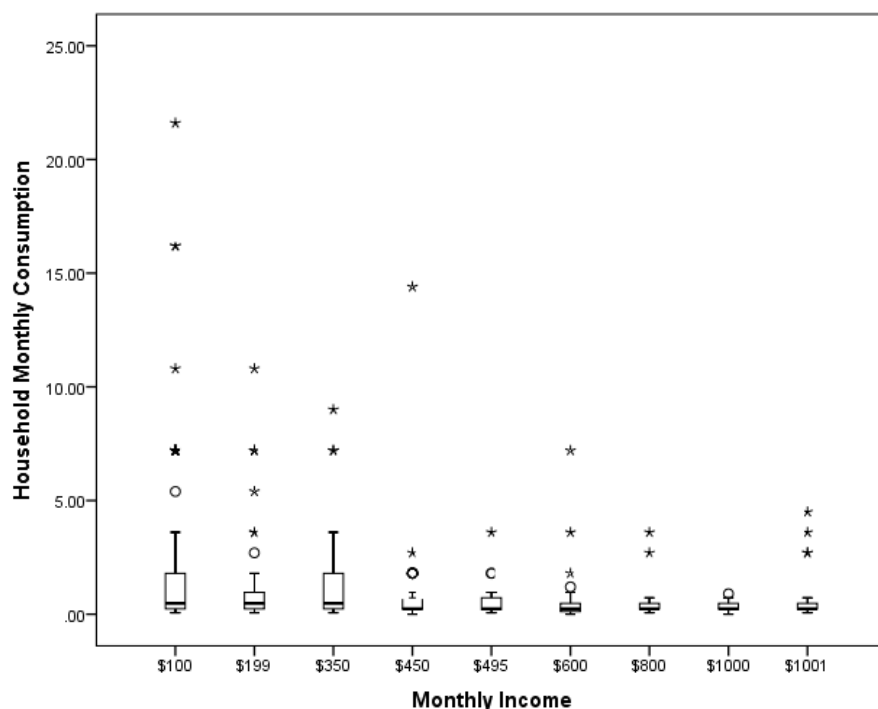
Figure 11 Mean Consumption Quantity by Monthly Income

Source: Authors

The results presented in Figure 12 indicate the household monthly expenditure on AIVs by district. There is strong difference among the districts, in medians. Binga show the least median. The monthly expenditure on AIVs in Binga relative to other district is very low. At least 75% of households in Mbire, Binga and Makonde have monthly expenditure less than US$20.
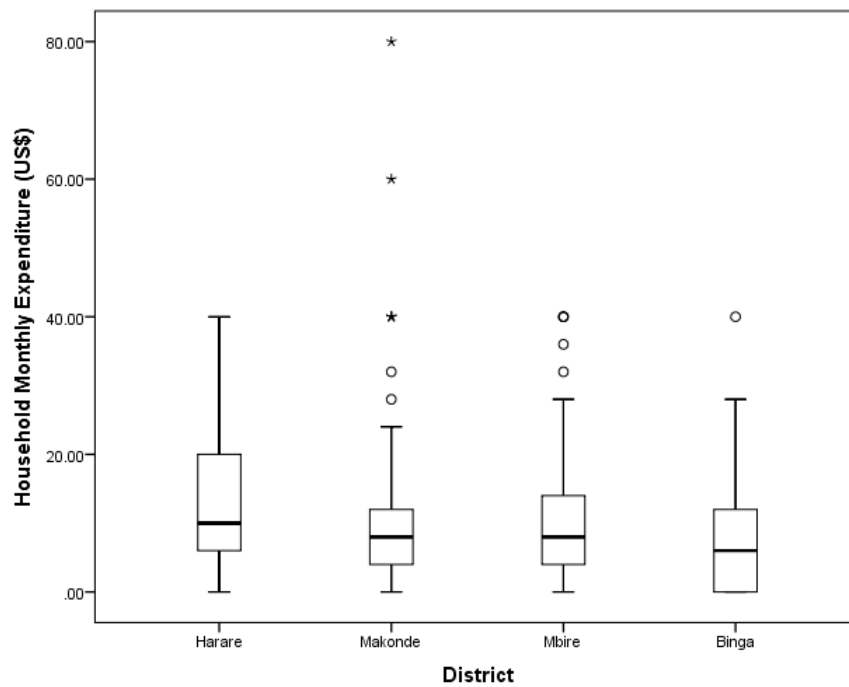
Figure 12 Household monthly expenditure on AIVs by district

Source: Authors

We analysed monthly consumption of AIVs using the frequency data. The frequency of consumption variable was collected as an ordinal variable in the data collection stage. Respondents had the choice of seven frequency options from which they would identify how often they consumed AIVs. The scale of for which the frequency of consuming AIVs was from one to seven, presentation details:

1. Less than once per month
2. At most twice per month
3. At most once per week
4. Every second day
5. Once every day
6. Twice every day
7. Three times everyday

The results are presented in Figure 13. The frequency of consumption AIVs per household by district is relatively low. Our survey results show that the majority of the households consumed AIVs at most once per week, followed by at most twice per week.
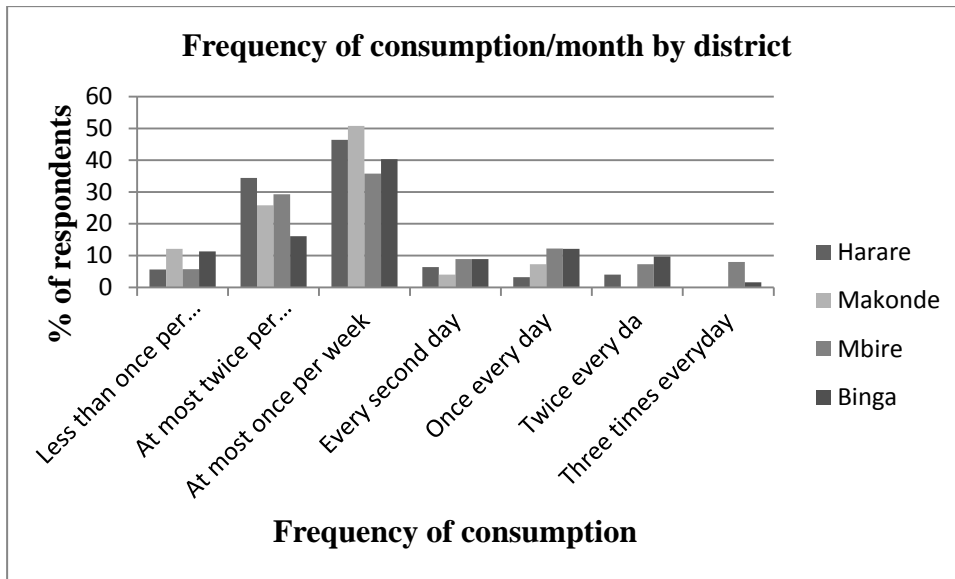
Figure 13 Frequency of consumption per month by district

Source: Authors

We used Chi-square to determine if the frequency of consumption differs between the four districts. χ^2 (18) = 44.546, p=0.00 (p<0.05). There is a statistically significant difference in the frequency of consumption between the four districts.

3.5 Factors influencing AIVs consumption

3.5.1 Descriptive analysis between monthly household consumption and districts

It was hypothesised that variation in AIVs consumption would exist across geographical regions and racial groups, hence included in the model as explanatory variables. We conducted a descriptive analysis between AIVs household monthly consumption and districts. The results are presented on Table 3. Makonde had the least mean (0.73kg), followed by Harare (0.79kg) whereas households in Mbire and Binga had means of 1.52kg and 1.46kg respectively.

Table 3 Descriptive analysis of monthly AIV consumption (kg/hh) by district

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Harare	125	.79	1.670	.149	.50	1.09	0	14
Mbire	123	1.52	2.841	.256	1.01	2.03	0	22
Binga	124	1.46	2.544	.228	1.01	1.92	0	16
Makonde	124	.73	1.383	.124	.48	.98	0	9
Total	496	1.13	2.215	.099	.93	1.32	0	22

Source: Authors

We did the ANOVA table analysis to determine if the means were statistically different. There is statistical significant difference between the groups $p =0.003< 0.05$ at 95% confidence interval. Therefore, we concluded that significant were exhibited among the districts.

3.5.2 Coefficient of the mean household consumption by district using OLS estimates

Table 4 indicates the difference between the mean of household consumption of the four district samples explained by 2.7% of the variation in consumption. The Constant coefficient shown in Table 4, is an estimate of the mean consumption (kg/hh) of respondents in Harare and is 0.793. The mean household consumption of AIVs in Makonde is 0.063 lower than Harare. As expected the mean household consumption for Mbire and Binga is 0.726 and 0.671 higher than Harare, respectively.

Significant values shown in Table 4 also reveal that Mbire and Binga at $p =0.009< 0.05$, $p =0.016< 0.05$ respectively, at 95% confidence interval, mean household consumption are significantly higher than Harare means. Whereas, Makonde, had a negative coefficient, shows that at $p =0.821> 0.05$ at 95% confidence interval, the mean household consumption is not significant from Harare mean.

Table 4 Coefficient of the mean household consumption by district

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.793	.196		4.047	.000
	mbire	.726	.278	.142	2.609	.009
	binga	.671	.278	.131	2.417	.016
	makonde	-.063	.278	-.012	-.226	.821

a. Dependent Variable: Monthly Consumption AIVs

Source: Authors

3.5.3 Coefficient of the mean household consumption by district, classical location and income using OLS estimates

The monthly household income, classical locations namely growth point and rural, and Makonde exhibits negative coefficient. The variation in household mean consumption for the included variables can be explained by 6.8%.

Table 5 presents results for the second model, included the household income and classical location. The monthly household income influences the consumption of AIVs, $p = 0.023 < 0.05$ at 95% confidence interval. The mean household consumption is statistically different from the urban mean (constant), $p = 0.019 < 0.05$, at 95% confidence interval. However, the other remaining variables are not significant in determining the mean household consumption with the constant.

Table 5 Coefficient of the mean household consumption by district, classical location and income

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.467	.353		4.161	.000
	mbire	.745	.483	.145	1.543	.124
	binga	.685	.484	.134	1.417	.157
	makonde	-.256	.341	-.050	-.750	.453
	Rural	-.212	.407	-.048	-.519	.604
	Growthpoint	-1.228	.522	-.162	-2.351	.019
	Monthly Income	-.001	.000	-.137	-2.282	.023

a. Dependent Variable: Monthly Consumption AIVs

4 Discussion and conclusions

The study shows the rating of important factors when purchasing AIVs in Zimbabwe. AIVs were being perceived to be locally produced, to have medical and beneficial properties and were nutritious. Consumers also consumed AIVs because they are perceived to improve family health. Some consumers also rated taste as another factor when purchasing AIVs.

Mbire and Binga consumed more AIVs on average. The higher consumption quantities observed in Mbire and Binga, relate to how the AIVs can be important for improvement of food security in the two marginalized districts. Figure 1, depicts that the two regions are perennial food insecure. More so, Figure 5, shows that these two regions have low incomes, with most of the population surviving on incomes below poverty line, implying that they are unable to meet their most basic needs. Another possibility explanation in these two districts, they located in areas characterised with low annual rainfall, Table 1 this may result in perennial crop failures, hence people tend to rely on AIVs for food security. The results imply that Binga, though Figure 1, depicts it as the most food insecure districts of Zimbabwe, here in this study, Binga is more likely to food security compared to Mbire. However, Makonde and Harare households consumed on average 0.79kg and 0.73 kg of AIVs per month, respectively. A possible explanation for the two districts (Harare and Makonde) is these districts, particularly Harare is the capital city of Zimbabwe, Makonde is located in one of the most high potential areas in terms of agricultural productivity. Households in Harare may not rely much on AIVs for food security, but probably consume the AIVs for health reasons and diet diversity.

The results also demonstrate that a unit in change in household monthly income will decrease the consumption of AIVs. This is consistent with the postulation that income would have a negative and statistically significant impact on the consumption of AIVs, which means , the more the income the household have, the less willing to consume AIVs. Our study confirms the findings of Muhanji et al. (2011:194). One possible explanation cited by Muhanji et al. (2011:194) is the middle to high income earners particularly the urban dwellers, consumed little in fear of risking their health. Or the household with high income tend to have a variety of vegetables, hence they will not rely on AIVs for sources of nutrients. Empirical study suggested that the consumption of AIVs tend to be inversely proportional to household income, the poor the households (that is low income) the more likely to eat more AIVs than their high income counterparts (Jansen van Rensburg et al., 2007:318).

It is evident that the consumption of AIVs is positively influenced by age. This means that the older the age the more the consumption of AIVs. This implies that the younger people are more likely to consume less. This is consistent with the postulation that age would have a negative effect to consumption of AIVs. This is in support with FAO report that stated people have gradually adopt to lifestyles with less time for household work, they may prefer vegetables that are quicker to cook. Another possibility to low consumption by younger people, they may lack the knowledge on how to prepare the AIVs as supported by Odhav et al. (2007:430). They attributed the decline for AIVs to ignorance among the young generation. In particular, lack of information on the nutritional value of AIVs and the knowledge on how to prepare them.

Generally, there is great interest in the AIVs. The consumers show strong preferences on Spider flower (38%), Pumpkin (27.8%), Cowpeas (14.8%) and Okra (10.2%) throughout all the districts. However, consumers in Harare, Binga and Makonde preferred most Spider flower and Mbire has Pumpkin as the most preferred AIVs. However, most of the households in Mbire, Binga and Makonde preferred to grow the AIVs in their gardens.

AIVs should be included into the national programmes for the country to address food and nutrition insecurity. As it is mainly poor households areas with perennial food insecurity tend to rely more on indigenous crops found in their areas. It is more efficient to include these indigenous crops in the national programmes and to implement food security programmes targeting the poor. In particular, AIVs, because they provide much needed vitamins and contain medicinal properties. The Minister of Women Affairs, Gender and Community Development raised concern over the erosion of the AIVs germplasm, and said the nutrition unit of the Ministry of Health and Child Welfare should further extend the policy, not only from the point of view of HIV and AIDS cases but promoting a holistic approach to health for everyone. Food security in the areas of study can be improved by promoting the production of AIVs and consumption

Acknowledgement

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