Food Availability and Household Dietary Diversity in Ruiri-rwarera Area of Meru County in Kenya

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Abstract Food security broadly encompasses availability, accessibility and utilization of food. Household dietary diversity that relies on the number of food groups consumed over a given period has previously been used to measure food security. This study was conducted on 60 households who were randomly selected and data obtained through face to face interviews, structured questionnaires and key informant interviews in Ruiri-Rwarera Ward of Meru County in Kenya. The area being semi-arid receives average annual rainfall of about 700 mm with an elevation of 1100 metres above the sea level. Residents from this area mainly depend on subsistence agriculture for income and livelihood. Data from structured interview questionnaires was analysed using Statistical Package for Social Sciences (SPSS) software version 20.0 to establish the percentage frequencies, means and standard deviation. Chi-Square was used to test the significance of associations between variables. Household social demographic characteristics were investigated. The level of education, the size of household, time taken to the market, means of transport, land ownership, farm size, occupation, monthly income and their sources showed significant association with the number of food groups consumed by households ($p<0.05$). Location, marital status, household food expenditure, control of farming decisions, distance from the market, type of road network and nutritional status showed no relationship.

Keywords: food security, households, food groups, dietary diversity

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1. Introduction

Food security is a broad concept that includes factors related to the nature, quality, access and security of food supply [1]. The 1996 World Food Summit in Rome declared that *"food security exist when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life"* [2]. Food security largely depends on food availability, accessibility and utilization. Food availability is achieved when sufficient quantities of food are available to all individuals and largely depends on sufficient production of crops and livestock products. Food accessibility is attained when household members have enough resources to acquire food. Adult literacy has been reported to positively contribute to food accessibility. Utilization requires active health systems, sufficient energy from diet and access to clean water and sanitation [3].

Availability of food for consumption may be influenced by geographical location, seasons, preservation, distribution systems as well as income [4]. In rural areas, people mainly rely on what they produce for consumption [4,5]. Food insecurity therefore may mean a general failure of agriculture to produce enough food as well as failure of other livelihood activities, insufficient incomes from other sectors to guarantee access to sufficient food and poor development policies [6]. In Kenya, 12% of households have been reported to be food insecure. Majority of them showed unacceptable consumption pattern composed of three food groups (vegetables cooked with oil and consumed alongside a staple) [7].

Although household food access has been measured using household food consumption and expenditure [8], they may not be reliable in rural population that mainly relies on subsistence farming and spend considerably less on food [5]. Household dietary diversity that relies on the number of food groups consumed over a given period has previously been used to measure food security [9]. It considers food availability, nutritional adequacy as well as household access and income [3,10,11].

This study therefore aimed at determining food availability and household dietary diversity among rural population of Ruiri-Rwarera area of Meru County in Kenya.

2. Methodology

2.1. Study Site

This study was conducted in Ruiri-Rwarera Ward of Meru County in Kenya. Raw data obtained from a weather station in Ruiri showed that the area receives an average rainfall of about 700 mm per annum. The area is categorized semi-arid and is located 1100 metres above the sea level. Residents from this area mainly depend on subsistence agriculture for income and livelihood.

2.2. Study Design

The field survey was conducted among randomly selected households by face-to-face interviews using a structured questionnaire. During the survey, data on demography and socio-economic characteristics were obtained. Household dietary diversity score sheet was used to collect data on food groups consumed in the past 24 hours.

2.3. Estimation of Sample Size

This study was conducted on 60 households based on reference [12] where the authors anticipated that if a problem exists with 5% probability in a potential participant, then the problem will almost certainly be identified in a pilot study involving 59 participants with 95% confidence. This study being a pilot study of a larger study covering various agro-ecological zones of Meru County therefore considered 60 participants.

2.4. Sampling Unit and Target Population

The household (HH) was considered as the sampling unit in this area and a household member was defined as a person who has lived in the household for at least 3 out of the past 12 months and who normally eat food served from the same pot [13].

The study targeted a member of the household most responsible for meal preparation for the family which was mainly women. Only female participants with good hearing and memory, residing permanently in the household, understanding the questions and willing to participate were sampled [14].

2.5. Sampling Procedure

Household survey participants were selected from the two study locations. Households were sampled by stratified random sampling. The sample size of 60 households was proportionately distributed among two study locations. The survey was conducted by face-to-face interviews using structured questionnaire. An informed verbal consent was obtained from each participant.

Each focus group discussion (FGD) was composed of 6-10 participants from participating households, a research assistant and a moderator. A maximum of 10 participants were recruited from each location. A focus group discussion guide was used during discussions. All participants gave an informed verbal consent before the discussions commenced.

The key informant were sampled purposively to include the representatives from the various categories of institutions and people with knowledge on food security issues in the area. These included farmers, religious leaders, administrative leaders, health practitioners and teachers. Each participant gave an informed verbal consent.

2.6. Data Processing and Analysis

Data from structured interview questionnaires was analysed using Statistical Package for Social Sciences (SPSS) software version 20.0 to establish the percentage frequencies, means and standard deviation. Chi-Square was used to test the significance of associations between variables. Repeated themes that emerged from the FGDs and KIIs were noted and related to the data acquired through the household survey.

3. Results and Discussion

3.1. Socioeconomic and Demographic Characteristics of Participants

A total of 60 households from the study community participated in the survey. Majority (80%) of the households in the study area comprised of 4 or more members whereas 33% of the households comprised of 7 members or more (Table 1). A previous study conducted in Meru County reported 32.4% of the population having 6 members or above [15].

Table 1. Socioeconomic and demographic characteristics of participants

Variable	Categories	% Frequency
Location	Ruiri	40.0
	Rwarera	60.0
Household size (members)	1-3	20.0
	4-6	46.7
	≥7	33.3
Age of respondent (years)	< 25	6.7
	26-35	13.3
	36-50	36.7
	> 50	43.3
Highest level of education	No formal education	16.7
	Primary	73.3
	Secondary	10.0
Occupation	Unemployed	30.0
	Informally employed	60.0
	Self-employed	10.0
Marital status	Single	6.7
	Married monogamous	53.3
	Married polygamous	23.3
	Divorced/separated/widowed	16.7
Main source of household income	Salary/wages	30.0
	Farming	56.7
	Business/others	13.3
Household monthly income (KES)	< 5000	73.3
	5001-10000	26.7
Household monthly expenditure (KES)	< 5000	90.0
	5001- 10000	10.0

Eighty percent (80%) of the respondents were 36 years or above. Only 10% of the population had secondary education, 73% had acquired primary education and 16.7% never went to school at all. An earlier study conducted in the County reported that 11.8% had never been to school [15]. Consequently, majority of the participants were informally employed.

Household's monthly income varied widely (KES 500 to 9,000) with a mean of KES 4163±2165 (Table 1). This concurred with the FGDs where participants affirmed that people earn very little and can hardly afford three meals a day *"most people only afford one meal mainly in the evening. For breakfast is plain tea unless there is left over from supper then it can be consumed with the tea"*.

About 56% of the participants depended on farming for livelihood with about 73% earning less than KES 5000 per month. A previous study conducted in various agro-ecological zones of Meru County showed similar results [15]. This was also supported by FGDs and key informants who affirmed that farming and casual work was the main source of income and this income was generally low. About 90% spend less than KES 5000 per month and this could possibly be due to the fact that most of them consumed what they produced in their farms as reported in the FGDs and key informants.

3.2. Land Ownership and Farming Practices

Majority of the participants were farmers (90%) who mainly practiced subsistence and commercial farming (Table 2). A similar trend was earlier reported in various agro ecological zones of Meru County [15]. About 80% of the participants owned or shared land, 63% had 3 acres of land or less and 10% of the participants indicated that they lease land. A previous study reported 10% of the rural households practice farming on leased or hired land [15].

Despite men in this region traditionally having the right to inherit land and therefore expected to control farming decisions [15], about 76% of women in this study had control over farming decisions.

Table 2. Farming practices

Variable	Categories	% Frequency
Farming	Yes	90
	No	10
Reason for farming	Subsistence	16.7
	Commercial	3.3
	Commercial and subsistence	70
	Not applicable	10
Land ownership status	Own	73.3
	Shared	6.7
	Leased	10
	Not applicable	10
Household's farm size (acres)	< 1	13.3
	1- 3	50
	≥4-	26.7
	Not applicable	10
Control of farming decisions	Yes	76.7
	No	13.3
	Not applicable	10

3.3. Crop and Animal Production

Majority of the respondents relied on maize (≥ 80%) and beans (50-79%) farming (Table 3). Other crops were produced by less than 50% of the respondents. About 50% and 33% of the respondents kept 1-3 cows or 1-3 goats respectively while 46% kept more than 3 chicken. This indicates that majority of the respondents in this area are small scale farmers that rely on small animals and field crops that are rain dependent.

Table 3. Crop and Animal Production

Crop Production		Animal Production		
Type of crop	% Population	Animal type	Categories	% Population
Maize	≥ 80	Cows	None	46.7
Garden beans	70- 79		1 to 3	50
Black beans	50-59		> 3	3.3
Irish potato and mangoes	40-49	Goats	None	33.3
Cow peas, sorghum and sweet potato	30-39		1 to 3	33.3
Pigeon peas, tomato, kales and green grams	20-29		> 3	33.3
Peas, pawpaw, onions, carrots, cassava, oranges, hot pepper, capsicum and millet.	10 - 19	Sheep	None	86.7
			1 to 3	13.3
Brinjals, arrow roots, coriander, banana, avocado, lemon, watermelon, guava, white sapota, cabbage, spinach, yam, passion fruit, tomato and garlic.	< 10	Chicken	None	36.7
			1 to 3	16.7
			> 3	46.7

3.4. Handling and Management of Agricultural Produce

Of the total farm production, about 33.3% of the participants produced excess food of which 10% shared with friends and relatives while 23.3% sold directly in the market suggesting that majority of the respondents did not produce food in excess. This is also attributable to challenges encountered in handling of excess food mainly as a result of weevil infestation or rotting. According to the key informants, people mostly sell the produce, mainly maize to cereal shops and leave very little for own consumption. Few people have stores or small granaries while majority stored their food on the floor of their houses. Additionally produce harvested during rainy season is spoilt and contaminated with aflatoxin. Key informant explained that, *"The main problem during storage is weevils' infestation. To cope, they sell most of their produce and keep the rest with cereal store owners from where they get as they need and pay nothing for storage but store owners trade on their produce. Store owners don't charge for storage, it's based on trust since no agreements are signed. They fear using poisonous pesticides"*.

3.5. Markets' Accessibility

Most participants (80%) traveled more than a kilometer to the food market mainly by walking (63%) or using motorcycle taxi (23.3%) popularly known as *bodaboda* with majority (53.3%) spending 15 minutes or less (Table 4). According to the FGDs and key informants, there was adequate supply of food in the market but people did not have sufficient money. There was one tarmac road and others were mainly weather roads often impassable during rains indicating poor market accessibility.

Table 4. Accessibility to Food Markets

Variable	Categories	% Frequency
Distance to the nearest food market (km)	< 1	20
	1- 3	33.3
	≥ 4	46.7
Means of transport to the food market	Walking	63.3
	Motorcycle taxi	23.3
	Public motor vehicle	13.3
Time taken to the market (minutes)	≤15	53.3
	16-30	20
	31-45	26.7
Type of road network to the market	Tarmac	60
	Marram	3.3
	Earth road	36.7

3.6. Coping Strategies

Majority (80%) of the participants faced food shortages with most of them reducing portion of food cooked (53%), skipping meals (10%) or selling livestock (16.7%) to obtain income for food as a coping mechanism (Table 5).

Most participants (56.7%) obtained foods on loans or credit from local shops.

According to the key informants, people took up casual labor as a means of coping, some moved to live with relatives for food. Wild vegetables such as amaranthus and black nightshade which were once considered weeds were consumed during such times of scarcity. About 16.7% of the respondents reported to have ever received relief food in past two to five years. When relief food was available, only 2-3kgs were given per household monthly indicating relief food was not reliable.
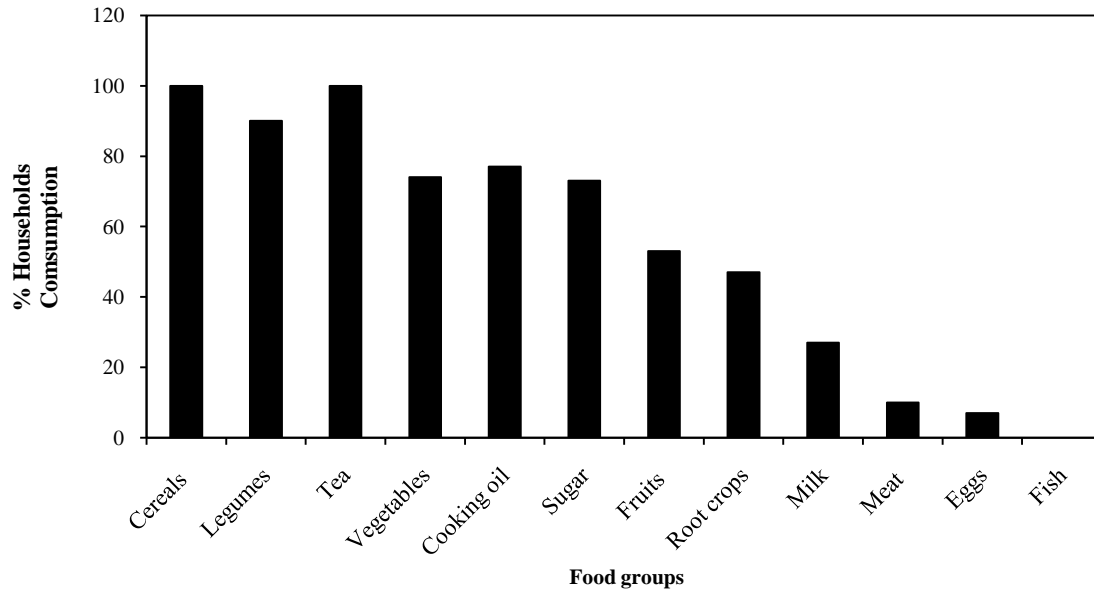
Table 5. Dealing with Food Shortage

Variable	Categories	% Frequency
Coping strategy in food shortage	Reduce food cooked	53.3
	Skip meals	10
	Sold poultry/livestock	16.7
	No shortage	20
Monthly bank withdrawal for food expenses	Yes	16.7
	No	83.3
Amount withdrawn for food	None	83.3
	≤3000	6.7
	>3000	10
Loan taken for food/food bought on credit	Yes	56.7
	No	43.3
Amount borrowed to buy food	None	43.3
	≤1000	46.7
	>1000	10

3.7. Household Dietary Diversity Score

The survey found 9 main food groups consumed by more than 20% of the household in the area (Figure 1). Ten percent of the households were considered to be food insecure consuming 4 food groups and less. This figure could be an under estimation of the real food security situation in the area. This is because the study was conducted in the month of March and time of food scarcity in the area begins from the month of October. Focus group discussions and key informants affirmed that food insecurity is rampant in the area and in fact sometimes majority do not even afford three meals in a day. In this regard, the study categorized participants using the average number of food groups consumed. The mean number of food groups consumed in this area was 6.07±1.36 ranging from 3 to 9 food groups. About 63.3% consumed 6 food groups and above while 36.7% consumed below average.

All the participants consumed at least a cereal and tea in the past 24 hours (Figure 1). In fact cereals are most common food group consumed by nearly all participants [5,13]. In addition more than half the population consumed legumes, vegetables, cooking oil, sugar and fruits while about 47% consumed some root crops. This could be because of social backgrounds since most people tend to eat foods they grew up eating. In fact every region of a country has its own typical foods and ways of combining them into meals [4].

Figure 1. Food groups consumed by household

The food groups least consumed included milk and milk products, meat and eggs while none consumed fish. This is similar to another study conducted among rural women in Western Kenya [5]. This may be associated with low income levels considering that animal protein sources are generally expensive. As income levels rise, people tend to diversify away from a reliance on cereals and roots/tubers and begin to purchase more animal source foods, fruits and vegetables [4].

It is important to note that the tea consumed was prepared using sugar and plenty of milk although it was not considered as a milk product to avoid over-reporting on milk products. Tea was the main source of sugar in their diet.

These results are in agreement with key informants and FGDs where it was noted that the main meal was stiff porridge (*ugali*) prepared from maize meal and *githeri* which is a mixture of mainly maize and beans. However, there seemed to over-reporting especially with regard to fruits although as regards to protein foods, there seems to be agreement between the results above and the key informants who affirmed that there are more carbohydrates and only little protein in the diet and vitamins are disregarded. They further explained that proteins are expensive and people prefer to sell it for money while fruit is considered a luxury.

These finding is also supported by FGDs where the women confirmed that animal protein such as meat and chicken are scarce because they are expensive. They also concurred that fruits and vegetables are lacking in their diet and that there were no kitchen gardens due to scarcity of water such that even when rain water was harvested, it could not cater for the kitchen garden but just for drinking and domestic use.

3.8. Factors influencing Dietary Diversity in the Area

This study found that dietary diversity score was significantly influenced by age, education, occupation, household size, main source of household income, household's monthly income, land ownership status, farm size, means of transport to market and time taken to the market ($p < 0.05$).

Age has been previously reported to have a strong association with food insecurity [7]. This study found that over 50% of the respondents above 36 years consumed more than 6 food groups compared to 10% below the age of 35 years, indicating that age significantly influence household dietary diversity.

Majority of women with primary (40%) and post primary education (10%) were found to consume more than 6 food groups, compared to those who never went to school (13.3%), indicating that education significantly influences household dietary diversity. This is in agreement with an earlier report that showed most food insecure households were headed by women with low or no education [7]. Adequate nutrition knowledge has been shown to translate to better diets [4] and healthy nutrition status [16]. In this study, low level of education of the participants may be a contributing factor towards relatively low dietary diversity among households.

Occupation of the participant was strongly associated with dietary diversity. Majority of respondents informally employed (46.7%) consumed more than 6 food groups compared to those unemployed (10%) and self-employed (6.7%). Twenty percent of the unemployed respondents consumed less than 6 food groups. This could be attributed to the low income available for food associated with unemployment.

Majority of households (46.7%) that relied on farming as the main source of income had a more diverse diet as opposed to those with small businesses or relied on remittances (handouts). This could be associated with the ability of participants to grow a variety of crops and keep animals for subsistence. Previous studies have shown that most rural households consume what they produce from their own farms [5,17,18,19].

Table 6. Association between demographic and social-economic factors with food groups consumed.

Variable	Categories	(% population) n=60		P-value
		≥6 food groups	<6 food groups	
Location	Ruiri	26.7	13.3	0.662
	Rwarera	36.7	23.3	
Age (years)	≤ 35	10.0	10.0	0.017
	≥ 36	53.5	26.7	
Education	None	13.3	3.3	
	Primary	40.0	33.3	0.047
	Secondary	10.0	0.0	
Occupation	Unemployed	10.0	20.0	
	Informally employed	46.7	13.3	0.006
	Self-employed	6.7	3.3	
Marital status	Single	3.2	3.3	
	Married monogamous	30.0	23.3	0.459
	Married polygamous	16.7	6.7	
	Divorced/separated/widowed	13.3	3.3	
Main source of household income	Salary/wages	16.7	13.3	
	Farming	46.7	10.0	0.000
	Business/other	0.0	13.3	
Household monthly income (KES)	< 5000	40.0	33.3	0.019
	≥5001-10000	23.3	3.3	
Household food expenditure (KES)	< 5000	56.7	33.3	0.858
	≥5001-10000	6.7	3.3	
Land ownership status	Own	53.3	20.0	0.012
	Do not own	16.7	16.7	
Farm size (acre)	<3	36.7	26.7	
	≥3	23.3	3.3	0.033
	Not applicable	3.3	6.7	
Control of farming decisions	Yes	32	23.3	
	No	6.7	6.7	0.157
	Not applicable	3.3	6.7	
Nearest food market (km)	Less than 1	20.0	3.3	
	1-3	16.7	13.3	0.269
	>3	26.7	20.0	
Means of transport to market	Walking	40.0	23.3	0.028
	Bodaboda/matatu	23.3	13.3	
Time taken to the market (minutes)	< 15	40.0	13.3	0.038
	16-45	23.3	23.3	
Type of road network	Tarmac	36.7	23.3	0.539
	Murram/earth road	26.7	13.3	
Household size (members)	1 - 3	13.3	6.7	
	4 - 6	33.3	13.3	0.009
	≥7	16.7	16.7	

Respondents (40%) who earned ≤Ksh.5000 consumed more than 6 food groups compared to 33.3% who consumed less. Additionally majority of respondents (23.3%) who had a monthly income of ≥ Ksh.5000 consumed more than 6 food groups compared to 3.3% who consumed less suggesting that household income influenced household dietary diversity and low household income contributed to food insecurity in the area. This is in agreement with other findings that households with low income may suffer from malnutrition and as income levels increase, families tend to spend more on food [4]. Most key informants also alluded to the fact that most households are poor and barely have enough food or even afford to give tithe in church.

Majority of participants who owned land consumed more than 6 food groups and especially those with large acreage (≥ 3 acres). This is possible because a majority of them rely on farming for their livelihood [15]. They can

therefore afford to diversify the crops grown and animals kept since their main source of food is their own farm production as explained earlier. This finding was also supported by the key informants and focus group discussion participants.

Means of transport and time taken to the market also influences diet diversity in this study population. Majority of those who consumed a more diverse diet took not more than 15 minutes to reach the food markets. This could be as a result of convenience which has been found to influence dietary variation [4].

Additionally, majority of respondents with 1-3 (13.3%) and 4-6 (33.3%) members consumed more than 6 food groups as compared to households with ≥ than 7 members indicating that household size significantly influence dietary diversity in this area. This is comparable with an earlier finding that found a strong association between household size and food insecurity [7].

This study also investigated the association between dietary diversity and other variables including location, marital status, household food expenditure, control of farming decisions, distance from the market, type of road network and nutritional status and found no relationship ($p>0.05$).

4. Conclusions and Recommendations

Ten percent of the households had unacceptable dietary diversity and could be considered food insecure. This figure could be an underestimation considering that the study was not conducted during the time of scarcity. The average food groups consumed in this area is 6 and about 37% consumed below average. The main problem influencing food availability/security in the area was insufficient rainfall. The population majorly relies on rain-fed agriculture which has been quite unreliable. Irrigation has been suggested as an important measure curbing food insecurity. Extending extension services to areas where these services are not available would also go a long way to improve food security.

The household may consider adopting other drought resistance crops such as sorghum and cassava in order to reduce overreliance on maize and legumes.

Acknowledgements

References

[1]   Iram, U and Butt, M.S, Determinants of household food security: An empirical analysis for Pakistan. *International Journal of Social Economics,* 31(8): 753-66, 2004.

[2]   Declaration R. Rome Declaration on World Food Security and World Food Summit Plan of Action. 1996.

[3]   Swindale, A and Bilinsky, P, Household dietary diversity score (HDDS) for measurement of household food access: indicator guide. Washington, DC: Food and Nutrition Technical Assistance Project, *Academy for Educational Development.* 2006.

[4]   Geissler, C and Powers, H.J (Eds.), Human nutrition. Oxford University Press, 2017.

[5]   Ebere, R.A., Kimani, V.N and Imungi, J.K, Dietary patterns of the Iteso community living in Amagoro division of Western Kenya. *IOSR Journal of Nursing and Health Science,* 6(3). 2320-1940, 2017a.

[6]   Devereux, S and Maxwell, S. (Eds.). Food security in Sub-Saharan Africa. London: ITDG. 2001.

[7]   Forsen, Y., Horjus, P., William, K., Clark, L., Kute, A and Kisingu J, Comprehensive food security and vulnerability survey: Summary report Kenya 2016. World food programme. https://documents.wfp.org/stellent/groups/public/documents/ena/wfp285611.pdf?iframe (accessed on 31st October 2018).

[8]   Jones, A.D., Ngure, F.M., Pelto, G and Young, S.L, What are we assessing when we measure food security? A compendium and review of current metrics. Advances in Nutrition, 4(5):481-505, 2013.

[9]   Hoddinott, Jand Yohannes, Y, Dietary diversity as a household food security indicator. Food and Nutrition Technical Assistance Project (FANTA), Academy for Educational Development, 2002.

[10]   Ruel, M.T and Alderman, H, Maternal and Child Nutrition Study Group. Nutrition-sensitive interventions and programmes: how can they help to accelerate progress in improving maternal and child nutrition?. *The Lancet,* 382(9891):536-51, 2013.

[11]   Kennedy, G., Ballard, T and Dop, M.C, Guidelines for measuring household and individual dietary diversity. *Food and Agriculture Organization of the United Nations,* 2011.

[12]   Viechtbauer, W., Smits, L., Kotz, D., Budé, L., Spigt, M., Serroyen, J and Crutzen, R, A simple formula for the calculation of sample size in pilot studies. *Journal of clinical epidemiology*, 68(11): 1375-9, 2015.

[13]   Fanzo, J., Remans, R., Pronyk, P.M., Negin, J., Wariero, J., Mutuo, P., Masira, J., Diru, W., Lelerai, E., Kim, D and Nemser, B. A 3-year cohort study to assess the impact of an integrated food-and livelihood-based model on under nutrition in rural western Kenya. Combating micronutrient deficiencies: food-based approaches, 76-91. 2011.

[14]   Ebere, R.A., Kimani, V.N and Imungi, J.K, Prevalence of diabetes mellitus and its association with demography, socio-economy and nutritional status of women of Amagoro division in western Kenya. *IOSR Journal of Nursing and Health Science;* 6(3). 51-7, 2017b.

[15]   Mwoga, G.M., Murithi, E.M and Waswa, F, Smallholder farmers' livelihood and their adaptation capacity to climate variability in Meru County, Kenya. *Agricultural Journal*, 8(5):236-241, 2013.

[16]   Ali, A.T and Crowther, N.J, "Factors predisposing to obesity: a review of the literature," *Journal of Endocrinology, Metabolism and Diabetes of South Africa,* 14 (2). 81-4, 2009.

[17]   Oiye, S.H., Simel, J.O., Oniang'o, R.U and Johns, T.I. The Maasai food system and food and nutrition security. Indigenous Peoples' Food Systems: The Many Dimensions of Culture, Diversity and Environment for Nutrition and Health. *FAO*. 2009.

[18]   Macharia, A., Orr, A and Schipmann, C. Cereals consumption patterns in Kenya. *International Crops Research Institute for the Semi-Arid Tropics (ICRISAT),* Nairobi, 2012.

[19]   Wanjala, W.G., Onyango, A., Makayoto, M and Onyango, C, Indigenous technical knowledge and formulations of thick (ugali) and thin (uji) porridges consumed in Kenya. *African Journal of Food Science,* 10(12):385-96, 2016.