Determinants of household dietary diversity in *Yayu* Biosphere Reserve, Southwest Ethiopia

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ABSTRACT

Lack of dietary diversity is a severe problem among the poor in the developing world, including Ethiopia. Empirical evidence for factors contributing to low dietary diversity hardly exists. The objective of this study was to analyze determinants of Household Dietary Diversity and consumption behavior in *Yayu* biosphere reserve, South-West Ethiopia. A cross sectional survey was conducted on 183 randomly selected households. Primary data were collected from sample households through interviews, focus group discussions and key informant interviews. Secondary data were collected by reviewing different documents. Descriptive statistics and econometric models were used for analyzing quantitative data. The ordered logit model was employed to determine the influence of explanatory variables on the dependent variable. The average household dietary diversity score was 5.5±1.7SD. About 17.5% of the sampled households belonged to low, 61.2% to medium and 21.3% to high dietary diversity. The age of the household head, education, income, access to irrigation, home gardening and dietary diversity awareness affected household dietary diversity positively and significantly and distance from market negatively. In conclusion, policy and development interventions should target education and awareness creation tools to provide households up to date nutritional knowledge and agricultural technologies to increase production and income, and thereby enhance household dietary diversity.

Keywords: Household Dietary Diversity Ordered Logit, *Yayu* Biosphere Reserve, Ethiopia.
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INTRODUCTION

Poor quality diets are the norm in resource limited environments across the globe. Risks for a range of micronutrient deficiencies are high when grain or tuber-based staple foods dominate (Daniels, 2009). The current global nutrition situation indicates that malnutrition, in all its forms (under-nutrition, micronutrient deficiencies, overweight and obesity) is widespread (Grace, 2016). The report from FAO (2013) indicates that the diets of developing countries have improved except Africa and Southern Asia. Africa and Southern Asia did not fully benefit from improvements and their diets remain unbalanced and heavily dependent on stable crops. Dietary diversity refers to increasing the consumption of a variety of foods across and within the food groups and is considered to be one that is constituted of foods from all food groups so as to ensure that the population has adequate amounts of key nutrients to attain and maintain acceptable levels of growth and development (Ruel *et al.,* 2013). While adequate food is necessary for optimal development and performance, lack of optimum number of essential micronutrients in the daily food intake of individuals is yet another form of food insecurity, a challenge in most developing countries (FAO, 2012). Because no single food can contain all required nutrients, dietary diversity has been conjectured to have greater practical potential of meeting nutrient requirements (Labadarios *et al*., 2011). Ensuring dietary diversity is a challenge for rural communities in developing countries like Ethiopia (Kennedy *et al*., 2007; Kibrom Sibhatu *et al*., 2015), a major cause of micronutrient malnutrition in sub-Saharan Africa (FAO, 2013; Thompson and Meerman, 2014) and starch dominated staples with inadequate animal products, fresh fruits and vegetables (Getnet Mekuria et *al*., 201). Less than 4% of the children in rural Ethiopia were fed with four or fewer food groups out of seven food groups (EDHS, 2011) and it was found that the average child eats 1.46 food groups per day (IFPRI, 2015) and the mean of household dietary diversity score was 4.7 and 40% of households are with low dietary diversity (Smith *et al*., 2006). Animal source food (ASF), fruits and vegetables are not a common diet items, whereas cereals contribute about 75% of the Ethiopian diet (Nguyen *et al*., 2013; Abdulhalik Workicho *et al*., 2016). A complex combination of underlying social, economic, physical, and environmental factors

affects dietary diversity and food consumption behavior of individuals and communities. Key determinants of household dietary diversity vary by context, i.e., cultural beliefs and taboos, social and income status, intra-household food distribution, market dynamics, knowledge, and gender (Taruvinga *et al*., 2013) and extent of technology related with food production, processing, preparation and storage (Keding *et al*., 2013).

Ethiopia has improved dietary energy supply while dietary diversity remained low. The estimation from the Central Statistical Agency (CSA) shows that the average energy consumption increased from 2,200 kcals/capita/day in 2000 to over 2400 kcals by 2011 (FMOH, 2016). However, the dietary patterns reported from the survey showed little change from 2005 to 2010, demonstrating pervasive low dietary diversity. Some 60% of households had low and 40% medium diet diversity scores, indicating poor dietary preferences and consumption patterns in Ethiopia (Alemayehu Seyoum *et al.,* 2012; Degye Goshu *et al*., 2013). The feeding practices of Ethiopian families remain sub-optimal. Only 4.3% of children consumed the recommended four food groups per day (FDRE, 2013).

In Ethiopia, dietary energy supply has improved while diversity remained low (insufficient protein, vitamin and minerals) (IFPRI, 2018). Many studies focused on determinants of household dietary energy consumption (or dietary quantity) and on individual dietary diversity at the expense of household dietary quality and diversity in Ethiopia. Need, therefore, arises to focus on household level of determinants of dietary diversity and dietary quality given the fact that a diverse diet (especially micronutrients) is normally rare in rural communities of developing countries. The Sustainable Development Goal that is ending all forms of malnutrition cannot be achieved without optimum consumption of dietary diversity in countries like Ethiopia. Identifying the determinants of dietary diversity is vital to draw policy options, devise appropriate interventions, and ultimately help enhance investments in food and nutrition security. Almost no study has been conducted on identifying factors that affect household dietary diversity in *Yayu* Biosphere area. Therefore, the study was aimed to assess the determinants of household dietary diversity and consumption behavior in that area. Findings help stakeholders, policy makers and program planners working on livelihoods, agriculture,

health sector, food and nutrition. They also provide baseline data and serve as reference for to future researchers.

MATERIALS AND METHODS

Description of the study area

The research was conducted in the *Yayu* Biosphere Reserve specifically in *Achibo, Witate* and *Gechi* kebeles of *Yayu* woreda which is situated in Ilu Ababora Zone of Oromia National Regional State and it is located about 582 Km west of Addis Ababa. Its agro-ecology is lowland and highland. The mean annual temperature is about 20°C and the mean annual rainfall is 2100 mm per year. The Woreda has a total population of 57,938 (27,969 males and 29,969 females). About 11794 (9974 male and 1820 female) are households. Of the total population 20% are living in urban areas while the rest 80% are living in rural areas.

Sample size and sampling procedure

Sample selection was done employing three-stage sampling method. At the first stage, the study area was purposely selected. In the second stage, three kebeles (*Achibo*, *Witate* and *Gechi*) were selected out of a total 18 kebeles found within the biosphere area using simple random sampling method. At the end, 183 respondent households were selected from the three kebeles by systematic random sampling method. Table 1 summarizes the sample proportions in each kebele.

Table 1. Distribution of sampled households in the study area

Selected PAs*	Total household heads			Sampled household heads		
	Male	Female	Total	Male	Female	Total
Gechi	666	129	795	31	19	49
Witate	831	191	1022	43	22	63
Achibo	921	190	1111	53	15	68

* Peasant association

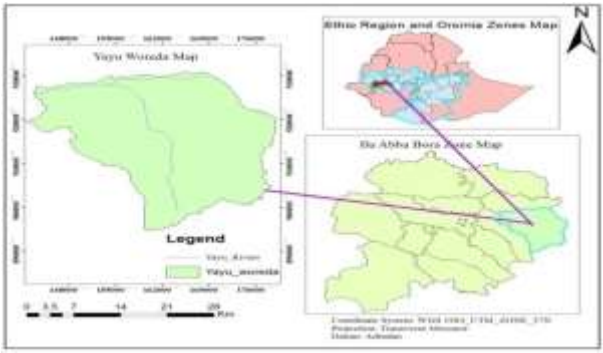

Figure 1. Geographic location of Yayu *woreda* in Ethiopia

Data types, sources and collection methods

A cross-sectional survey was conducted in rural households of the study area. In this study, both qualitative and quantitative data type were collected from both primary and secondary sources of data. Primary data were collected from sampled households using semi-structured questionnaire, interview guide for Focused Group Discussion (FGD) and key informant checklist. Secondary data were gathered from woreda offices and from published documents.

Using the FAO guidelines for measuring household dietary diversity (FAO, 2008), the dietary diversity was assessed based on the number of food groups consumed over the immediate past 24 hour. The person who is responsible for preparing food in the previous day was interviewed to obtain information on foods consumed. The recall period of 24 hours has been chosen by FAO, as it is less subjective to recall error, less cumbersome for the respondent and also conforms to the recall time period used in many other dietary diversity studies (Steyn *et al., 2006,* Kennedy *et al,* 2007*)*.

Definition of variables and working hypotheses

The dietary diversity tool has been proposed and used by FAO to measure and assess food groups consumed during a defined reference period and universally (Table 2).

Table 2. Definition of the variables and measurements

Acronym	Independent variables	Type	Unit	Expected sign
SEXHH	Sex (household head)	Dummy	1 male, 0 female	+ve
AGEHH	Age (household head)	Continuous	Years	-ve
EDULEHH	Education level	Continuous	Schooling (years)	+ve
HHSIZ	Household size (number)	Continuous	Number	-ve
LANDSIZ	Land holding size	Continuous	Hectare	+ve
LIVSOWN	Livestock owned	Continuous	Tropical livestock unit	+ve
ACIRR	Access to irrigation	Dummy	1 access, 0 no access	+ve
HOMGARD	Home garden practice	Dummy	1 for yes, 0 for none	+ve
INCOME	Income of household	Continuous	Birr	+ve
MARDIS	Market distance	Continuous	km	-ve
EXTCONT	Agric. extension contacts	Continuous	Contacts per year	+ve
AGINPUT	Agricultural inputs use	Dummy	1 for use, 0 for none	+ve
HEWCONT	Health extension contact	Continuous	Contacts per year	+ve
CREDUSE	Credit use	Dummy	1 use, 0 for none	+ve
AWARDD	Awareness (dietary diversity)	Dummy	1 aware, 0 for not	+ve
NUTRKNO	Nutritional knowledge	Continuous	Score from 1-7	+ve

Note: Household Dietary Diversity (HDD) Status (Low HDDS = 0; Medium HDDS = 1 and High HDDS = 2). recognized as a key component of healthy diets (FAO, 2008); Low HDD = 0 (if the dietary diversity score of households is less than four), Medium HDD =1 (if four to six), High HDD = 2 (if more than six).

Methods of data analysis

Data were analyzed using descriptive statistics and econometric model. Frequency distribution, mean, percentage distribution and standard deviations were employed. Chi-square analysis was

employed for comparing groups such as sex of household head, access to irrigation, home gardening, fertilizer use, credit use awareness on dietary diversity and one-way ANOVA for comparing groups like age, education level, household size, land-holding size, livestock, income, market distance, extension contact and nutrition knowledge of households. Ordinal logistic regression model was used to determine the relationship between the dependent variables and a set of explanatory variables.

The econometric model

Ordered logit model is specified as follows: According to Green (2008), the ordered logit model regression equation takes the form:

$$Y^* = \sum_{k=1}^{k} \beta_k X_k + \varepsilon \quad (1)$$

Where Y* = is unobserved and thus can be thought of as the underlying tendency of an observed phenomenon,
X_k= A vector of explanatory variables, β = Coefficients to be estimated, and ε = A random error term (assumed to follow a standard normal distribution for logistic distribution). There is a random disturbance term, which, in this case, has a standard logistic distribution. This reflects the fact that relevant variables may be left out of the equation, or variables may not be perfectly measured. The Ordered Logit Model estimates part of the above:

$$Y^* = \sum_{k=1}^{k} \beta_k X_k \quad (2)$$

The observed or defined categorical variable Y_i is determined from the model as follows:

$$\begin{aligned} y &= 1 \text{ if } y^* \leq \mu 1 \\ y &= 2 \text{ if } \mu 1 < y^* \leq \mu 2 \\ y &= 3 \text{ if } \mu 2 < y^* \leq \mu 3 \\ y &= j \text{ if } \mu_{j-1} < y^* \end{aligned} \quad (3)$$

Where y is observed in j number of ordered categories, μ's are unknown threshold parameters separating the adjacent categories to be estimated with β's, so μ1, μ2, and μ3 is a set of thresholds of the household dietary diversity gap to be estimated. The general form for the probability that the observed y falls into category j and the μ's and the βs are to be estimated with an ordinal logit model is:

$$\text{Prob}(y = j) = 1\text{-}L\left(\mu_{j\text{-}1} - \sum_{k=1}^{k} \beta_k X_k\right) \quad (4)$$

Where L (·) represents cumulative logistic distribution.

RESULTS AND DISCUSSION

Description of the sampled household characteristics

A total of 183 households were involved in the analysis. The mean of age of the household head was 47.4 years and the average education level of households was 2.4 years of schooling. The mean of household size was 5.1. The average land holding of the households was 1.6 ha and livestock was 1.92 tropical livestock unit (TLU). One-way ANOVA test revealed that age of household head, education level of the head, household size, land and livestock holding of the households had a significant mean difference among household dietary diversity categories (Table 3). The knowledge of households about nutrition did not vary; they had similar exposure. The average annual income of the households was 21,118 ETB. An increase in income enabled smallholders to diversify the diet and also to buy more non-food goods, and this tends to imply a greater dietary quality. The average distance taken to travel from home to the nearest market place was 4.4 kms. The average number of contacts with the agricultural extension agent was 9.7 and health extension workers 3.4 times per year (Table 3). The one-way ANOVA test showed significant difference between HDD categories in terms of income, distance to market, agricultural and health extension contacts. The survey result showed that out of the households sampled 79.2% of households were headed by males and 20.8% by females. Only 12% of heads of the households had access to irrigation and 79.2% of households participated in home garden production. About13.7% of the households had access to credit and utilized the services. About 72% of the respondents had awareness of dietary diversity on the importance and health consequences of poor dietary diversity. The chi-square test indicated that there was significant difference among male and female headed households in terms of home garden practice, irrigation utilization and use of chemical fertilizers among household dietary diversity categories but not credit use (Table 4).

Dietary diversity status of households

The study results showed that from 183 of households, 32 (17.5%) participants consumed up to three food groups (low dietary diversity), 112 (61.2%) consumed four to six food groups (medium dietary diversity), and 39 (21.3%) participants consumed seven or more food groups (high dietary diversity) in their diet during the preceding 24 hours. The household dietary diversity scores ranged from 2 to10 food groups with the mean of 5.5$\pm$1.7SD. The mean dietary diversity scores of low household dietary diversity category was 2.94, medium was 5.3 and high was 7.9 (Table 5). Similar findings were reported before in Ethiopia (Abdulhalik Workicho *et al*., 2016; Admassu Tesso *et al*., 2017).

Food groups of households

The finding of the study showed all participants (100%) consumed cereals (Table 6). This implied that the households' diet was predominantly based on cereals. The findings of this study corroborate many previous studies (Vakili *et al*., 2013; Mkemwa, 2015; Mbwana *et al*., 2016) which reported the dominance of cereals. The consumption of root and tubers was reported by 46% of households as their meals in the past 24 hours. Likewise, from these households 62.2% were from high and 50% were from medium household dietary diversity category and only 14.7% were from low household dietary diversity category (Table 6). A similar result was also reported before (Tadesse *et al*., 2016). About 51.9% of the households reported consuming vegetables within the recent 24-hrs. These households were from high (82.1%), medium (49%) and low (25%) household dietary diversity categories. Households did not consume Vitamin A rich dark green leafy vegetables. This observation is consistent with the study of Admassu Tesso *et al*., (2017). About 19% of the sampled households consumed fruits; from high household dietary diversity category 43.2% of them consumed it, while few percentages of the low and medium household dietary diversity category consumed fruits (Table 6). The findings indicate that intake of foods rich in animal sources was significantly low in terms of frequency for the entire sample. Only 27.3% of households consumed meat, 16.4% consumed dairy products and 22% consumed

eggs. Households with high household dietary diversity consumed meat (54.1%), dairy products (24.3%) and eggs (40.5%). Those with medium HDDS consumed meat, dairy product, and eggs, by 29.5%, 18% and 21.4% of the sampled households, respectively. The proportion of animal source food consumption was higher among households with high HDDS than medium and low HDDS. This could be due to high income that enabled the people to purchase the expensive animal protein. This implied that households in low and medium category had low purchasing power and could not afford the expensive meat.

This finding is consistent with a previous study (Herrador *et al*., 2015; Bundala *et al*., 2017; Schwei *et al*., 2017). Fish was not consumed at all among households of the study area. Related findings were also reported before (Bekele Megersa *et al*., 2014; Getnet Mekuria *et al*., 2017). About 75% of households consumed legumes or nuts and seeds food group like lentils, beans and peas in the form of cooked (*wot, kolo,* and *nephro*). Low consumption of this food group limits the intake of plant protein, B vitamins and dietary fiber which are required for growth and development, especially in children and women of reproductive age (Mkemwa, 2015). From low, medium and high HDDS category 73.5%, 75.3% and 83.8% of households consumed this food group respectively (Table 6). The pattern followed previous reports (Mkemwa, 2015). In this study 86% of participants consumed oil, butter and fats food group. Households from low, medium and high HDDS category 61.8, 89.3 and 97.3% consumed this food group respectively. The findings of this study were in line with those reported by Abdulhalik Workicho *et al*. (2016). Foods such as sugar, honey, cakes, biscuits and juice drinks were all in this group. Only 32.8% of respondents consumed different forms of sweets**.** Coffee, tea, local alcohols were most frequently consumed by all households; similar condition has been reported before (Tadesse *et al*., 2016).

Table 3: Comparison of household dietary diversity categories (continuous explanatory variables)

Variables	**Household dietary diversity category**								F
	Low		**Medium**		**High**		**Total**		
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	
Age	40.8	8.5	49.6	8.0	48.6	7.2	47.4	8.7	13.24***
Education level	0.6	1.6	2.0	2.7	5.2	2.8	2.4	3.0	32.23***
Household size	4.1	1.5	5.3	1.6	5.4	1.6	5.1	1.6	8.59***
Land-holding size	0.9	0.5	1.8	1.2	2.6	2.5	1.8	1.6	11.37***
Livestock	0.8	1.1	2.0	1.8	2.7	3.0	1.9	2.1	15.07***
Income	7081	4892	20064	21200	35661	69300	21118	36900	14.14***
Market distance	4.7	1.4	4.5	1.4	3.9	1.2	4.4	1.4	9.01***
Extension contact	3.5	6.8	10.6	11.8	12.5	13.4	9.7	11.8	7.22***
HEW contact	2.5	3.7	3.2	3.4	4.4	3.8	3.4	3.6	5.44***
Nutrition knowledge	2.4	2.6	2.5	3.2	4.5	3.6	2.7	3.3	1.87NS

***Significant at less than 1% probability level, NS = non-significant

Source: Own survey, 2018

Table 4. Comparison of household dietary diversity categories (dummy explanatory variables)

Variables		Household dietary diversity category								χ^2
		Low		Medium		High		Total		
		N	%	N	%	N	%	N	%	
Sex of HH	Female	10	31.2	24	21.4	4	10.3	38	20.8	
	Male	22	68.8	88	78.6	35	89.7	145	79.2	14.382**
Access to	No	32	100.0	98	87.5	31	79.5	116	88.0	
irrigation	Yes	0	0.0	14	12.5	8	20.5	22	12.0	28.94***
Home gardening	No	12	37.5	24	21.4	2	5.0	38	20.8	
	Yes	20	62.5	88	78.6	37	95.0	145	79.2	18.31***
Fertilizer use	No	20	62.5	32	28.6	6	15.4	58	31.7	
	Use	12	37.5	80	71.4	33	84.6	125	68.3	23.014***
Credit use	No	25	79.4	98	87.5	35	89.2	158	86.3	
	Yes	7	20.6	14	12.5	4	10.8	25	13.7	1.766^{NS}
Awareness on	No	18	56.0	31	27.7	9	22.7	51	28.0	
DD	Yes	14	44.0	81	62.3	30	77.3	132	72.0	33.726***

** Significant at 5% probability level, *** at 1%, and NS Non significant; Source: Own survey, 2018

Table 5. Distribution of respondents by level of household dietary diversity

HDDS level	Frequency	%	Range	Mean	SD	Max	Min
Low	32	17.5	1-3	2.94	0.25	3	2
Medium	112	61.2	4-6	5.3	0.8	6	4
High	39	21.3	7-12	7.9	1	10	7
Total	183	100	1-12	5.5	1.7	10	2

Source: Own survey 2018; "max" stands for maximum, "min" for minimum

Econometric analysis

The variables assumed to have influence on household dietary diversity were tested in the model and out of 14 variables entered into the model eight of them were found to be significant while six of them were not found to be statistically significant.

Age of household head: Contrary to expectation, the age of household heads was found to be positively affecting dietary diversity of the household (Table 7). This is expected as age of a household increases, it is assumed that farmers could acquire more knowledge and experience, which can enhance their understanding on their diets. The model output indicates that holding other variable constant, for a one unit increase in age of household head's odds ratio in favor of high category with household dietary diversity increases by the factor of 1.353. Some previous reports appear to be claiming the opposite (Jones *et al.*, 2014; Romeo *et al*., 2016; Ochieng *et al*., 2017).

Educational level of household head: As education increases the knowledge and skill of the people in a society, it has been hypothesized to have a positive relationship with household dietary diversity. As expected, education level of household head had a positive influence on the household dietary diversity. By holding the influence of other variables constant, a one unit increase in household head education level, the odds ratio in favor of high category with household dietary diversity increased by the factor of 1.538. This implies education increases knowledge of nutritional diets and proved to be one of the most important determinants of dietary diversity consumption. Educated household heads could have better understanding on health benefits of consuming nutritious food so that

they spent a higher amount of their food budget on diversified diet than uneducated ones. The findings agree with many previous findings on significance of education to household dietary diversity. Education of the household head plays a positive role for household dietary diversity (Taruvinga *et al*., 2013; Jones *et al*., 2014; Koppmair *et al.*, 2016). The more households are educated, the more they are likely to attain a higher dietary diversity. Moreover, Davidson and Kropp (2017) described that educated household head is almost twice as likely to produce vitamin A rich fruits and vegetables for consumption. While Fuller *et al*. (2004) observed that educational achievements within the household, independent of the additional income it brings, increase consumption of NABs (Non-alcoholic beverage) such as fluids, milk and yogurt.

Livestock owned: Livestock ownership of households' significantly and positively influenced household dietary diversity. The model output indicates that keeping other variables constant, a unit increase in livestock ownership leads the odd ratio in favor of high category with household dietary diversity increase by a factor of 1.38. This implies that households who own more livestock are more likely to diversify their diet than households owning a smaller number of livestock. The finding corroborates other studies that reported association between dietary diversity and livestock ownership (Rashid *et al*., 2011; Arega Bazezew, 2014; Bekele Megersa *et al*., 2014; Abdulhalik Workicho *et al*., 2016). Further, Taruvinga *et al*. (2013) indicated that rural households with livestock ownership are more likely to move from a medium dietary diversity status into a high dietary diversity status.

Access to irrigation: As expected, access to irrigation positively and significantly affected household dietary diversity. The result shows keeping the influence of other variables constant, household access to irrigation, the odd ratio in favor of high category with household dietary diversity increases by a factor of 5.824. This implies that households who have access to irrigation are more likely to increase their dietary diversity than households without access to irrigation.

Table 6. Food groups of households

Food Groups	Household dietary diversity category							
	Low		Medium		High		Total	
	N	%	N	%	N	%	N	%
Cereals	32	100.0	112	100.0	39	100.0	183	100.0
Roots & tubers	4	12.5	56	50.0	24	62.5	84	46.0
Legumes & pulses	24	75.0	84	75.0	33	84.6	137	76.0
Vegetables	8	25.0	55	49.1	32	82.1	96	51.9
Fruits	2	6.0	15	13.2	17	43.2	34	18.7
Meats	1	3.0	33	29.5	21	54.1	50	30.1
Eggs	1	3.0	24	21.4	16	40.5	40	22.4
Fish	0	0.0	0	0.0	0	0.0	0	0.0
Dairy products	1	3.0	20	18.0	9	24.3	36	16.4
Oils & fats	19	61.8	100	89.3	38	97.3	157	86.0
Sweets	3	8.8	31	27.7	27	70.3	60	32.8
Spices & beverages	20	63.0	100	89.2	38	97.3	157	86.0

Source: Own survey, 2018

The finding suggests that using irrigation enhance household dietary diversity due to the fact that it provides an opportunity for participants to grow a variety of cash and domestic horticultural crops which may directly improve their diet. Indirectly, cash crops from irrigation schemes can also improve household's food purchasing power. The finding is consistent with other reports (Headey and Ecker, 2012; Moyo and Machethe, 2016; Tizita Damtew, 2017).

Home gardening: Home gardening has affected household dietary diversity positively and significantly. Keeping the influence of other variables constant, household's access to home garden increases the odd ratio in favor of high category by a factor of 2.97. This implies that household with home gardening are more likely to diversify their diets than households without home gardening. Home gardening provides a means to access a variety of foods that may not be available in the market through cultivation of fruits, vegetables, and other crops. The finding of this study is congruent with previous studies (Zarihun Kebebew *et al*., 2011; Ajah *et al*. 2013; Galhena *et al*., 2013; Bundala, 2017) as they described cultivation of home gardening was an evident factor of having diverse diet for the household. Furthermore, Cabalda *et al*. (2011) suggested that home gardens normally provide a variety of diets like vegetables, fruits, and roots or tubers.

Income: Income is an important and significant indicator of the general economic well-being of a household and therefore assumes positive relationship for household dietary diversity. The positive relationship of this variable indicates that the higher income households are more likely to diversify their diet than poorer households. By controlling the influences of other variables constant, a one unit increases in income of household, the odds ratio in favor of high category with household dietary diversity increases by a factor of 1.202. The result is in line with the previous findings (Linderhof *et al*., 2016). Higher income increases dietary diversity at the household level and allows a household to the purchase of more food with higher nutritional quality. Higher agricultural revenue is associated with a higher probability that a household will consume diversified diet and have positive significant association (Arega Bazezew, 2014; Dillon *et*

al., 2015). Income determines a household's level of consumption (Bamidele *et al*., 2010).

Awareness on dietary diversity: the ordered logit analysis indicates that dietary diversity awareness has a positive correlation with household dietary diversity and significant at 1% probability level as it was hypothesized. The model output result shows that holding other variable factors constant, the odd ratio in favor of high category with household dietary diversity increases by the factor of 4.036 for households who are aware about dietary diversity. This implies that awareness improves knowledge on the individual food items and helps to make general evaluations of the dietary diversity of that household. Nutrition aspects go along with knowledge and awareness to ensure proper selection of foods for good health. Awareness provides consumer information which would help to consume food wisely and relevant skills needed to prepare food well. The result is consistent with research findings of Powell *et al*. (2017) who reported that lack of nutrition information results into poor dietary eating that instigate to inadequate nutrients intake. Awareness encourages people to consume healthy meals and to carry out proper child feeding practices (Nathan, 2008; Nsele, 2014).

Distance to market: The ordered logit model result indicates that distance to market had significant and negative influence on household dietary diversity at α=0.05. A one unit increase in market distance leads the odds ratio in favor of high category household dietary diversity to decrease by a factor of 0.643. This agrees with Stifel and Minten (2017) who reported strong link between remoteness from markets and household dietary diversity. Kibrom Better market access through reduced distance could contribute to higher dietary diversity (Sibhatu *et al*., 2015; Hirvonen *et al*., 2017)

CONCLUSION

This study estimated status and determinants of household dietary diversity. The study demonstrated that the diet of all of the households was composed of cereal, legumes, oils and spices at the expense of

animal source foods, fruits and vegetables. Foods from animal sources (meat, eggs and milk and milk products) were a rare component in the household's diets, particularly in households with low HDDS. The dietary diversity of the study area is indeed associated with different factors. The study revealed that various intermediate factors like age of household head, education level of household head, livestock ownership, home gardening, total income, access to irrigation awareness of dietary diversity were found to positively influence household dietary diversity. However, distance from the market was found to be negatively associated with HDD. From the overall findings of the research, it is possible to deduce that the majority of the sampled populations were under medium dietary diversity calling for a holistic intervention with respect to enhancing household dietary diversity and consumption. Based on the findings of the study, we recommend that the regional and federal governments should provide access to education for households to broaden their understanding of the nutritional health benefits of a diverse diet and Yayu Agricultural and Natural Resources Office and stakeholders in the agricultural sector should promote and encourage availability of home gardening strategies, expand access to irrigation, introduce agricultural technologies to boost income of rural households and thus diversify their diet. Further, the regional and federal government should enhance awareness of the people on dietary diversity with community health workers and development agents, as well as media campaigns such as on the radio and TV programs and mobile messaging. Market infrastructure should be improved to enhance households' access to market that could contribute for improving household dietary diversity and consumption behavior.

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Table 7: Parameter estimates of ordinal logistic regression

Variables	Estimate	Standard error	Wald	P-value	Odds ratio
Sex	-0.059	0.513	0.013	0.908	0.942
Age	0.302	0.073	17.115	0.000***	1.353
Education	0.431	0.086	25.005	0.000***	1.538
HH size‡	0.123	0.148	0.690	0.406	1.130
Land size	0.219	0.174	1.592	0.207	1.245
Livestock	0.322	0.130	6.164	0.013**	1.380
Irrigation	1.762	0.572	9.482	0.002***	5.824
Gardening	1.089	0.472	5.313	0.021**	2.970
Income	0.184	0.059	9.723	0.002***	1.202
Market‡	-0.441	0.139	10.038	0.002***	0.643
Extension‡	0.004	0.019	0.056	0.813	1.004
Inputs‡	-0.174	0.476	0.134	0.714	0.840
HEW‡	0.064	0.053	1.431	0.232	1.066
Awareness	1.395	0.512	7.429	0.006***	4.036

** Significant at 5% probability level, *** at 1%; Source: ordered logit model output. HH size stands for household size, Market for distance to market, Extension for extension contact, Inputs for agricultural inputs, HEW for health extension worker. Following Hamilton, 2006, ordered logit estimates a score, as a linear function of the X_k. The equation would be HDDS = 0.103Age + 0.431Education + 0.322Livestock + 1.762Irrigation Access +1.089Homegarden + 0.000208Income - 0.441Market Distance.

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