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Determinants of household dietary diversity score in food insecure areas of West Amhara region, Ethiopia

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Abstract
This study attempted to identify major determinants of farm households' dietary diversity in Amhara region of Ethiopia using data collected from 300 households. The study indicated 26.8% of households were in the low dietary diversity score category while 66.9% were under the medium and 6.3% were in the high category. All the households reported consumption of cereals while 86% consumed pulses. A mean household dietary diversity score of 4.42 food items were computed for all categories. The ordered probit estimate indicated positive likelihood of dietary diversity score with household head education of above primary education, primary education of spouses, weekly contact with extension agents, tropical livestock unit and land size owned. A negative likelihood of dietary diversity score identified with family size and age of spouse. The marginal effects of the explanatory variables indicated 18.6% and 13.7% decrease in probability of falling under low dietary diversity score associated with higher education level of household head and spouse respectively. Weekly extension contacts provided 17.9% reduction in the probability of falling in low dietary diversity score category. Increase in family size and age of spouses associated with increase in the probability of falling in low dietary diversity score category. Increase in land size owned and tropical livestock unit have decreased probability of falling in low dietary diversity score and increased probability of falling in medium and high categories. Households with high food gap months consumed less diversified food than households with low food gap months so that dietary diversity is a promising indicator for food security for livelihood surveys with caution on difficulty of rural households to attain high dietary diversity due to supply side factors. Attention should be given on targeting whole family, increase in extension service, asset building and raising awareness on family planning to improve household dietary diversity.

Keywords: Western Amhara, dietary diversity, determinants, ordered probit model

1. Introduction
The transformational vision of the 2030 Agenda for Sustainable Development calls on all countries and stakeholders to work together to end hunger and prevent all forms of malnutrition. This ambition can only be fulfilled if agriculture and food systems become sustainable, so that food supplies are stable and all people have access to adequate nutrition and health [1].

Food insecurity, or the inability of households and individuals to access food of adequate quantity and quality, is an important determinant of malnutrition. However, exploring the causal relationships between food insecurity and nutrition outcomes requires detailed information at the household – or even better, at an individual - level [1]. According to WFP [2], food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life.

Food security policies need to focus therefore not only on calorie intake but also on the consumption of a diversified diet which promotes the intake of different nutrients and prevents many diseases. Reduction in dietary diversity will lead to an increase in the proportion of malnourished people [3]. In food-insecure areas, meeting minimum standards of dietary quality is a challenge that has often not given enough emphasis [4].

Dietary diversity is widely recognized as a key dimension of diet quality and a promising indicator of food security [5]. Scant of evidence from developed countries showed that dietary diversity is strongly associated with nutrient adequacy [6].

Dietary diversity is defined as an increase in the variety of foods within and across food groups capable of ensuring adequate intake of essential nutrients that can promote good health, physical as well as mental development [7]. The more food groups included in daily diet, the greater the likelihood of meeting nutrient requirements because all nutrients can't be found within a single food item [8].

Developing countries are heavily challenged with the 'triple burden of malnutrition' encompasses the three dimensions of undernutrition (wasting, stunting & underweight), micronutrient deficiencies and overnutrition [4]. A large portion of the Ethiopian population have been affected by chronic and transitory food insecurity [9]. The situation of chronically food insecure people is more and more severe. Food security situation in Ethiopia is highly linked up to severe, recurring food shortage and famine, which is associated with recurrent drought. Currently, there is a growing consensus that food insecurity and poverty problems are closely related in the Ethiopian context. More than 50% of the total population, of whom the majority reside in rural areas, does not have access to the medically recommended minimum average daily intake of 2100 calories per person per day [10].

Amhara region also suffers from recurrent droughts and about half of the districts in the region are drought-prone and chronically food insecure. Majority of the population of the region (89%) live in rural areas depending heavily on agricultural activities where cereals account for more than 78% of cultivated land and about 85% of total crop production [11]. According to Households Consumption-Expenditure survey [12], Amhara region has experienced a poverty headcount index of 26.1%, next to Tigray (27%) and Benshangul Gumuz (26.5%), which is above the national average poverty incidence of 23.5%. The food poverty of Amhara region also reported being 31.3% which is one of the highest next to Tigray region (32.9%). The total population of the region is 20,558,851 with 50.6% of female population [13].

FAO [1] indicated food security as one major determinant of nutritional outcomes, especially for children. Other factors include: women's educational level; resources allocated to national policies and programmes for maternal, infant and young child nutrition; access to clean water, basic sanitation and quality health services; lifestyle; food environment; and culture. More context-specific assessments are recommended to identify the links between household food security and nutrition. This study, therefore, attempted to identify factors for farm households' dietary diversity score in the west of Amhara region productive safety net areas.

2. Methodology

Data for this study were collected from three districts of west Amhara region out of ten Bilateral Ethiopia-Netherlands Effort for Food Income and Trade (BENEFIT) Realizing Agricultural Livelihood Security in Ethiopia (REALISE) programme at Bahir Dar University Cluster targeted Districts.

Multi-Stage sampling was employed to identify sample households. In the first stage, the three districts namely Libokemkem and Lay Gayint from South Gondor zone and Enebise Sar Midir from East Gojjam zone were selected purposely. As the study focus was on Productive Safety Net Program (PSNP)[1] beneficiary households its proportion was used as an important criterion to select 2 kebeles from each district. In the second stage, a total sample of 300 households were selected randomly with probability proportional to size in every selected kebeles incorporating 70% PSNP beneficiaries and a quota of 20% allocated for female-headed households.

Enumerators were selected based on merit and experiences then subjected to training on the content of the questionnaire and on the data collection software (CSPro). Pretesting of the questionnaire undertaken so that data collectors and a supervisor were made familiar with the questions and their expression and presentation to the farmers. Modifications were then made based on field OBServations with a thorough discussion.

Data collection executed in November 2018 at the premises of the sampled households using personal interview of the household heads and wives for questions related to gender when applicable. The data then analyzed using descriptive statistics such as mean, percentages, frequency tables and cross-tabulations as well as Ordered Probit Regression.

Following FAO [4] in order to further assess dietary diversity score, three categories were formulated namely; low dietary diversity category (≤ 3 food groups); medium diversity category (4 to 6 food groups) and high diversity category (≥ 7 food groups) for households. Hence, the dietary diversity score (DDS) of households converted into categorical and ordinal measures, ordered discrete variables. For such data set ordered probit or logit models are the most appropriate for analysis [14] for multinomial logit or probit models would fail to account for the ordinal nature of the dependent variable [15]. While the logit assumes a logistic distribution of the error term, the probit assumes a normal distribution. Of course, the logistic and normal distributions generally give similar results in practice. However, ordered probit is the most widely used model for ordered response [16]. Therefore, the ordered probit model is used in this study.

The ordered probit, developed by McKelvey and Zavoina [17], is constructed on a latent (unOBServable) random variable which is stated as follows [18, 19].

$$y_i^* = x_i'\beta + e_i, i = 1, 2, \ldots, N \quad (1)$$

where $E(e_i|x_i) = 0$ and $Var(e_i|x_i) = 1$. Treating y_i, the OBServed variable, as a categorical variable with J response categories and also as a proxy for the theoretical (unOBServed) random variable, y_i^*, and defining $\mu = \mu_{-1}\ \mu_0\ \mu_1 \ldots \mu_{J-1}\ \mu_J$ as a vector of unOBServable threshold (or cut point) parameters, the relationship between the OBServed and the latent variables can be written as:

$$Y_i = j \text{ if } \mu_{j-1} < y_i^* \leq \mu_j, j = 0, 1, 2, \ldots, J \quad (2)$$

Where $\mu_{-1} = -\infty$, $\mu_0 = 0$, $\mu_J = \infty$ and $\mu_{-1} < \mu_0 < \mu_1 < \cdots < \mu_J$. The probabilities will thus be given as follows:

$$\begin{aligned} \text{Prob}[Yi = j] &= \text{Prob}[\mu_{j-1} < y_i^* \leq \mu_j \\ &= \text{Prob}[\mu_{j-1} - x_i'\beta < e_i \leq \mu_j - x_i'\beta \\ &= \Phi(\mu_j - x_i'\beta) - \Phi(\mu_{j-1} - x_i'\beta) \end{aligned} \quad (3)$$

[1] PSNP is a flagship social protection program of the Government of Ethiopia supported by a consortium of 11 development partners and has been operational in Ethiopia since 2005

Where $\Phi(\cdot)$ is the standard normal cumulative distribution function and J is the response categories, in this case 1, 2 and 3 since there are three categories for DDS.

As observed by Greene [20], since there is no meaningful conditional mean function and the marginal effects in the ordered probability models are not straightforward, the effects of changes in the explanatory variables on cell probabilities are normally considered. These are given by:

$$\frac{\partial Prob\{cell j\}}{\partial x_i} = [\phi(\mu_{j-1} - x_i'\beta) - \phi(\mu_j - x_i'\beta)]x\beta \quad (4)$$

with $\phi(\cdot)$ being the standard normal density function. In the light of the preceding discussion, the empirical model of this study is specified as:

$$DDS_{ij} = \alpha + \beta W_i + \gamma X_i + \delta Z_i + \varepsilon_i \quad (5)$$

where DDS is dietary diversity of households; subscript i represents a household, subscript j (j = 1, 2, 3) represents the three-pronged categorization of alternative dependent dummy variables indicating (i) whether a household falls within low DDS category, (ii) whether a household falls within moderate DDS category, and (iii) whether a household is within high DDS category; W, X and Z are, respectively, socioeconomic and institutional characteristics hypothesized to influence DDS; $\alpha, \beta, \gamma, \delta$ are parameters to be estimated and $\varepsilon \sim$ NID(0, 1).

Food items were categorized into 12 different food groups with each food group counting toward the household self-reported score if a food item from the group was consumed by anyone in the household in the previous 24 hours of a normal day, not a fest or a fasting day. The food groups used to estimate DDS included: cereals, roots or tubers; vegetables; fruits; meat or other meat products, eggs, fresh or dried or fried fish, pulses,, milk or other milk products, oil, fat or butter; sugar or honey, condiments, spices, coffee or tea. The score obtained was then categorized in to three levels using some cut-off values indicating low dietary diversity, medium dietary diversity and high dietary diversity categories. However, as there is no international consensus on which cut-off values to use [21], DDS less than or equal to three as low dietary diversity group and between four to six as medium category while DDS greater than or equal to seven as high diversity score category.

3. Results

3.1 Household characteristics

From the total sample about a third were female-headed households. The mean age of sample households was about 50 years which is evenly distributed except for non-PSNP beneficiary female headed households (FHH) which was the highest of about 57 years. Average household size of 4.63 members per household reported across the surveyed households with the highest for non-PSNP male headed households (MHH) having 5.32 members. Computation of the mean landholding of sample households indicated variation with the highest land ownership of 1.01 ha for MHH non-PSNP beneficiaries and the lowest size of 0.48 ha for FHH in both categories.

The education level of the household heads was explored using categorical data into different education levels indicated that majority of the household heads (55%) were found to have no formal education while only 7.33% had attained primary level of education. PSNP beneficiaries FHH had the most no formal educated heads with 79.57% of them having no formal education at all. On the other hand, non-PSNP beneficiaries MHH registered the least percentage (31.58%) of heads in the illiterate category. The average livestock asset owned, computed using a conversion factor [22] was 2.11 Tropical Livestock Unit (TLU) which significantly vary between PSNP beneficiaries and household headship. Livestock asset owned by PSNP beneficiaries was observed to be less than half of the non-PSNP beneficiaries (Table 1).

Table 1: Socio-demographic characteristics of sample households

Variables	PSNP		Non-PSNP		Total (N=300)
	MHH (N=123)	FHH (N=93)	MHH (N=76)	FHH (N=8)	
Headship of households (%)	41	31	25.33	2.67	100
Average age of household head (years)	49.72	49.61	49.86	56.88	49.91
Average household size (no.)	5.05	3.64	5.32	3.25	4.63
Average landholding (ha)	0.64	0.48	1.01	0.48	0.6
TLU	1.82	1.05	3.88	2.11	2.11
Education level of household heads (%)					
None	49.59	79.57	31.58	75	55
Read and write	20.33	4.3	34.21	12.5	18.66
Religious education	6.5	0	5.26	0	4
Primary education	8.94	5.38	7.9	0	7.33
Junior to high school	14.64	10.77	21.06	12.5	15.01

Source: Survey Results, 2018

3.2 Food Security Status

Months during which the household experienced a lack of food such that members of the household had to go hungry were recorded for the last 12 months [23]. Surveyed households self-reported food shortage mainly in the months of September, August and July while relatively adequate food provision reported in January, December and February. Non-PSNP MHH reported adequate provision in November, December, January and February and for FHH extended to March and April. For PSNP beneficiaries only January by MHH and none by FHH reported as adequate food provision months in the reference period (Table 2).

Table 2: Self-reported food gap months of sample households

Food gap months	PSNP				Non-PSNP				Total	
	MHH		FHH		MHH		FHH			
	N	%	N	%	N	%	N	%	N	%
January	0	0.0	1	1.3	0	0.0	0	0.0	1	0.5
February	2	2.0	3	4.0	0	0.0	0	0.0	5	2.3
March	6	5.9	4	5.3	1	2.9	0	0.0	11	5.0
April	8	7.9	4	5.3	2	5.9	0	0.0	14	6.4
May	9	8.9	8	10.7	4	11.8	1	14.3	22	10.1
June	41	40.6	36	48.0	9	26.5	4	57.1	91	41.7
July	72	71.3	58	77.3	27	79.4	5	71.4	163	74.8
August	89	88.1	62	82.7	31	91.2	7	100.0	190	87.2
September	91	90.1	65	86.7	29	85.3	7	100.0	192	88.1
October	45	44.6	44	58.7	14	41.2	4	57.1	107	49.1
November	14	13.9	13	17.3	0	0.0	0	0.0	27	12.4
December	2	2.0	2	2.7	0	0.0	0	0.0	4	1.8

Source: Survey results, 2018

Across sample farmers an average of 2.647 months of self-reported food gap months (FGM) reported. Comparison between groups on average food gap months indicated comparable results except highest of 3.125 months reported for FHH non-PSNP beneficiaries (Table 3).

Table 3: Mean number of food gap months (FGM) self-reported by sample households

Particular	PSNP				Non-PSNP				Total	
	MHH		FHH		MHH		FHH			
	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
FGM (no.)	123	2.585 (2.076)	93	2.57 (2.248)	76	2.789 (2.305)	8	3.125 (2.232)	300	2.647 (2.185)

Source: Survey results, 2018
Figures in parenthesis indicate standard deviation

3.3 Dietary diversity of households

Consumption of different food category within 24 hours of a normal day, a day in which there is no fest or fasting, for sample households indicated that all households consumed cereals and about 91% also reported consumption of condiments, spices, coffee or tea followed by about 86% of pulses. The least consumed food types reported were fruits, eggs and meat or other meat products while none reported consumption of fresh or dried or fried fish (Table 4).

Table 4: Self-reported food types consumed by the sample households in 24 hours of a normal day

Types of foods	PSNP				Non-PSNP				Total	
	MHH		FHH		MHH		FHH			
	N	%	N	%	N	%	N	%	N	%
Cereals	118	100.0	88	98.9	74	100.0	7	100.0	288	100.0
Roots or tubers	39	33.1	27	30.3	23	31.1	2	28.6	91	31.5
Vegetables	42	35.6	28	31.5	44	59.5	4	57.1	119	41.2
Fruits	1	0.8	1	1.1	1	1.4	0	0.0	3	1.0
Meat or other meat products	4	3.4	3	3.4	5	6.8	1	14.3	14	4.8
Eggs	1	0.8	4	4.5	1	1.4	0	0.0	6	2.1
Fresh or dried or fried fish	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Pulses	104	88.1	70	78.7	66	89.2	7	100.0	248	85.8
Milk or other milk products	9	7.6	5	5.6	9	12.2	0	0.0	24	8.3
Oil, fat or butter	71	60.2	56	62.9	55	74.3	3	42.9	186	64.4
Sugar or honey	11	9.3	9	10.1	15	20.3	0	0.0	36	12.5
Condiments, spices, coffee/tea	107	90.7	80	89.9	69	93.2	5	71.4	262	90.7

Source: Survey results, 2018

The DDS computed for the different categories under the study indicated similar results of about 4 food groups for all categories except for non-PSNP MHH which was the highest, 4.89 followed by 4.625 for non-PSNP FHH (Table 5).

Table 5: DDS of sample households

Particular	PSNP				Non-PSNP				Total	
	MHH		FHH		MHH		FHH			
	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
Food Item Diversity (DDS)	118	4.305 (1.291)	88	4.125 (1.294)	73	4.89 (1.318)	8	4.625 (1.768)	287	4.408 (1.332)

Source: Survey results, 2018
Figures in parenthesis indicated standard deviation

From the total households about 67% fall in the medium DDS while only 6.3% fall in the high DDS category. From the sample districts highest share of low DDS of about 40% and low share of only 1.08% of high DDS category recorded for Enebise Sarmidir district (Table 6).

Table 6: Share of sample districts in DDS categories

DDS Category	Share of districts in DDS category			Total
	Lay Gayint	Libo kemkeme	Enebise Sarmidir	
Low	27.08	14.29	39.78	26.8
Medium	65.63	75.51	59.14	66.9
High	7.29	10.20	1.08	6.3

Source: Survey results, 2018

Attempts were made to OBServe correlation between DDS and food gap months using both *Pearson's and Spearman's correlation analysis* methods. As indicated in Table 7 below highly significant and negative correlation between DDS and food gap months observed using both methods.

Table 7: Pearson's and Spearman's correlation analysis between DDS category and Food Gap Months

Pearson's correlation			Spearman's correlation between DDS category and Food Gap Months
	DDS category	Food Gap Months	
DDS category	1		Spearman's RHO = -0.1617
Food Gap Months	-0.1998	1	
	P value = 0.0007		P value = 0.0060
	Number of OBS = 287		Number of OBS = 287

Further investigation of the pair wise comparison of mean of FGM between DDS categories indicated significance difference in between low DDS and Medium DDS ($P<0.01$) as well as between high DDS and low DDS categories ($p<0.1$) but not between high and medium DDS categories (Table 8).

Table 8: Pair wise comparison of mean of Food Gap Months between DDS category

FGM	Contrast	Std. Err.	P > T
Medium DDS vs Low DDS	-1.051	0.284	0.000
High DDS vs Low DDS	-1.141	0.552	0.040
High DDS vs Medium DDS	-0.090	0.520	0.862

Mean comparison t-test of FGM by DDS category indicated that households with low DDS category to have 3.36 FGM which is significantly higher than the overall mean FGM of 2.65 ($p<0.01$). For medium DDS category FGM of 2.352 computed which is significantly lower than the overall mean FGM ($p<0.05$) while inconclusive result obtained for the high DDS category (Table 9).

Table 9: Mean comparison test (T-Test) of food gap months by DDS category

DDS Category	Variable	OBS	Mean	Std. Err.	[95% Conf. Interval]	
Low DDS	FGM	77	3.363	0.254	2.857	3.869
	Ho: mean = 2.65 t = 2.8086					
	Ha: mean < 2.65 Ha: mean != 2.65 Ha: mean > 2.65					
	Pr(T < t) = 0.9968 Pr(|T| > |t|) = 0.0063 Pr(T > t) = 0.0032					
DDS Category	Variable	OBS	Mean	Std. Err.	[95% Conf. Interval]	
Medium DDS	FGM	192	2.312	0.145	2.026	2.600
	Ho: mean = 2.65 t = -2.3242					
	Ha: mean < 2.65 Ha: mean != 2.65 Ha: mean > 2.65					
	Pr(T < t) = 0.0106 Pr(|T| > |t|) = 0.0212 Pr(T > t) = 0.9894					
DDS Category	Variable	OBS	Mean	Std. Err.	[95% Conf. Interval]	
High DDS	FGM	18	2.222	0.608	0.939	3.504
	Ho: mean = 2.65 t = -0.7036					
	Ha: mean < 2.65 Ha: mean != 2.65 Ha: mean > 2.65					
	Pr(T < t) = 0.246 Pr(|T| > |t|) = 0.491 Pr(T > t) = 0.754					

The ordered probit estimates indicated that above primary education of household heads, primary education of spouses, access to extension service (Frequency), land size owned and TLU indicated significant positive relationship with DDS. Family size and age of spouse indicated negative relationship with DDS. PSNP membership has no significant effect of DDS which might be associated with wrong targeting (wrong inclusion and exclusion of beneficiaries) as indicated by [24] as a major challenge of PSNP intervention in the country (Table 10).

Table 10: Estimates of the ordered probit model

Particular		Coefficient	Std. Err.	Z
PSNP Beneficiary (No)		-0.115	0.226	-0.510
Headship (FHH)		0.715	0.493	1.450
HH Education	Informal Education	0.281	0.241	1.170
	Primary Education	-0.119	0.356	-0.330
	Above Primary Education	0.852***	0.312	2.730
Spouse Education	Informal Education	0.299	0.327	0.910
	Primary Education	0.646*	0.382	1.690
	Above Primary Education	-0.070	0.364	-0.190
Access to credit service (No)		0.230	0.199	1.150
Access to extension service (Frequency)	once a year	0.007	0.237	0.030
	every month	0.323	0.261	1.240
	every two weeks	-0.030	0.380	-0.080
	Weekly	0.923*	0.542	1.700
Access to market information (Yes)		0.137	0.204	0.670
Family size		-0.130*	0.070	-1.860
Age of household head		0.018	0.012	1.440
Age of spouse		-0.026*	0.015	-1.770
Land size owned		0.267*	0.159	1.680
TLU		0.172***	0.055	3.120
μ_1		-0.544	0.608	
μ_2		2.155	0.631	
Number of Observations		194		
Log likelihood		-127.221		
LR chi2(19)		44.05		
Pseudo R2		0.148		
Prob > chi2		0.001		

***, **, * Stand for values statistically significant at 0.01, 0.05 and 0.1 levels respectively

As the coefficients of the ordered probit fail to represent the magnitude of the effects of the explanatory variables on the dependent variable [15], the marginal effects are discussed. Accordingly, above primary education level of household head reduced the probability of falling under the low DDS category by 18.6% while increased falling in the medium category by 7% and that of high DDS category by 11.6%. Moreover, spouse primary education resulted in reduction of probability of falling in low DDS category by 13.7% and increased falling in the medium DDS category by 4.4%. Similarly, frequent or weekly contact with extension service providers showed 17.9% decline on probability of falling in low DDS category while a unit increase in land ownership has decreased the probability of falling in low DDS by 6.9%, increased for high DDS by 1.8%. A unit increase in TLU reduced the probability of falling in low DDS by 4.4% while increased for medium DDS by 2.5% and for high DDS by1.9%.

Conversely, a unit increase in family size has shown 3.3% increased probability of falling in the low DDS and decrease by 1.9% from medium and 1.4% decreased from the high DDS category. A unit increase in age of spouse resulted in increase of the probability of falling in low DDS by 0.7%, decrease by 0.4% and 0.3% from medium and high DDS category respectively (Table 11).

Table 11: Marginal Effects for Ordinal Probit Model

Particular		Y=1		Y=2		Y=3	
		DY/DX	Std. Err.	DY/DX	Std. Err.	DY/DX	Std. Err.
PSNP beneficiary (No)		0.030	0.059	-0.017	0.034	-0.013	0.025
Household Headship (FHH)		-0.144	0.072	0.033	0.036	0.111	0.100
Household head education level	Informal	-0.076	0.064	0.050	0.042	0.026	0.024
	Primary	0.036	0.110	-0.028	0.086	-0.008	0.024
	Above primary	-0.186***	0.058	0.070**	0.036	0.116**	0.054
Spouse education level	Informal	-0.073	0.073	0.038	0.031	0.035	0.044
	Primary	-0.137**	0.063	0.044*	0.024	0.093	0.070
	Above primary	0.019	0.102	-0.013	0.069	-0.007	0.033
Access to credit (No)		-0.059	0.051	0.034	0.030	0.025	0.022
Access to extension	once a year	-0.002	0.065	0.001	0.043	0.001	0.022
	every month	-0.080	0.063	0.043	0.033	0.037	0.032
	every two weeks	0.008	0.106	-0.005	0.071	-0.003	0.035
	Weekly	-0.179***	0.071	0.030	0.068	0.149	0.122
Access to market information (Yes)		-0.035	0.051	0.019	0.027	0.016	0.024
Family Size (Number)		0.033*	0.018	-0.019*	0.010	-0.014*	0.008
Household head age (years)		-0.005	0.003	0.003	0.002	0.002	0.001
Spouse age (years)		0.007*	0.004	-0.004*	0.002	-0.003*	0.002
Land size owned (hectare)		-0.069*	0.041	0.039	0.024	0.029*	0.018
TLU (Number)		-0.044***	0.014	0.025***	0.009	0.019***	0.007

Note: DY/DX for factor levels is the discrete change from the base level.

4. Discussion

Households with insufficient access to food often face other challenges related to food insecurity including poor health, a decline in productivity and malnutrition. These challenges can often create a vicious circle where households are unable to produce enough food, even in good years, because they are battling with insufficient means of production, chronic health issues and are unable to work to their full potential [9]. Dietary diversity-the number of different foods or food groups consumed over a given reference period-is an attractive indicator for food security [25-27]. Hoddinott and Yohannes [28] found that for every 1 percent increase in dietary diversity there was an associated 1 percent increase in per capita consumption, a 0.7 percent increase in total per capita caloric availability, a 0.5 percent increase in household per capita daily caloric availability from staples, and a 1.4 percent increase in household per capita daily caloric availability from non-staples. These associations, which were found in both rural and urban areas and across seasons, did not depend on the method used to assess the associations, or on the number of unique food groups consumed as the measure of dietary diversity.

In south Africa Faber [5] reported that households with low dietary diversity also experienced more food shortages during the previous 12 months than households with a higher dietary diversity. It can thus be argued that dietary diversity is a promising indicator for food security to be used in livelihood surveys.

This study indicated negative association between FGM and DDS categories. The mean of FGM between DDS categories indicated significance difference between low DDS and Medium DDS as well as between high DDS and low DDS categories. Disparity was also observed between DDS categories regarding FGM as households with in low DDS category indicated higher FGM than the overall mean and households with in medium DDS category witnessed lower FGM. These results are mixed but reliable in indicating the fact that households in the rural part of the region which are marginal only have access to some of the food types indicated to consume might be due to underdeveloped market and poor infrastructure.

5. Conclusion

The food security status of the sample farmers indicated food shortage encountered mainly in the months of September, August and July and for non-PSNP households 4 months of adequate food provision but none for PSNP beneficiaries. Food gap months of PSNP households were twice that of non-PSNP. Since high food gap months are directly related to low DDS, consideration of narrowing food gap months mainly for PSNP households need special attention to address nutrition security.

Fruits, eggs and meat or other meat products were the least consumed while none reported consumption of fresh or dried or fried fish so that DDS of about 4 computed for all the sample households. This clearly indicated the need of introduction of suitable fruit crops to households to improve DDS of households.

Households with high food gap months consumed a diet with less variety than households with low food gap months, as shown by the negative association between FGM and DDS. Households with low dietary diversity also experienced more food shortages during the previous 12 months than households with a higher dietary diversity. It can thus be argued that dietary diversity is a promising indicator for food security to be used in livelihood surveys but attention should be given regarding difficulty of rural households to attain high DDS due to supply and associated factors to some food items by the marginal rural households. The ordered probit model result indicated a positive likelihood between DDS and above primary education of household heads, primary education of spouses, access to extension service, land size owned and TLU. In contrary family size and age of spouse indicated a negative likelihood with DDS. These indicated the need for targeting of whole family in interventions, increase in extension services, asset building as well as raising awareness on family planning in the food in-secured parts of the region.

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