Determinants of Household Dietary Diversity Score in Food Insecure Areas of Ethiopia

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Abstract

The study assessed the Ethiopia-Netherlands Bilateral project implemented, for Realizing Sustainable Agricultural Livelihood Security, in Tigray, Amhara, Oromia, and South Nations, Nationalities, and Peoples regions in Ethiopia. It is a project-based study on which the baseline data were collected from 1902 household heads to assess the determinants of households' dietary diversity score for food insecure households in the country. The method of analysis applied was descriptive statistics and ordered Probit Model. The results indicated that the majority of sample households dominantly consumed staple cereal food with inadequate animal products, fresh fruits, and fish. The average household dietary diversity score of 4.79 was principally made from the consumption of staple cereals, condiments/spices/tea/coffee, vegetable consumption, and considerable consumption of oilseeds and pulses or legumes. The study revealed significant differences in consumption patterns among regions, and university cluster respondents with respect to key food groups. The household dietary diversity scores are generally low for Productive Safety Net (PSNP) beneficiary households which are 4.56 for food groups and 5.25 for non-PSNP households. The household dietary diversity score categories revealed considerable differences between the two groups with 27% of PSNP households falling under the low household dietary diversity score category, whereas only 16% for non-PSNP households. However, the medium category of household dietary diversity score is the same for the two groups indicating that the high household dietary diversity score was 13% for PSNP and 24% for Non- PSNP households. Fruits, eggs, and meat or other meat products were the least consumed. A household head dietary diversity score of about four was computed for all the sample households. This clearly indicated the need to introduce suitable fruit crops and animal-source foods to household heads to improve the dietary diversity scores. This calls for considering seasons when providing food/cash transfer support for the PSNP beneficiaries. The model result also indicated PSNP, education level, and land ownership indicated a significant positive relationship with household dietary diversity score. Family size, extension frequency, and age of household heads indicated a negative relationship with the household dietary diversity score category. The study suggested that strategies aimed at improving the consumption behavior of rural households in the study area should be directed to address the determining factors of household food consumption.

***Key words**:* Food security, Dietary Diversity Score, Ordered Probit Model, Ethiopia

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Introduction

Ensuring food security in Ethiopia is one of the country's greatest challenges. In 2015/16, nearly one in five Ethiopians required food support because of drought alone demonstrating a high level of food insecurity. Moreover, a large segment of the population is vulnerable to food insecurity. Rapid population growth, climatic and land pressures, commodity price spikes, and other challenges significantly hamper to strengthen food security (Cochrane, 2018). Before 2005, the Government of Ethiopia (GoE) launched emergency appeals for food aid and other forms of emergency assistance almost annually. Although these succeeded in averting mass starvation, they did not banish the threat of further famine and did not prevent asset depletion for marginally poor households affected by adverse rainfall shocks. In response, the GoE and a consortium of donors implemented a new response to chronic food insecurity in rural Ethiopia. Rather than mounting annual appeals for assistance and ad-hoc distribution of food aid, they established the Productive Safety Net Program (PSNP), a federal government program implemented almost entirely through government systems, with harmonized donor support.

PSNP is one major component of the food security program implemented by the government of Ethiopia with the support from donors that aimed at providing more reliable and timely support to chronically food insecure households. It provides transfers to the food insecure population in chronically food-insecure districts in a way that prevents asset depletion at the household level and creates assets at the community level. Unlike the annual emergency appeals, the PSNP was conceived as a multiyear program to provide recipients with predictable and reliable food transfers. Most beneficiaries undertake public works (Coll-Black *et al.*, 2012). It extends support to these households through two channels: Direct support (DS) and

Public Works (PW). PW is a major component of the PSNP designed to address the underlying causes of chronic food insecurity by creating access to market, improving access to services and natural resources, and rehabilitating and enhancing the natural environment. This is achieved by engaging the labor rich but poor households in the construction of various PW as an employment opportunity in the rural Ethiopia. DS is provided for households with no labor or could not contribute. People who are eligible for unconditional direct support do not participate in PSNP of the Public Work.

In line with the PSNP, BENEFIT REALISE (Bilateral Ethiopia-Netherlands Effort for Food Income and Trade - Realizing Sustainable Agricultural Livelihood Security in Ethiopia) started in 2018 as a three-year project. This project aimed to take lessons learned from the Wageningen University and Research Capacity building for scaling up of evidence-based best practices in Agricultural Production in Ethiopia (CASCAPE) and Integrated Seed Sector Development (ISSD) programs to PSNP target districts. BENEFIT REALISE aimed at improving sustainable food security, income, and trade among rural households in Ethiopia with the goal of enhancing human, organizational and institutional capacities to adapt, validate and scale best fit practices to improve the resilience of chronically food insecure households in PSNP districts.

Developing countries are heavily challenged with the ‘triple burden of malnutrition’ encompassing the three dimensions of under-nutrition (wasting, stunting & underweight), micronutrient deficiencies, and over nutrition (FAO, 2017). A large portion of the Ethiopian population has been affected by chronic and transitory food insecurity (Abduselam, 2017). The situation of chronically food insecure people is more and more severe. Food security situation in Ethiopia is highly linked with 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 (Mota *et al*., 2019).

Food insecurity in Ethiopia derives directly from dependence on undiversified livelihood based on low inputs and low output rain-fed agriculture. Food insecurity incorporates low food intake, variable access to food, and vulnerability of livelihood strategy that generates food in good times but is not resiliently adequate. These outcomes correspond broadly to chronic, cyclical and Transitory Food Insecurity (TFI), which are all endemic in Ethiopia. The main triggers for TFI in Ethiopia are drought and war. In response to these formidable challenges, BENEFIT REALISE project targeted food insecure districts where PSNP is being implemented to improve the livelihood of farming households. In these areas, the project aimed at introducing best fit agricultural technologies, ensuring improved seed access, enhancing the capacity of farmers, and creating enabling environment as well as tackling systemic bottlenecks. Through these themes, the project aspires to enhance food security and improve livelihood as well as speed up PSNP graduation. Various actors have been undertaking different initiatives towards tackling hunger and improve the livelihood of the rural poor in the food insecure parts of the country for decades. However, not all interventions assess the impact the intervention brought to the livelihood of the farming community as the project has supported mainly food insecure households in its target regions of Ethiopia. Though the project has aimed to reduce food gap months, increase dietary diversity, and increase productivity as well as

assets in the target intervention areas, its impact on the stated areas of intervention has not yet been assessed. Understanding factors for HDDS may contribute to understand and take part on the relevant areas to enhance HDDS.

Material and Methods

Description of the Study Area

BENEFIT-REALISE project generated baseline data and information through a baseline study in selected intervention districts at the beginning of the interventions in October, 2018. Baseline data collected were used in setting targets for the planning and monitoring of progress towards its goal and evaluation of the achievements at the end of the project in 2020. REALISE interventions targeted 60 *Woredas* known by their moisture stress and limited livelihood options in four regions: 20 in *Amhara*, 20 in *Oromia*, 10 in Southern Nations, Nationalities and People (SNNP), and 10 in *Tigray*. This baseline survey covered 18 *Woredas* of the 60 total program target *Woredas* in 14 zones of the four regions of Ethiopia (Figure 1).

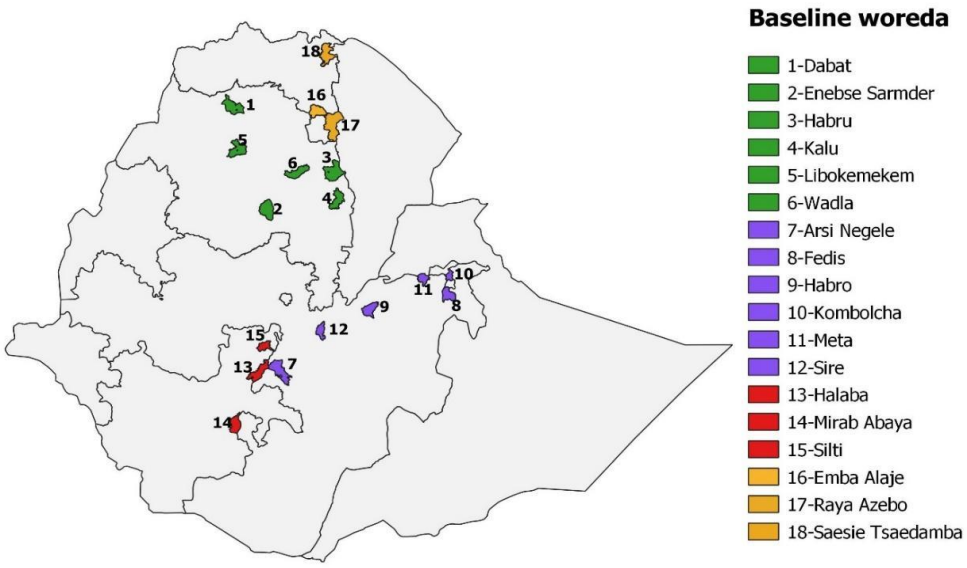

Figure 1. Map of study area

Sampling Design

This study applied multi-stage sampling procedure to identify sample households. In the first stage, 18 *Woredas* from four regions (*Amhara, Oromia, SNNP* and *Tigray*) were selected. As the program focuses on PSNP client households, in the second stage, representative number of households were selected randomly with probability proportional to household size in every selected *Woreda* incorporating 70% PSNP clients with a quota of 20% FHHs. Based on this, the total sample size for this study was 1902 HHs (including both MHH and FHH). The table below shows the sampling size per cluster.

Table 1. Number of households covered by the survey

Region	University Cluster	Number of *Woredas*	No. of respondents				
			Male		Female		Total
			PSNP	Non-PSNP	PSNP	Non - PSNP	
Amhara	*Bahir Dar*	3	123	76	93	8	300
	Woldia	3	118	75	85	22	300
Oromia	*Arsi*	2	89	58	43	10	200
	Haramaya	3	174	79	36	13	302
	Oda Bultum	1	89	30	21	10	150
Tigray	*Mekelle*	3	72	83	108	37	300
SNNP	*Hawassa*	2	92	38	49	21	200
	Arba Minch	1	59	46	32	13	150
Total		**18**	**816**	**485**	**467**	**134**	**1902**

Method of Data Collection

The main sources of information for this study were the sample households. The survey was implemented with the tripartite collaboration of REALISE top management, eight REALISE cluster universities, and WUR. To ensure good logistics management and facilitate collaboration, *Woreda* stakeholders and participants were informed on the time of the survey in advance. The project also formed eight teams across the eight cluster universities, each consisting of one supervisor, and 2-5 enumerators. The data collection was conducted from November 13th to December 3rd, 2018. A total sample consisting of 1902 households was selected from 36 *Kebeles* and 18 *Woredas*. To ensure data quality, data coding, merging, transforming, and cleaning were undertaken before analysis.

Method of Data Analysis

Both descriptive analysis and econometric model were employed to achieve the objectives of this study. Descriptive statistics like mean, variance, standard deviations, frequency distributions, and percentages were used to assess the socio-economic situations of the sample respondents. When it comes to the framework of analyzing ordinal responses, like high, medium and low, the ordered probit (and logit) models have come to be widely used (McElvey and Zavoina, 1975). Because of the ordinal nature of the dependent variables, ordered probit techniques, which are also suggested by previous literatures such as Oswald and Clark (1995), Macbride (2001), Ferrer-Carbonell (2005), and Caporale *et al.*, (2007), were used for this study. Similar estimated coefficients are found when the two different dependent variables are regressed separately with ordered logistic techniques, compared to the ordered probit regressions. Moreover, the results of the ordered probit technique are found equivalent to those generated by the ordered logit technique. Hence, both the ordered logistic estimated models and the ordered probit estimated models yield the same results.

Furthermore, Greene (2012) discusses that ordered probit models are built around a latent regression assuming a continuous and latent measure of the dependent variable which is given by:

$$y_i^* = x_i' \beta + \varepsilon_i \quad \ldots\ldots (1)$$

where: x_i' would be a vector of explanatory variables, the vector of parameters to be estimated is β and ε_i , y_i^* would respond to the ordinal reported scales of the dependent variable y_i. Both dependent and independent variables are selected based on literature reviews and summarized in Table 1 below.

The equation in question does not imply a linear utility function by default, i.e., the vector of explainable variables could also contain quadratic terms.

In equation (1) y_i^* is unobserved and what is observed is as follows:

$y_i=0 \; if \; y_i^* \leq 0$…….....…… (2)

$y_i=1 \; if \; 0<y_i^* \leq \mu 1$……..... (3)

$y_i=2 \; if \; \mu 1<y_i^* \leq \mu 2$ …….. (4)

$yi=J \; if \; \mu J-1 \leq yi*$……. (5)

Where: the μ's are unknown parameters to be estimated simultaneously with β., and The μ-variables could be seen as a form of censoring, that is the μ's represents different thresholds to be estimated simultaneously with β.

As Greene (2012) assumes $\varepsilon \sim N$ (0,1) which would give the following properties:

Prob (y_i = 0 | xi) = Φ(−xi′β) ……..... (6)

Prob (y_i = 1 | xi) = Φ(μ1 − xi′β) − Φ(−xi′β) ……..…..... (7)

Prob (y_i = 2 | xi) = Φ(μ2 − xi′β) − Φ(μ1 − xi′β) …… …… (8)

Prob (y_i = J | xi) = 1 − Φ(μJ−1 − xi′β) …….. (9)

where: Φ (..) represents the cumulative distribution function.

For the probabilities to be positive, the following must apply: 0 < μ1 < μ2 < ⋯ < μJ−1 …..(10) The nature of the ordered probit model implies that in order to get estimations of any parameter that could be interpreted as a magnitude,

one must calculate marginal effects, as discussed in Greene (2012). Marginal effects are calculated as follows:

$\partial\ Prob\ (yi=1|xi)xi=[-\emptyset(xi'\beta)-\emptyset(\mu 1-xi'\beta)]\beta i$ ……(11)

$\partial\ Prob\ (yi=2|xi)xi=[-\emptyset(\mu 2-xi'\beta)-\emptyset(\mu 1-xi'\beta)]\beta i$ ……(12)

$\partial\ (yi=J|xi)xi=1-\emptyset(\mu J-xi'\beta)\beta i$ ……...(13)

The general output from the ordered probit regression model does not include the common F-test or R^2 value, typically found in an OLS regression. Hence, a different method of determining whether the included interaction variables have any explanatory power in explaining the model must be considered. Specifically, a Wald Test of composite linear hypotheses about the parameters of the two regression models is considered. The Wald Test tests whether the interaction variables, taken as a whole, are significant by testing whether the interaction of Probit and logistic regression does not have equivalence with the R-squared that is found in an OLS regression, i.e. the proportion of variance for the response variable explained by the predictors.

Table 1. Definition of variables, measurement and hypothesis

Variable	Type and Definitions	Measurement	Hypothesis
Dependent Variable			
HDDS	Ordered from minimum of 0 to maximum of 12	Ranges from 0 to 12 food groups	
Explanatory Variable			
AGHH	Represents age of the household head	In years	+
SEXHH	A dummy variable representing sex of the client	0= female 1= Male	+
MARHH	A dummy variable representing the marital status of the household head	0=single 1= Married	+
EDUHH	Represents the educational level of household head	Number of years completed	−
FMSZ	Represents the number of family members of the household	In number	+
LANDOWN	Represents the land size owned by the household	In hectare	+
PSNP	A dummy variable represents if a household is beneficiary of PSNP or not	0 = not beneficiary 1 = Beneficiary	+
PRIMOCC	Represents primary occupation of the household head	0 = Agricultural 1 = Non-agricultural	+
EXTFREQ	Represents frequency of extension contact	In number	+
MARINF	A dummy variable represents market information access	0 = No 1 = Yes	+

Results and Discussion

Descriptive Statistics Results

The Key Performance Indicators (KPI) of the REALISE program are food gap months close to zero for the first tercile, and drop to 0.68 and 2.03 months to the second and third terciles, respectively, over the project period and increases the HDDS of REALISE target increased at least by one food group over the project period compared to the baseline at all levels.

Number of Food Gap Months (FGMs): The base line values indicated those food gap months close to zero for the first tercile and drop to 0.68 and 2.03 months to the second and third terciles, respectively over the project period (Figure 2).

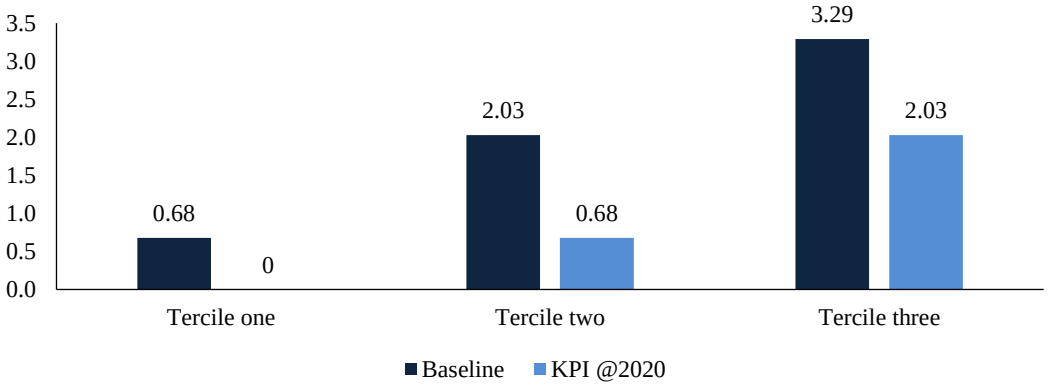

Figure 2. REALISE target in food gap months for PSNP households

The food gap months is defined based on the self-reported food shortage months experienced by the households from their own yearly production, considering the staple food and food intake of the community in the study areas. The mean number of food gap months for the eight clusters was around 3.14. It ranges between 1.31 in *Woldia* and 4.75 in *Arba Minch*. Region wise,

the food gap months were high in SNNP (4.05) and *Oromia* (3.62), moderate in *Tigray* (3.22), and low at *Amhara* (2.03). Among PSNP households, the food gap months were found high for all regions with mean value of 4.16 (3.80 in *Oromia*, 3.77 in *Tigray*, and 2.35 in *Amhara*). The PSNP mid-term evaluation report conducted by IRPRI showed that 2018 mean food gap in PSNP households was higher in SNNP (2.8 months) and *Oromia* (2.5 months) and lower in *Tigray* (1.5 months) and *Amhara* (1.4 months) (Table 2 and Figure 3). The baseline study results showed similar trend except the figure variation that can be attributed to differences in sample size and study areas; FHHs' food gap months was 3.24 while MHHs' was only 3.00 months.

Table 2. Households' food gap months

University Cluster		**Regions**		**PSNP status**		**SEX**	
Bahir Dar	2.75	*Amhara*	2.03	PSNP	3.39	MHH	3.00
Woldia	1.31	*Oromia*	3.62	Non-PSNP	2.61	FHH	3.42
Arsi	3.08	SNNP	4.05				
Haramya	3.66	*Tigray*	3.22				
Oda Bultum	4.28						
Arba Minch	4.75						
Hawassa	3.53						
Mekelle	3.22						
Total	**3.13**		**3.13**		**3.13**		**3.13**

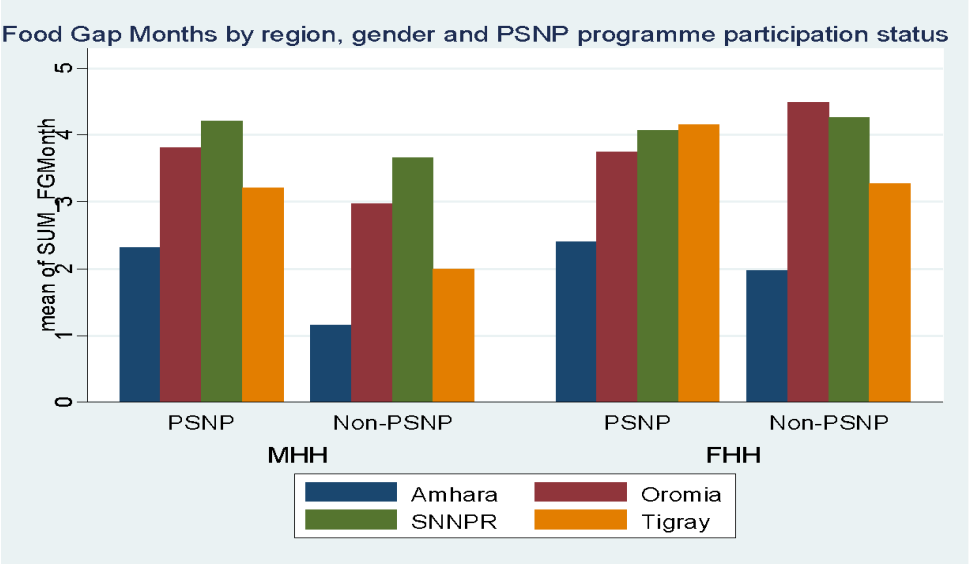

Figure 3. Food gap months by region and PSNP program participation status

The baseline study showed that households experiencing food shortage vary from 2% low in December to 82.4% in July. While the harvested *Meher* crops (from November through January), and the government PSNP transfer improved physical and economic food access, food shortage intensified in June, July, August, and September where more than 50% of the population is challenged to obtain enough food on their table to feed their family members (Figure 4)

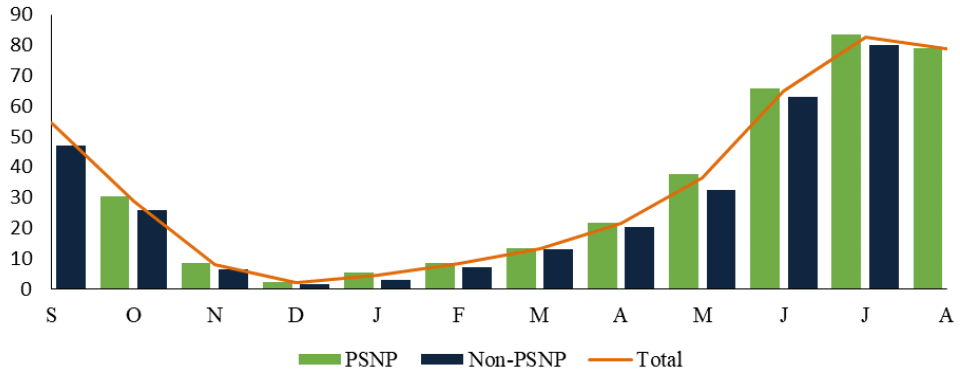

Figure 4. Percentage of households (PSNP, Non-PSNP & Total) experiencing food gap average months of good Gap in 2018 production season

Household Dietary Diversity Score (HDDS): The Household Diversity Dietary Score (HDDS) is comprised of the following twelve food groups: staple cereals; tubers; meat; eggs; fish and shellfish; legumes; vegetables; fruit; milk and milk products; oil and oil seeds; sugar; and tea/coffee. The highest possible score for the dietary diversity is 12 and the lowest 1, where 12 is equal to the most diversified diet and 1 is the least diversified diet. The study looked into the number of food groups consumed by household members over a 24-hour period (Figure 5).

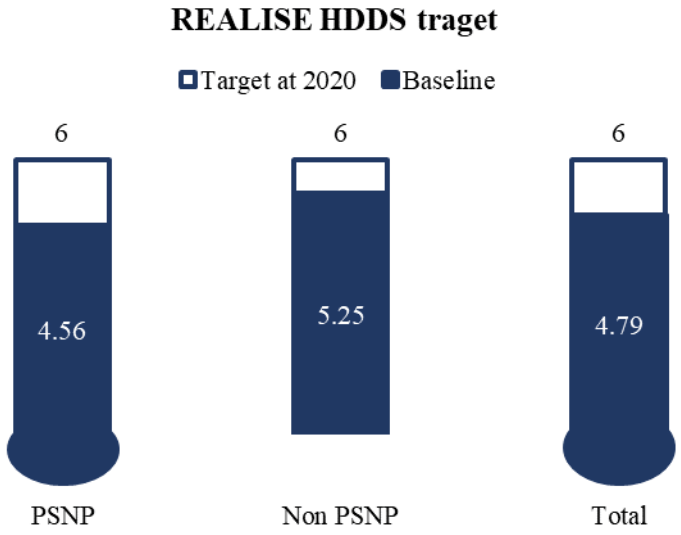

Figure 5. REALISE HDDS target

Intensity of Household Dietary Diversity Score

Following FAO (2017), in order to further assess dietary diversity, 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.

Intensity of HDDS by clusters: When using the three category scales of HDDS, the study showed that considerable proportion of sample households fall under low HDDS in *Haramaya* (43%), *Hawassa (*54%), and *Oda Bultum* (37%) university clusters. On the other hand, proportion of households falling under high HDDS was found at *Mekelle* (30%), and *Arsi* (29%) university clusters (Table 3).

Table 3. Dietary diversity score by cluster

Region	Cluster	Actual mean HDDS	Rounded HDDS	Low HDDS	Medium HDDS	High HDDS
Amhara	*Bahir Dar University*	4.41	4	77 (24%)	193 (67%)	19 (7%)
	Woldia University	5.44	5	24 (8%)	203 (72%)	56 (20%)
Oromia	*Arsi University*	5.77	6	16 (8%)	125 (63%)	58 (29%)
	Haramya University	4.21	4	129 (43%)	117 (39%)	51 (17%)
	Oda Bultum University	4.36	4	55 (37%)	71 (48%)	22 (15%)
SNNP	*Arba Minch University*	4.53	5	30 (20%)	108 (72%)	12 (8%)
	Hawassa University	3.57	4	90 (45%)	109 (55%)	1 (1%)
Tigray	*Mekelle University*	5.63	6	23 (8%)	185 (63%)	88 (30%)
	National	4.79	5	444 (24%)	1111 (60%)	307 (16%)

Intensity of HDDS by PSNP participation status: The mean of HDDS among PSNP and non-PSNP households was computed, and the findings showed that HDDS is generally low among the two groups. Except for a little variation, the mean of HDDS for PSNP households was 4.56, and for non-

PSNP households 5.25. However, the HDDS categories revealed considerable differences between the two groups. For instance, 27% of PSNP households fell under low HDDS category, whereas only 16% did among the non-PSNP households. While the medium category of HDDS is the same for the two groups, the high HDDS was 13% for PSNP and 24% for non-PSNP households (Table 4).

Table 4. HDDS by PSNP participation status

PSNP participation status	Actual mean HDDS	Rounded HDDS	Low HDDS	Medium HDDS	High HDDS
Yes	4.56	5	344 (27%)	749 (60%)	161 (13%)
No	5.25	5	100 (16%)	362 (60%)	146 (24%)
Total	4.79	5	444	1111	307

Orderd Probit model Result on Determinants of HDDS

The ordered probit regression model indicated LR chi^2 (9) statistically significant at 1% ($p<0.01$) which indicated the model is good fit in representing empirical data. For the national data set, the ordered probit estimates indicated PSNP status, education level, and land ownership indicated significant positive relationship with HDDS. Family size and age of household head indicated negative relationship with HDDS (Table 5).

Table 5. Orderd Probit model resut HDDS determinants with their Marginal effects

HDDS	**Coef.**	**Std. Err.**	**Y_1 (dy/dx)**	**Y_2 (dy/dx)**	**Y_3 (dy/dx**
PSNP Status (Yes)	0.311*	0.058	-0.098***	0.025***	0.073***
Household headship (MHH)	0.035	0.099	-0.011	0.003	0.008
Household head age (years)	-0.006*	0.002	0.002**	-0.001***	-0.001**
Primary occupation (Agriculture)	-0.001	0.012	0.000	0.000	0.000
Household head education (years)	0.012**	0.005	-0.004**	0.001**	0.003**
Marital status (Married)	-0.061	0.039	0.019	-0.005	-0.014
Land size owned (ha)	0.207*	0.039	-0.065***	0.017***	0.048***
Extension frequency (number)	-0.098*	0.028	0.031***	-0.008**	-0.023***
Market information (Yes)	0.094***	0.053	-0.030*	0.008*	0.022*
cut1	-0.483	0.161			
cut2	1.241	0.163			
Number of observations	1,896				
LR chi2(9)	123.08*				
Pseudo R^2	0.0339				

Note: *, **, and ***are statistically significant at 1%, 5% and 10% significant level.

The result of ordered probit model indicated that a change in PSNP status from PSNP beneficiary to non-PSNP beneficiary will decrease being in the low HDDS category by about 10% while increase being in the medium HDDS category by 2.5%, and being in the higher HDDS category by 7.3%, which are highly significant (P<0.01). As non-PSNP farmers are better-off, the finding of this study is valid. Similarly, the descriptive statistics results in Table 8 amplify higher HDDS for non-PSNP households.

An increase of a year in household age significantly increased the probability of falling in the low HDDS by 0.2% (p<0.01), while it decreased the

probability of falling in medium and higher HDDS by the same magnitude of 0.1% ($p<0.05$). This result ties well with previous studies in Ethiopia wherein similar results were reported (Admasu and Beneberu, 2019).

As education level of the household head increased by one year, the probability of falling in low HDDS decreased significantly by 0.4% ($p<0.05$), while it increased the probability of falling in medium HDDS by 0.1% ($p<0.05$), and increased to the higher HDDS category by 0.3% ($p<0.05$).

When comparing this result to those of older studies in Latin America (Cordero-Ahiman *et al*., 2021), it must be pointed out that these basic findings are consistent with research showing that education was associated with increased scores on both the HDD and HFS, compared to the head of a household with no formal schooling. Similarly, Samuel *et al*, (2020), in his study of social, economic, and DDS characteristics and anemia confirms that anemia was significantly associated with the lowest wealth index, and formal education of household justifying the result of this paper. Respondents with no education background were affected 6.3 times more than the educated women.

A hectare increase in land size was observed to reduce the probability of falling in low HDDS by 6.5%, while an increase in probability of falling in medium HDDS by 1.7%, and higher in HDDS category by 4.8% at p-value of less than 0.01.

Extension frequency was associated with the probability of an increase in low HDDS, and a decrease in medium and high HDDS which might be associated with market-oriented production and lower diversification of farmers who are better beneficiaries of extension services.

Access to market information indicated a decrease in the probability of low HDDS by 3%, and an increase in medium HDDS category by 0.8% as well as an increase in higher HDDS by 2.2% ($P<0.1$).

Conclusions and Recommendations

Conclusions

Ordered probit model result indicated that the household's decision to diversify the HH diets was influenced by PSNP status, age of household head, education level, land ownership, extension, and market information. Extension service measured as the frequency of visits was one of the important determinants of household's dietary diversifications. This particularly was associated with the probability of an increase in low HDDS and a decrease in medium and high HDDS which might be linked with market-oriented production and lower diversification of farmers who are better beneficiaries of extension services. Such results point out that there is a need to incorporate a comprehensive extension nutrition sensitive package in the agricultural extension service provision in addition to focussing on commercialization. Farm size by any means would increase the dietary diversity since more family size encourages the probability of households to diversify their dietary consumption. This would underline the knock-on effect of the return on primary education. Furthermore, the descriptive result based on the household diversity questionnaire indicated that the overwhelming majority of sample households dominantly consumed staple cereals. The baseline study revealed obvious differences in consumption patterns among university clusters respondents when it comes to food groups such as root crops, fruits, legumes, milk and dairy products.

The HHDDS were generally low for both PSNP and non-PSNP groups. Such results indicated that there were similarities in the livelihood status and the need to expand for Safety Net targeting to non PSNP HHs as well. Food shortage intensifies in June, July, August, and September where more than 50% of the population is challenged to put enough food on their table to feed their family members. There are still gaps in the literature, particularly in comprehensively conceptualizing the level of dietary diversity at a household level and in modeling and estimating the determinants and impacts of dietary diversities. The effect of different social, cultural, institutional, economic, natural, and human factors influencing the level of household food consumption warrants better attention. The use of panel data in household food consumption studies has been limited, with most existing studies based on cross-sectional data sets. Use of panel data may better reveal the dynamics of HHDD.

Recommendations

Based on the findings of the study the following recommendations are forwarded:

- Despite the importance of nutrition in food security and the overall well-being of citizens, this study indicated that there dominates consumption of limited food groups by the majority of the people. Fruits, eggs and meat or other meat products were the least consumed while consumption of fresh or dried or fried fish was not reported. Thus, HDDS of about 4 was computed for all the sample households. This clearly indicated the need to introduce suitable fruit, crops, and animal source foods to improve HDDS of households.

- This study also indicated that there is a need to give emphasis for nutrition beyond surplus production. Attention should be given to the factors related to increasing HDDS for the implementation of projects related to nutrition and food security in Ethiopia.
- Food/cash transfer support for the PSNP beneficiaries should be provided on time and should target harsh seasons.
- Unlike this particular study which used limited variables, it is recommended to include other variables which would allow understanding of the differences in agro-ecology, food habits, as well as norms of the targeted population. Moreover, use of panel data may better reveal the dynamics of HHDD.
- This study has relied solely on quantitative data which would limit understanding of the whole story as well as why it is so. Therefore, it is recommended to consider both qualitative and quantitative methods for a holistic and in-depth understanding of the research problem under investigation.
- The use of Ordered Probit Model allowed better understanding of the determining factors for HDDS which are disaggregated into the low, medium and high HDDS categories. It is, therefore, recommended to follow a similar econometric model for better understanding of the role played by the independent variables.

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