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Determinants of Rural Household Seasonal Food Insecurity in Gambella Regional State in Case of Nuer Zone Jikow Woreda

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Abstract: *The main objective of the study was to investigate the determinants of seasonal food insecurity status of farming rural households, to identify factors influencing rural household's food insecurity status. In light of this, examinations of the demographic and socio economic characteristics of sampled households were undertaken. The necessary data were extracted from primary data of sampled rural households. In this study, two stage probability proportional to size sampling procedure was employed to select 6 kebeles and 233 sample households out of 28 kebeles of the study areas. The data was analyzed by STATA, econometrics model and descriptive statistics. The specific statistic used includes, mean, standard deviation, percentage, tables, and frequency distribution. In addition, t and chi-square tests were used to compare food secure and insecure sample groups with respect to explanatory variables. A binary logistic model was used to identify the determinants of seasonal food insecurity. A total of eleven explanatory variables, 6 continuous and 5 dummy, were included in the empirical model. Out of these, seven were found to be statistically significant. The result of the study revealed that 80 % of sampled rural households in study area were food insecure and it was check by using recommended minimum calorie requirement (i.e., 2200kcal) whereas 20 % of sampled rural household was food secure. The finding suggest the following set of policy recommendation, limiting population size, and improve the production and productivity of the agriculture sector in longer term, educate people to catch up with model technology like improved seed, utility of farm size, modeling livestock rearing, environment were recommended.*

Key words: *rural household seasonal food insecurity, Nuer Zone Jikow Woreda.*

1. INTRODUCTION :

1.1 Background of the Study

Globally, Food security and insecurity are terms used to describe whether or not households have access to sufficient quality and quantity of food. The concept of food security was originated in the mid-1970s during the international discussion on global food crisis. The initial focus of food security was primarily on food supply problems of assuring the availability and to some degree the price stability of basic food stuffs at the international and national level (FAO, 2005). Food security is perceived at the global, national, household and individual levels. However, food security at global level does not guarantee food security at the national level. Similarly, food security at the national level does not guarantee food security at the household or even the individual level (Duffour, 2010).

1.2 Statement of the Problem

Ethiopia is one of the poorest countries in the world of today it get some extraordinary amount of food aid over the past several decades through short run and long run programs. In spite of the fact that Ethiopia has abundant natural resources, most of its socio economic signals are extremely low and show adverse. It includes safety net and similar support programs that aimed to achieve the problem of food insecurity to the maximum. If not, it aimed to narrow the gap between the demand and supply of food aid to the minimum (Frehiwot F. 2007).

In the last three decades the region faced with frequent climatic variability and agro ecological change. It is evident that the agronomic calendar of the region pushed forward with one month duration. The average annual temperature of Gambella town surrounding and jikow woreda was relatively low than the current annual temperature. These trends increase in alarming rate from time to time synergic with the current climatic change (H/Miriam et.al march 2012).

The aim of this research was to explore farmers view points as to why they face seasonal food shortage and to help identify the root causes of transitory food insecurity in Nuer Zone Jikow woreda. The outcome of the study was obviously have both basic (academic) and applied (practical) purposes.

2. Objective of the Study :

The general objective of this study was to identify the most important factors influencing food insecurity in rural households of Jikow woreda. The specific objectives of the study were:

- To examine the effects of variables that may influence food insecurity of rural households and identify the most important determinants;
- To describe the relationship between food insecurity and its determinants; and
- To analyse the effect of major determinants on the probability of household food security.

2.1 Research Questions

Based on research objectives, the study had addressed the following research questions:-

- What is the current status of food insecurity problem in the rural households of the Jikow Woreda?
- What were the most important factors that influence food insecurity of the rural households in Jikow Woreda?
- What are the proportional relationship between food insecurity and its determinants?

2.2 Significance of the Study

This study was significances for several bodies: in the first place, it has a great significance for the researcher himself. Through the study process, a researcher was familiar with several research methods and methodology. Secondly, the study was offer information for policy makers who will promote diversification to improve the factors that determine seasonal food insecurity in rural areas. Thirdly, so, the rural households in the study area was benefited from the result of paper by receiving some service and support if concerned bodies' will have response based on information. Fourthly, the information which will produce through the study will serve as additional reference for future studies on the determinants of seasonal food insecurity.

2.3 Scope and Limitation of Study

Geographically, this research was conducted in Nuer Zone Jikow woreda in the Gambella regional state. Jikow is bordered on the south by the Anuak Zone, on the west by the Alwero River which separates it from Wantewa, on the north by the Baro River which separates it from South Sudan, and on the east by Lare. Towns in Jikow include Nipnip and Kuachthiang. Based on the 2007 Census conducted by the Central Statistical Agency of Ethiopia (CSA), this woreda has a total population of 35,556, of whom 19,134 are men and 16,422 women; with an area of 1,081.04 square kilometers, Jikow has a population density of 32.89, which is greater than the Zone average of 23.79 persons per square kilometer. While 2,261 or 6.36% are urban inhabitants, a further 2,314 or 6.51% are pastoralists. A total of 5,864 households were counted in this woreda, which results in an average of 6.1 persons to a household, and 5,723 housing units. According to the intention of the researcher and the objective of the study, this research was incorporate thematic, spatial and temporal scope that the research was be limited to examine concerning the rural household food insecurity and its coping mechanism.

Thematically, the scope of this study was limited to the determinants of rural household food insecurity in its coverage. It will serve for the investigation of planned food security and contributions to rural household. Therefore, the finding of the study was considered as representing all issues faced by rural house food insecurity in the woreda.

3. LITERATURE REVIEW:

Causes of Food Insecurity

Causes of Seasonal Food Shortage in Other Countries

The major challenge to food security in Africa is the underdeveloped and underperforming agricultural sector that is characterized by over reliance on primary agriculture, low fertility soils, ecological degradation, significant food crop loss both pre and post-harvest, low levels of education, social and gender inequality, poor health status, cultural insensitivity, natural disasters, minimal value addition and product differentiation and inadequate food shortage of preservation that result in significant commodity price fluctuation (Mwaniki, 2005). All factors, however, can be related in some fashion to two basic causes: insufficient national food availability and access to food by households and individuals.

The evolution of the problem varied in different parts of sub Saharan Africa. In seven sub Saharan African countries (Angola, Chad, Chad, Ghana, Malawi, Mozambique and Namibia) the proportion of the undernourished substantially decreased, while others have gone through a deterioration process (Kidane et al 2006). About 80% of the

increase in the proportion of the undernourished is observed in conflict countries, where famine has been widespread. The type of food insecurity observed in sub Saharan Africa is a combination of widespread chronic food insecurity, resulting from continuing or structural poverty, transitory emergency related food insecurity, which occurs in periods of intensified pressure caused by natural disasters, economic collapse, or conflict (FAO, 2004).

Causes of Seasonal Food Shortage/insecurity in Ethiopia

The food security situation in Ethiopia has been extremely unstable due to the combination of environmental, socio political and developmental instabilities. Lack of food in the household imposes inordinate strains on the daily burdens of its members.

Coping mechanisms have been eroded in many households due to significant depletion of assets and displacement. Current conventional wisdom on food insecurity in Ethiopia asserts that the problem can be conceptualized as follows: (i) landholdings are too small to allow most farming households to achieve food production self-sufficiency; (ii) population increase reduces landholdings further and places intolerable and limited application of yield enhancing inputs; (iii) recurrent drought and food production shocks to abnormally low yields; (iv) limited off farm income employment opportunities restrict diversification and irrigation options, leaving people trapped in increasingly unviable agriculture; (iv) redistribution of land by the state has achieved socially equitable outcomes, but at the cost of household food security. Fears of further redistribution generated tenure insecurity which resulted in some cases unwillingness to invest effort in measures to improve soil conservation and enhance fertility.

Although food insecurity as problem at national level was first felt in Ethiopia in 1960s, it only started influencing policy in the 1980s when food self-sufficiency became one of the objectives of the Ten Year Perspective Plan that took place after the 1983/84 drought and famine, which claimed millions of lives (Haile et al, 2005).

Determinants of Household Food Security Status

Much of the literature on seasonal food insecurity analysed factors that influence seasonal food insecurity of rural farm households using appropriate regression models. Wilma et al (2003) used a logistic regression model to predict seasonal household food insecurity. According to their findings, the probability of a household being seasonally food insecure decreased, when the household has a vehicle, has many types of appliances, their toilet facility is water-sealed, has more bed rooms, the mother is employed and the educational attainment of the mother is high.

Ramakrishna et al (2002) made an assessment on food insecurity situation in North Wello Zone of Ethiopia. A food balance sheet was constructed and food security causation was examined using a binary logistic regression model. Accordingly, cereal production, educational status of the household head, fertilizer consumption, household size, land size, and livestock were found to be the most determining factors of household food security. Along with food availability and entitlement factors, the study suggested that attitudinal variables also influence food insecurity Ramakrishna et al (2002).

A study by Kidane et al (2005) reported the causes of household food insecurity in Koredegaga peasant association, Oromia Zone. The study showed the determinants of households' food insecurity using a logistic regression procedure. As a result, farm land size, ox ownership, fertilizer application, education level of household heads, household size, and per capita production were found to be significant predictors. The analysis of partial effects revealed that an introduction to fertilizer use and an improvement in the educational level of household head resulted in higher changes in the probably of food security. Simulations conducted on the basis of the reference category of farmers, representing food secure households, revealed that both educational levels of household heads and fertilizer applications by farmers have relatively high potential to more than double the number of food secure households (Kidaneet al, 2005). In view of the reviewed literature, this study examined the most important factors that influence food security status of rural households in JikowWoreda of Nuer Zone Gambella Region.

Conceptual Framework

This conceptual frame work displays how determinants of rural household seasonal food insecurity are developed and what opportunities they provide. The figure below describes the conceptual frame work of determinants of rural household seasonal food insecurity detailed the positive and negative effects on our study areas:

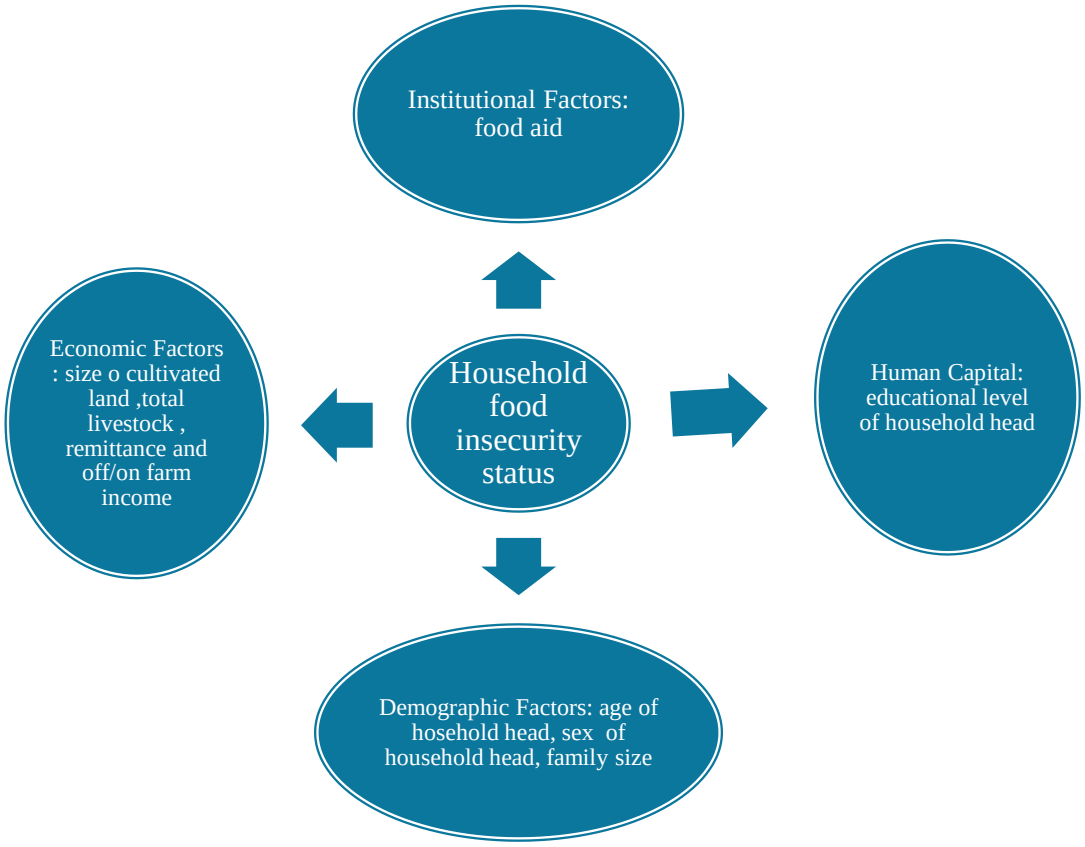

Figure: the determinants of rural household seasonal food insecurity framework for analysis
Figure 2.1 Conceptual Framework Sources: adapted from Dabholkar et al. (2000), modified by researcher.

4. METHOD:

4.1 Research Type and its Approach

To carry out this study, both quantitative and qualitative research approaches was used. Meanwhile, for the researcher to attempt and understand critically the determinants of seasonal food insecurity in Nuer zone Jikow woreda, mixed research was applied to fill the weakness of one approach by the strength of the other. Therefore, based on Kothari (2004) both qualitative and quantitative research approaches will appropriate to achieve these objectives.

4.2 Sample Frame and Sample Size Determination Technique

To realize the stated objectives and answer the research questions, primary data was collected from a representative sample of respondents out of the total population of 5,684 rural households from the study area. Following Kothari (2004), the study used two stage sampling method. Thus, in the first stage by considering the limitations of time and other resources, from 28 kebeles of the woreda six of them was selected purposively.

In the second stage, the sample frame or list of all households heads based on their wealth rank from the six sample kebeles administrative office were taken. Wealth rank is important to draw proportional representatives of samples. As far as, the researcher experience, the list of household heads previously documented for the purpose of several extension services and agricultural input distribution. Subsequently, following Yamane (1967) formula which applied in many studies, a total 233sample of household's head was selected by applying systematic random sampling technique (Kothari, 2004) by keeping fair proportion of poor medium and better off group households based on wealth status Yamane formula which was used to determine sample size as:

$$n = \frac{N}{1 + N(e)^2}$$

Where:
N = total households which is equal to 560
n = size of the sample 233 households

e= standardization at a given confidence level 5 %
n= $560/1+560*0.05^2$
= 560/2.4
= 233

The study focused on 560 rural households from the study areas and researcher talk only 233 sample size who was selected from six kebeles, out of these 90 % were supposed to be sample size of six kebeles households and 10 % was from town administration officials and professional experts in the towns.

4.3 Empirical Model

After determining the demand for both home-produced and market-purchased goods (equation, we can calculate the amount of calories (C_{av}) available in the respective food items using Food calorie Conversion Table'. A household are food secure if their calorie available is greater than or equal to the minimum calorie required. Food and Agriculture Organization and the World Health Organization recommend a minimum calorie intake of 2100 Kcal per person per day or 3000 Kcal per adult equivalent per day to ensure food security at household level (Steffan et al., 2007). The needs are computed based on the requirement of the family members depending on age, sex, etc. Food composition table for Ethiopia used to estimate the quantities of various food items consumed by rural households (EHNRI, 2000).
Defining $Y_h=C_{av}- C_{min}$……..……..(11)
Assuming a linear relationship between food security status and various explanatory variables, the food security function Y_h can be written as:
$Y_h= \beta o + \sum_{j=1}^{n=k} \beta jXij + \varepsilon i$…….……..(12)

Where X_{ij} are explanatory variable and $\varepsilon i$is the error term and we assumed that εhas a standard normal distribution with mean zero and variance one.
Y_h= 1, if $C_{av}>C_{min}$…….……..(13)
Y_h= 0, if $C_{av}\leq C_{min}$……....(14)

Where Y_h denote a dummy variable that will be equal to 1 if the nutrition level of the h^{th}household exceeds some minimum threshold and 0 if not. The household observed to be food secure (Y_i=1) is assumed to have $Y_h\geq 0$; while the household observed to the food insecurity (Y_i =0) is assumed to have $Y_h< 0$. The observed dependent variable Y_i is a discrete variable, the model is a qualitative response model where Ø$_i$is the probability of household food security; such as,
Ø$_i$= prob(Y_i=1) = prob$(\sum_{j=1}^{k=9} \beta jXij + \varepsilon i > 0)$ ……..…..…….(15)

A logit model was used to determine factors affecting food insecurity. As the coefficients of the logistic model don not show magnitude, the marginal effects of the explanatory variables reported. A partial derivative was calculated for each household's, the change in the probability of food security with respect to a change in the k^{th} variable, and computed the average of the partial derivatives over the *H* households. The resulting marginal effect of the k^{th} explanatory variable on the probability of food security is
$\frac{\partial P[Y=1]}{\partial Xk} = \frac{1}{H}\sum_{h-1}^{H}\left(\frac{\partial P[Y=1]}{\partial Xk}\right)h = \frac{1}{H}\sum_{h-1}\emptyset\left(X\widehat{\beta k}\right)\widehat{\beta k}$ ……...(16)

Where is the density function of the standard normal distribution; β's are parameters to be estimated; X1 and X2 represents household characteristics (household size and average education); X3 is number of livestock; X4 and X5 are land size and quality respectively; X6 is improved Agricultural technology use; X7 is per capita aggregate production; X8 is on farm income and X9 is plowing system of the household.

These variables are identified from production and consumption behaviours of the farm households in the study area. Land size and improved seed are supply side variables while household size; livestock number and access to market are the demand side variables. Household size reflects labour availability. Number of livestock's and on farm income corresponds to capital and wage, respectively. Average education is the proxy variable for the attitudes of the households and expected influence food security positively. An apriority expectation of the probability of a household becoming food secure stated as
$\frac{\partial \bar{Y}}{\partial X2}, \frac{\partial \bar{Y}}{\partial X3}, \frac{\partial \bar{Y}}{\partial X4}, \frac{\partial \bar{Y}}{\partial X5}, \frac{\partial \bar{Y}}{\partial X6}, \frac{\partial \bar{Y}}{\partial X7}, \frac{\partial \bar{Y}}{\partial X8}, > 0$, while $\frac{\partial \bar{Y}}{\partial X1}, \frac{\partial \bar{Y}}{\partial X7}, \frac{\partial \bar{Y}}{\partial X9}, < 0$
Descriptive statistics used to understand the determinants of rural households seasonal food insecurity.

5. DISCUSSION:

Household food security status and education of household head

It was hypothesis that household food insecurity and education of household head has negative relationship. Categorization of household head as literate and illiterate exhibited that 41 percentages of household heads were literate and 59 percentages of household heads were illiterate. Among literate household heads 64 percentages were found to be food secures and out of 137 illiterate household heads 65 percentages were food insecure. The survey result showed insignificant relationship between educational level of household head and household seasonal food security status (Table 1.).

Table 1. Education of household head

Education	Food Insecure		Food Secure		Total		X^2
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage	
Literate	66	35	30	64	96	41	12.4439***
Illiterate	120	65	17	36	137	59	
Total	186	100	47	100	233	100	

Source: own survey (2019)

Improved Seed

The survey result showed that 38 percent in sampled households used improved seed whereas 62 percent of sampled households didn't used improved seed. Comparing two groups from food secure and food insecure status, 43 percent of food secure sampled households used improved seed whereas 37 percent of food insecure sampled households used improved seed, 57 percent of food secure sampled household did not used improved seed on farm whereas 63 percent of food insecure sampled household did not used improved seed. The chi- square shows insignificance relationship between used of improved seed and food security status of household.

Table 2. Household's food security status and use of improved seed

Improved Seed	Food Insecure N=186		Food Secure N=47		Total N=233		X^2
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage	
Yes	69	37	20	43	89	38	6.4136
No	117	63	27	57	144	62	
Total	186	100	47	100	233	100	

Source: own survey (2019)

Plowing system

It was hypothesis that household food insecurity and plowing system of household has negative relationship. Categorization of household plowing system as by hoe and oxen exhibited that 94 percentages of household plowing system were by hoe and 6 percentages of household plowing system were by oxen. Among hoe using household, 83 percentages were found to be food secure and out of 220 hoe using household 97 percentages were food insecure. The survey result showed insignificant relationship between plowing system of household and household seasonal food security status (Table 3.).

Table 3. Plowing system

Plowing	Food Insecure		Food Secure		Total		X^2
	Frequency	Percent	Frequency	Percent	Frequency	Percent	
Hoe	181	97	39	83	220	94	14.6312***
Oxen	5	3	8	17	13	6	
Total	186	100	47	100	233	100	

Source: own survey (2019)

Irrigation

The survey result showed that 11 percent in sampled households used irrigation whereas 89 percent of sampled households didn't used irrigation. Comparing two groups from food secure and food insecure status, 26 percent of food secure sampled households used irrigation whereas 74 percent of food insecure sampled households used irrigation, 92 percent of food secure sampled household did not used irrigation on farm whereas 8 percent of food insecure sampled

household did not used irrigation. The chi- square shows insignificance relationship between used of irrigation and food security status of household.

Table 4. Irrigation

Irrigation	Food Insecure		Food Secure		Total		X^2
	Frequency	Percent	Frequency	Percent	Frequency	Percent	
Yes	14	8	12	26	26	11	-12.2590
No	172	92	35	74	201	89	
Total	186	100	47	100	233	100	

Source: own survey (2019)

6. ANALYSIS:

Econometric results Analysis

As specified in the methodology part of this study, the analysis was made using binary logistic regression model. This model was used to see the relative influence of household's demographic, socio economic, human capital and institutional variables on food insecurity status. Identification of descriptive statistic is not enough to stimulate policy actions unless the relative influence of each factor is known for priority based intervention. Before discussing about the econometric model results, the model specification and data fitting should be made.

Diagnostics of the econometric model

Before running the model, the data were checked whether multicollinearity problem exist or no by running linear probability model (LPM). In this case VIF (variance inflation factor) technique was employed for all explanatory variables included in the model. The result indicates that, there is no multicollinearity problem among explanatory variables as shown in appendix.

Determinants of rural household's seasonal food insecurity

This section presents and discusses empirical findings of econometric model result. Estimates of the parameters of the variables expected to determine the seasonal food insecurity are displayed in the table below. The goodness of fit was tested by the log likelihood ratio (LR) test. The result show that the chi-square of 0.000 with 11 dependent variables and p-value of zero. This mean that X^2 is statistically significant and the model displays a good fit. The Pseudo R^2 of the model is also 33.12 %. This verifies that the model has a good fit to the data and explained significant non zero variation in factors influencing food insecurity among the total 11 explanatory variables included in the model, seven variables were found to be statistically significant in influencing the food insecurity status while the remaining four explanatory variables were statistically insignificant. Among factors which had significant influence on food insecurity are age of the household head and on-farm income. Were statistically significant at less than 5% probability level; number of milking cows, total livestock were significant at 1% probability level.

Table 5. maximum likelihood estimates of binary logistic model

Variables	Odd ratio	Std. err	z-value
Age	1.084584	0.0436807	2.02
Sex	0.0579832	0.0704756	-2.34
Family size	1.286321	0.2023914	1.60
Education	0.4644645	1.1883397	-1.89
Farm land size	1.080299	0.5709265	0.15
Total livestock	0.8619094	0.553324	-2.31
Num of milk	1.357883	0.1715013	2.42
Improved seed	0.457197	1.1805925	-2.00
On-farm income	0.9278436	0.314431	-2.21
Plowing system	0.936943	0.0867443	-2.56
Irrigation	0.4479904	0.2436454	-1.48
Constant	83.00133	179.6331	2.04
LR chi2 (11)	61.94		
Log likelihood	-86.176237		
Pseudo R^2	0.2644		

7. FINDINGS:

Interpretation of the significant explanatory variables

Age of the households head (AGE): this variable is found to be positive and significant at less than five percent probability level. The positive association can be explained by the fact that older farmers are less likely to be food insecure. It may be due to the fact that older farmers do not have the required labor force to produce more food crops than their counterparts become independent having their own household. And due to this the household would composed of young aged children with large family size. The odd ratio of 1.084584 implied that, other thing being constant, factor of 72 age of the household increased by one year. The possible reason for such result may be the old age bearing of children so that the family number increase whiles the head of the household was getting older and older.

A study carried out by Funmilola and Patricia (2014) in Nigeria also found different result. They revealed that as the household head advances in age, the probability of being food secure decreases. In contrast, a study done in the USA by Onianwa and Wheelock (2006) revealed that increasing age of household head by 1 year reduces the chances of food security.

Sex of the household head (SEX): Given the strong negative relationship between sex of household head and food insecurity. This negative relationship shows that the odds ratio0.0579832 is not in favor of the probability of being food insecure increase with decrease in being female household head. The possible reason is that with existing culture norm of being a female no need to work in all activities which generate income to reduce food insecurity for the whole family. The duty of women is to work only home activities. Most men married many wives, because of this the households size increase rapidly that mean the number mouths which need feeding will increases and income will decrease that lead the household to become food insecure.

Total Livestock holding (TL): The relationship between the amount of livestock holding in tropical livestock unit and seasonal food insecurity turned out to be negative and significant. The relationship is statistically significant at 1 percent probability level. This is an indication that ownership of livestock acts as a hedge against food insecurity in the study area. The possible explanation for the negative relationship is that livestock besides its contribution to the subsistence need and nutritional requirement, it also serves as accumulations of wealth so that disposed during times of need, especially when food stock in the household deteriorate. The odds ratio in favor of food insecurity decrease by factor of 0.8619094 when the amount of livestock in the household rises by one TL. This result is supported by Getachew (1993) & Abebaw (2003).

Number of milking cows (NUML): livestock as a source of income for study area in general are assumed to play big role because of recurrent flood hazard, recurrent erratic rainfall & drought. In similar manner animal product like milk and butter are also assume to be good source of income. Thus, it was believed that household with one and/or more milking cow(s) to have better food security status than household without milking cow(s). The relationship between owned milking cow(s) and seasonal food insecurity turn out to be positive and the coefficient is highly significant at less than one percent probability level. The odds ratio in favour of seasonal food insecurity, holding other variable constant, increase by a factor of 1.357883 as number of milking cow(s) decrease by one. The possible explanation is that milking cows have daily income, households with many milking cow(s) have highly daily income and are less likely to become food insecure than household with few or don't have any milking cow(s).

Improved seed (IMSEED): Improved seed is also a key input for improving agricultural productivity; thus enhancing household food availability and increasing household income. Table 2 confirms that improved seed very is important in attaining food security in the study area. Rural households that use improved seed are food secure, whereas 81% rural households who do not use improved seed are food insecure, and the difference between the users and nonusers of improved seed is significant. The survey result exhibit negative relation between on improved seed and food insecurity and the coefficient is significant at less than one percent probability level. Under ceterius paribus condition, the odds ratio in favor of food insecurity decrease by a factor of 0.4397197 as proportion of household improved seed increases by one. As proportion of improved seed increase the agricultural output increases, access to food by household also increases to the amount needed for household consumption. This result is consistent with a study by Bekele (2017), finding that improved seed beneficiaries earn higher income than non-beneficiaries. In addition, he suggested that sustainable access to improved seeds by food insecure households can ensure them to improve their food.

On farm income (ONFMIN): Income is explained in term of household income on their farm this is because rural households in Ethiopia and in study area in particular dependent on agriculture as a source of their income as a result, the rural household dependent of agriculture as a sources of their income for their entire life. The survey result exhibit negative relation between on farm income and food insecurity and the coefficient is significant at less than five percent probability level. Under ceterius paribus condition, the odds ratio in favour of food insecurity decrease by a factor of 0.9284817 as proportion of household income increases by one. As proportion of income increase the expenditure increases, access to food by household also increases to the amount needed for household consumption. In circumstances

where some covariant shocks happen, for instance rise in price of food commodity, this changes the habit of consumption of household and uses other alternative mean of serving their income.

A study by Ayalneh and Shimelis (2009), in Dire Dawa district, found that household size, the amount of household income or household access to income opportunities, an increase in the age of the household head, cultivated land size, amount of credit received by households, access to use of irrigation, and amount of livestock holding have significant influence on status of household food security.

Plowing system (PLS): For the farmers like in Jikow woreda, who almost entirely rely on traditional plough, farm oxen possession would be a critical production factor. The data on farm oxen ownership shows that about 97% of the households were without farm oxen. Surprisingly, another 3 % of the farmers have reported to own one ox. This means over most of the studied farmers have faced severe problems of traction power. From the findings it is not difficult to deduce that crop cultivation in the woreda is partly constrained by the lack of farm oxen. The survey result exhibit negative relation between ploughing system and food insecurity and the coefficient is significant at less than five percent probability level. Under ceterius paribus condition, the odds ratio in favour of food insecurity decrease by a factor of 0.936847 as proportion of household using oxen as plowing system increases by one.

8. RESULT:

Descriptive Results

Food security status of the households

The households' food security status can be measured by direct survey of income, expenditure and consumption. In this study households' food or calorie acquisition/consumption per adult per day is used to identify the food secure and food insecure households. The calorie consumed by the household is compared with the minimum recommended calorie of 2200 kcal per adult per day. If the consumption/acquisition is less than the recommended amount then, the household is categorized as food insecure and if greater than, as food secure.

The household's food security status was measured by direct survey of consumption. Data on available food for consumption, from home production, purchase and/or gift/loan/wage in kind for the previous seven days before the survey day by the household was collected. Then the data were converted in to kilocalorie and then divided by household size measured in AE. The calorie intake results is calculated by using the standard food composition table prepared by (Ethiopian Health and Nutrition Research Institute [EHNRI], 1997)

Table 6. Energy available per AE per day among sample households

Energy available Per AE in (kcal)	food insecure (N=186)	food secure (N=47)	total (N=233)	t-value
Maximum	2164.26	3151.52	3151.52	56.603
Minimum	1524.36	2210.50	1524.36	
Mean	1805.88	2655.78	2174.37	
Mean difference	2174.37			
St. Deviation	161.67	278.80	476.19	

Note: *** significant at 1 percent probability level of significant
Source: own survey (2019)

Sex of household heads

According to the survey results presented on table 7. from the total sampled households, male headed household accounted for 79 percent while female headed households accounted for 21 percent. The proportion of male headed households was 75 percent of total sampled food insecure households. In addition to this, male headed household accounted for 98 percent of the total sampled food secure households. Whereas, the proportion of female headed household out of total sampled food secure households and food insecure female headed households were 25 percent and 2 percent respectively. There is statistically significant proportion difference between food secure and food insecure households in term of sex. Thus, the result shows that there is great disparity of food insecurity status due to sex difference among the household heads.

Table 7. food security status by sex of the household head

Gender	food insecure		food secure		total		X^2
	Frequency	Percent	Frequency	Percent	Frequency	Percent	
Male	139	75	46	98	185	79	12.2836***
Female	47	25	1	2	48	21	

Total	186	100	47	100	233	100

Source: Field survey (2019)

9. RECOMMENDATIONS:

Based on the finding of this study, the possible policy recommendations that can be made from this study are as follows:

- As family size and food insecurity are positively related, serious attention has to be given to limit the increasing population in the study area. This can be achieved by creating sufficient awareness about family planning in the rural households. Even though every individual has a natural right to multiply himself with his willing partner. This right should be exercise with the ability to furnish his descendents with all the necessary or basic needs. So, along with creation of effective family planning through effective extension services some methods of incentive, such as material reward for those households accepting a given number of children by the end of productive age.
- As on farm income and food insecurity are negatively related on the model results, searching and providing productive technical skill that can make rural community competitive on saving and avoid communal culture that affect their saving on their production.
- Another policy implication from the findings of this study is that the effect of education on household food security and this confirms the significant role of the variable in consideration for betterment of living condition. The more the household head is educated, the higher will be the probability of educating family members and familiar with modern life style or technology. This should done by strengthening both formal and informal or adult education and vocational and skill training to rural household to reduce food insecurity status in the woreda.
- Productive resources especially farm land size is importance, even if the model result showed that farm land size and food insecurity have positive relationship, tackling the problem of food insecurity through increasing farm land size is mandatory. Land as a especial resources should be utilize in term of using it.
- Sustainable food security intervention must not exclude the improvement of production and productivity of agriculture sectors through use of irrigation. Although the finding of the showed that irrigation and food insecurity are negatively related and insignificant. Therefore we can tackle this by encouraged farmers who have irrigable farm land by provided them with input such as fertilizer, improved seed, and pesticide through effective extension services and credit facilities.

10. CONCLUSION:

The study was conducted with the specific objective of examining seasonal food insecurity situation, estimating the seasonal food insecurity gap and severity and identifying the determinants of seasonal food insecurity at household level in rural households in Jikow woreda of Nuer Zone Gambella region. The research objective was realized through conducting household survey in six kebeles of the study area. Household demographics, education status, on farm income, farm land size and other data deemed to be relevant were collected, organized, analysed and interpreted to come with possible results. The analysis employed both descriptive statistics and econometric methods. Descriptive statistics were employed to describe household characteristics with seasonal food status. Binary logistic model was employed to specified and estimated to identify determinants of seasonal food insecurity whereas copping mechanism was treated as an optional solution reflected from sampled households on time shocks. The sampled households were classified into food secure and food insecure groups based on kilocalorie or grain that was harvested for consumption by the households during last year 2018 cropping season. The descriptive statistics showed the existence of a significant mean difference in expenditure and household seasonal food insecurity status at less than 5 percent probability level between food secure and food insecure households. As a conclusion, since 79.8% of sampled household were food insecure and only 20.2 % of sampled households were food secure, it may be concluded that 80 % of the population in the study area always suffered with seasonal food insecurity.

In general, in our opinion the food security indices estimated in this study were fair representations of the extent and dimension of food security/insecurity in Jikow woreda. In order to achieve food security, strategies should be designed in a way that would focus on and address the identified determinants as well as other factors that are useful to achieve household food security.

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