INTERNATIONAL CONFERENCE ON
FOOD AND AGRICULTURAL ECONOMICS

PROCEEDINGS BOOK
(Full Texts-Abstracts-Posters)

27th -28th April 2017
Alanya Alaaddin Keykubat University, Turkey

DETERMINANTS OF HOUSEHOLD FOOD SECURITY OF SMALL SCALE FARMERS IN GEDARIF AND RAHAD LOCALITIES "HIGH AGRICULTURE PRODUCTION AREA" OF EASTERN SUDAN

Faiez Ahmed Mohamed Hamed ElNeel

Gedarif University, Faculty of Economics and Administration Sciences, Department of Economics, Sudan

Abstract

The study aims to assess the determinants of small sca le farmer household food security among Gedarif and Rahad localities "high agriculture production area" from eastern Sudan. Data used relies heavily on the results of sample survey of 336 households as of small scale farmers (agricultural land holding 20 feddans and less) in 8 villages collected during 2014. Analytical techniques employed included descriptive statistics, and multinomial regression model to examine the determinants of food security among the households surveyed. The study has shown that agriculture land was significantly related to the probability of a household being food secure in favour of mildly household food insecure access decreases by the factor (-1.464). Credit access was found to be significant positively related to food security in the study area. Farmers' access to credit will decrease the mildly and moderately household food insecurity access by the factors (-2.194 and -2.092), respectively, allow households to have opportunity to receive credit would build their capacity to produce more through the use of improved technologies. However, a household using technology was positively (1.347) and significantly related to the probability of a household being food secure, so increase productivity through using of technology it is significant policy that might increase food security in the area of study. Thus, land and credit access; and technology using in agriculture are most factors determining household food security in the study area, consistent with the fact that Gedarif state comprised high agriculture area, where the agriculture activities engaged more than 80% of population in rural area get hold of their income and hence manipulate household food security. In the light of the findings from the study, it is recommended that policy makers should increase efforts to improve access of agriculture land and credit by small scale farmers to improve the household food security situation in rural areas. Policies that will make micro-credit from government and nongovernmental agencies accessible to rural farmers to improve household food security in Gedarif State. Policy makers should make high efforts in agriculture and livestock sector to create more income and food diversification such as vegetables, fishes and fruits to decrees food insecurity, therefore using technology, extension, training are also be recommended. Policy makers should target the food insecure household groups to combat directly food insecurity and reduces their vulnerability, especially through fitting policies targeting the agricultural sector where most of the populations engaged by means of their livelihoods.

Key words: Household food security, Determinants of food security, small scale farmers, eastern Sudan

Introduction

Food insecurity in Sudan is concentrated in the rural areas. Majority of the Sudanese rural population chronically suffer from mass poverty in more severe situations than the urban dwellers. The research study is highly motivated by the fact that although Gedarif State is one of Sudan's major crop-producing there is significant evidence that there is temporary food insecurity in Gedarif that can change to chronic food insecurity. The last nutrition survey conducted in Gedarif by UNICEF and the State Ministry of Health in 2013 found in nine out of twelve localities in the state chronic malnutrition rates (stunting) among children less than five years higher than 20%. In five localities rates were higher than the state average rate of 30%, with East Galabat recording the highest, 45.5%. Likewise, the survey found very high and alarming rates of acute malnutrition, at serious levels for half of the state localities, and at critical level in three localities. The 2013 nutrition survey showed that dietary diversity is a problem throughout rural areas of Gedarif, with prevalence of households with a diverse diet at only 4.5%. This obviously shows a link between malnutrition and food insecurity in the state. As a paradox,

data available on the state level indicate that Gedarif is "food secure (referring availability of food)", thus potentially foiling efforts to investigate more the food security determinants at household level. Such an investigation is necessary, though, to not only identify determinants that increase food security, but also to understand the contradiction between state-wide food security and household level food insecurity.

This is why the issue of food insecurity has become the concern of many academicians, political leaders and other professionals today. Majority of the research works that have been done so far on the issues related to food insecurity in Gedarif State are very general and consider the problem from national or regional points of view, little work has been done to understand the food security problem at the household level in specific locations/districts. Most agricultural production comes from millions of rural households. Despite the increasing global concern of improving food security, the nature and extent of food security at the household level in rural areas is not well documented. The purpose of this study was, therefore, to investigate the critical determinants of food security in Gedarif and Rahad localities "high agriculture production area" of eastern Sudan.

Moreover, most agricultural production comes from millions of rural households. Despite the increasing global concern of improving food security, the nature and extent of food security at the household level in rural areas is not well documented. The purpose of this study was, therefore, to investigate the critical determinants of food security in Gedarif and Rahad localities "high agriculture production area" of eastern Sudan.

The main objectives of the study were to:

➢ Determine the food security situation among households in the study area, and
➢ Examine the principal determinants of household food security in the study area.

Literature Review

Most of the world's poorest countries are in Africa and many of these face chronic poverty and food insecurity. Agriculture, of which 85-90 percent is rain-fed in Sub-Saharan Africa, accounts for 35 percent of the region's gross national product (GNP), 40 percent of exports and 70 percent of employment (World Bank, 2000). Clover (2003), Smith (2007), Babatunde et al. (2007),Swamina than (2008), Oriola (2009), Fayeye and Ola (2007) are some of the works that have examined food security in developing countries. The authors argue that domestic policies in many developing countries have contributed very marginally to food security especially in Africa, and that, despite the growing global food production, hunger, malnutrition and famine are prevalent in many developing countries. From their analysis it is evident that improvement in food production in Sub-Saharan Africa will boost per capita GDP, raise purchasing power and access to food. Their major conclusion is that research is needed on new technologies that are output-driven, ecologically friendly, acceptable and affordable to the resource-poor farmers. Finally, they argue that good governance and stable political governance system will provide an essential and enabling environment for food security in Sub-Saharan Africa.

Sudan like other Sub-Saharan African countries has been since late seventies experiencing an economic crisis that exhibits itself in slow growth, worsening balance of payments, deteriorating terms of trade, slow growing exports and mounting debts, as said by: (Ali, 1994; Awad, 1998). This crisis escalated with political instability, food problems and population movements from the place of shortages (rural areas) to where food security is realized (Urban areas). At the same time production constraints in Sudan are impeded by various other challenges include the wide stretch of the country poor transport and storage facilities courted with: insufficient and inadequate capital, instable prices of the agricultural products, high production costs and absence of mechanization and modern technologies.

Gedarif State has more than 10 million arable feddan, though these huge resources are not distributed evenly among people. A few well-positioned merchants and government allies have access to huge agricultural schemes that exceed the permitted acreage. This exacerbated the problems of land shortage and blocked traditional routes that were used by pastoralists during their seasonal movements. The research study is highly motivated by the fact that although Gedarif is one of Sudan major crop producing state there are quite evidence indicating that The food situation in Gedarif was described as temporary food insecurity and able to change to chronic food insecurity (Taha, 2009).

Definitions and Concepts of Food Security

Food security is a concept that has evolved over time. As much literature has spiraled, many definitions and conceptual models on household food security have been presented (Smith et al.,1992). There are approximately 200 definitions and 450 indicators of food security (Hoddinott, 1999).In Africa, food crisis in the early 1970s stimulated a major concern on the part of the international donor community regarding supply short falls created by production failures due to drought and desert encroachment (Maxwell, 1992). In 1983, FAO analysis focused on food access, leading to a definition based on the balance between the demand and supply side of the food security equation: "Ensuring that all people at all times have both physical and economic access to the basic food that they need"(FAO, 1983).

Food security is indicating the ability of people to acquire their dietary intake required for a healthy productive life on a day-to-day basis. There are different concepts of food security that had been developed over time. The World Bank defined food security in 1986 as secure access by all people at all times to enough food for an active and healthy life. This definition implies that access to adequate food is subject to threats of different types and that the analysis of risk of inadequate access is an important concern.

There are two main dimensions to analyze food security issues. The first concern is the level of analysis. Food security can be analyzed at individual, household, community, regional or national level. The second direction relates to the time frame; individuals or groups of people may suffer from inadequate food consumption all of the time. The focus of the analysis in this situation is on the level of food consumption and the factors that determine it. In other circumstances the level of food consumption may be adequate when compared with some measures of need but variations imply that people do not have enough to eat some of the time. In this case the concentration of analysis concentration should be in the variability of food consumption, typically between seasons and between years, and the main consequences of this variation. A working definition of food security can only be specified when the level and time frame of the desired analysis is also specified.

In the World Bank (1986) report, Poverty and Hunger, this concept of food security is further elaborated in terms of: 'access of all people at all times to enough food for an active, healthy life. 'At the 1996 World Food Summit 182 nations agreed and adopted a still more complex definition: 'Food security, at the individual, household, national, regional and global levels. Food security is achieved when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life'(FAO, 1998).This definition integrates stability, access to food, availability of nutritionally adequate food and the biological utilization of food. As a result, a synthesis of these definitions, with the main emphasis on availability, access, and utilization, serves as working definition in projects of international organizations.

Food security Components

Common to most definitions of food security are the elements of availability, access, utilization and stability or sustainability.

Food security has also been defined in the World Food Summit in 1996 as the situation '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'. This definition encompasses four main dimensions of food security, namely physical availability of food, economic and physical access to food, ability of food utilization and stability of the other three dimensions over time.

By this definition, food security is a broad and complex concept which is determined by the interaction of a range of agro-physical, socioeconomic, and biological factors. A sustainable food security status cannot be attained unless all those four dimensions are fulfilled; they are interlinked and their multiple determinants are in a continuous dynamic, vivid state of motion. Attempts to investigate them have to come up with scientific, reliable and relevant procedures, as well as holistic and

complementary methods and tools to capture all aspect of its diversity as no single indicator could provide the information needed to determine the state of food security in a given population.

Food Availability

Food availability reflects the supply side in general, the overall availability of food at national, regional and household levels which is influenced by trade and domestic food production, including local sources of agricultural food production, livestock and fisheries, as well as collected wild foods. Commercial food imports and food stocks are highly influenced by the presence of well-functioning market systems able to deliver food to the area on a consistent basis and in adequate quantity and quality. At household level it reflects the availability of food for household in local markets and shops. Food availability is influenced by many underlying determinants such as macro-economic trends and events, government policies (subsidies), the functioning of international and domestic markets, exchange rates and the state of the physical economic infrastructure.

Food Access

Food access, which represents the demand side, is considered to be achieved when a household has the opportunity to obtain food of sufficient quantity and quality to ensure a safe and nutritious diet. Food access is widely influenced by determinants such as prices and household resources that allow households to obtain their food, typically either: (a) by growing it and consuming from their own stocks; (b) by purchasing it in the marketplace; (c) by receiving it as a transfer from relatives, members of the community, the government, or foreign donors; or (d) by gathering it in the wild. Household or individual ability to access those sources of food depends mainly on "their asset endowment and the social, economic, policy, physical, and natural environments, which define the set of productive activities they can pursue in meeting their income and food security objective" (LIFT, 2013: 4).

At the same time, abundant and available food at household level does not guarantee equal share within the household because there may be a tendency to serve the highly nutritious food in larger quantities to the males in the family or working members to the disfavorur of other household members. In other words, bias in intra-household distribution patterns, such as gender inequality, can negatively influence the food security of some of the household members (Pieters et al., 2013: 13).

Food Utilization

Food utilization requires a healthy diet, a healthy body, and a healthy physical environment. It represents an individual's food consumption and the ability to absorb nutrients contained in the food that is eaten, bearing in mind the importance of both the quantity and quality of food, in addition to good health practices, food safety, food storage, food preparation, diet diversification, food preferences, proper feeding practices, proper hygiene, sanitation and clean water supply, which all indicate the importance of non-food input for meeting all physiological needs and achieving the physical and mental development of an individual. Thus food utilization requires a practical understanding of proper health care, food storage, food preparation, and feeding practices, along with the associated behaviour.

This implies that even if a household has access to a sufficient amount of food, in term of quantity, but it is not of a good nutritious quality, this diet will not provide the body with nutrional ingredients that provide the body with its energy requirements. On the other hand, if the health condition of an individual is not good, then her or his body cannot benefit physiologically even from a balanced and adequate diet.

Furthermore, if a household's income improved but knowledge about best nutritional practices and individual nutritional needs does not exist, then income will not be spent to increase food security. Intra-household decision patterns could also hinder the most vulnerable groups (children and women) from acquiring their dietary needs for a healthy and productive life, just as cultural and personal preference for various food groups could highly influence the nutritional status.

Food Stability

Since food security status has to be sustained, its fourth dimension is stability over time. Stability is ensured when households and all individuals within have adequate and preferred food at all times to maintain a healthy living, therefore adverse effects of sudden shocks, such as an economic or climatic crisis or cyclical events such as seasonal food insecurity, have to be taken account in any assessment of food security.

Determinants of Food Security

Factors that affect household food security in various developing countries especially in Africa have been documented in some literature and these factors or determinants are most often thannot location-specific (i.e. different study areas were found to have variant attributes as food security determinants with some attributes recurring). The study conducted in Nigeria by Oluwatayo (2008)using probit model found out that sex of household head, educational level, age and income have positive influence on food security whereas household size has negative influence on household food security. Study by Sikwela (2008) in South Africa using logistic regression model showed that per aggregate production, fertilizer application, cattle ownership and access to irrigation have positive effect on household food security whereas farm size and household size have negative effect on household food security.

Babatunde et al. (2007) is another detailed work on food insecurity in Nigeria. The study utilized a three-stage random sampling technique to obtain a sample of 94 farm households and across sectional data in year 2005. Using the recommended calorie required approach; the study revealed that 36 per cent and 64 per cent of the households were food secure and food insecure respectively. The Shortfall/Surplus index showed that the food secure households exceeded their commended calorie intake by 42 per cent, while the food insecure households fell short of their commended calorie intake by 38 per cent. A logit regression model estimated showed that household income, household size, educational status of household head and quantity of food obtained from own production were found to determine the food security status of farming households in the study area.

Methodology

Sampling technique

Data were collected from 336 out of604 households[1]randomly selected as of small scale farmers all most in rural areas(owned agriculture land 20 feddans and less)through the use of household survey. Out of 235,000 households of Gedarif State according to 5th Sudanese censes in 2008, and 7,654 households out of two selected localities; which the sample represents about 8% of the households in selected localities; somewhere the data collected during April up to December 2014. The selected localities were Central Gedarif and Rahad. Eight villages were selected from each locality depending on the ecological zone, to reflect the livelihood of households in Rahad locality where the Rahad River allows household to diversify their income sources and food such as vegetables, fruits and fish, as well as in Gedarif locality the urbanization patterns are also be reflected.

Rain becomes heavier northwards, being lowest in the northern part of the state. All most of villages selected are rural areas; from Gedarif locality, the villages of Rawashda, EidElteen, Eshimliab and Ghiraigana were chosen to represent the central, northern and southern parts of the locality, respectively, and from Rahad locality, Wad Elshaeer, Borbur, Garamie and Bazoora East with the same pattern. Stratified sampling was used to select respondents randomly from each village. The total population was drawn for the 8 villages from the official statistics; the number of respondents was determined depending on the percentage within the sum of the 4 selected villages per locality. Both primary and secondary

---

1 604 HHs data are proprietor to FAO, 2014; when I was the main researcher for the study of the impact of agricultural activities on food security, in Gedarif and Rahad localities, 2014).
.

data were collected through personal interviews with the use of structured questionnaires. The questionnaire used covered the personal characteristics of the farmers, land acquisition, credit access, crops grown, livestock number and household assets. Also included in the questionnaire was the household food security scale which was used to measure the food security status of households.

Both qualitative and quantitative data analysis techniques were utilised. Food security indicators were used as first assessment of the households' situation; in addition, a correlation test was conducted to identify the relationship between food security indicator and some of its determinants, this study used the standard indicator: The HDDS assesses the quality of diets, at individual or household level, by calculating the number of food groups that are consumed on average. The standard set of 12 food groups used for this assessment are: 1) cereals, 2) fish, 3) roots / tubers, 4) pulses / legumes / nuts, 5) vegetables, 6) milk and milk products, 7) fruits, 8) oil / fats, 9) meat / poultry / offal, 10) sugar / honey, 11) eggs, 12) miscellaneous. The HDDS variable is calculated as total number of food groups consumed by the members of a household, then the average HDDS indicator is calculated for the sample population using the following formula:

$$\text{Average HDDS} = \frac{\text{nSum (HDDS)}}{\text{Total Number of n Household}}$$

Calculate the Household Dietary Diversity category for each household. 1 = Food Secure (Diet from 1-12), 2=Mildly Food Insecure Access(Diet from1-10), 3=Moderately Food Insecure Access (Diet from 1-8), 4=Severely Food Insecure Access (Diet from 6 and less); as shown in table 1 below:

Table 1. Household Dietary Diversity Score (HDDS) Category weighted

No	Food group	Score	Weight	HDDS Category
1	Cereals	6 ≤	4	Severely food insecure access
2	Roots and tubers			
3	Vegetables			
4	Fruits			
5	Meat, poultry			
6	Eggs			
7	Fish and other seafood	+6-8	3	Moderately food insecure access
8	Pulses, legumes and nuts			
9	Milk and milk products	+8-10	2	Mildly food insecure access
10	Oils and fats			
11	Sweets	+10-12	1	Food secure
12	Spices, coffee, tea			

Source: Field Survey, 2014.

Analytical model

The multinomial regression model was used to investigate the determinants of household food security among the study area. The Household Food Security Survey was used to disaggregate the households into food secure and food insecure households. The dependent variable in this case, food security is Household Dietary Diversity Score (HDDS).A variety of models can be used to establish the relationship between the potential determinants and food security. The study employed the multinomial regression model as follows.

$HDDS= \beta_0+\beta_1X_1+\beta_2X_2+\beta_3X_3+\beta_4X_4+\beta_5X_5+\beta_6X_6+\beta_7X_7+\beta_8X_8+\beta_9X_9+\beta_{10}X_{10}+\beta_{11}X_{11}+£$

Where:

HDDS= (Household Dietary Diversity Score: A dependant Variable which categorized in to 4 values, 1, 2, 3 and 4).

In this study the explanatory variables used in the model included:

X1 = Education level of Household Head (educated=1, otherwise=0).

X2 = Credit access (if yes =1, otherwise=0).
X3 =Labor age of HHH (ranged from 31-45 years).
X4 =Labor age of HHH (ranged from 46-60 years).
X5 = Livestock ownership (if yes =1, otherwise=0).
X6 =Wealth index (scale variable).
X7 = Technology used in agriculture (if yes =1, otherwise=0).
X8 =Agriculture land recoded (1=5 feddans and less, 2= 5-10 feddans, 3= 11-15 feddans and 4= 16-20 feddans).
X9 =Gedarif locality dummy (HH live in Gedarif locality = 1, otherwise = 0).
X10 = farm occupation (if yes =1, otherwise=0).
X11= Daily labour (if yes =1, otherwise=0).

However, the variable of technology used in agriculture are calculated by aggregated four types of technology used such as seed dressing, herbicide, pesticide and fertilizer in to three main production crops like millet , sorghum and sesame in addition to vegetables and fruits to categorize the technology variable in the analysis.

Results and Discussion

Respondent's Socio-Economic Characteristics

From our sample of 336 households considered rural and small scale farmers, table 2 indicates that 56.5% of our sample of study area are in Rahad locality, while, 43.5% are in Gedarif locality.

Table 2. Distribution of the Sample By Localities

Locality	Freq	Percent
Gadarif	146	43.5
EL-Rahad	190	56.5
Total	**336**	**100.0**

Source: Field Survey, 2014.

Food security in rural areas in Gadarif State is determined, in part, by land holding structures, systems of land tenure, the organization of agricultural production, availability of complementary inputs, access to credit and markets, opportunities for off-farm employment, and the accumulation of surplus value. Social relations in agriculture are in turn determined by land tenure systems. Table 3 shows, 83% of households in study area owned agricultural land for areas about five and less feddans, (84.2% in Gedarif and 82.1% in Rahad); while 17% owned land for areas about 5-10 feddans, (15.8% in Gedarif and 17.9% in Rahad). The results presented in the table indicate that, a higher percent of households owning small land size (5 feddans and less) which considered being by means of land less; with no great variation between localities.

Table 3. Distribution of Agricultural Land Owned

Land recoded	Both		Gedarif		Rahad	
	Freq	Percent	Freq	Percent	Freq	Percent
5 feddans and less	279	83.0	123	84.2	156	82.1
5-10 feddans	57	17.0	23	15.8	34	17.9
Total	**336**	**100.0**	**146**	**100.0**	**190**	**100.0**

Source: Field Survey, 2014.

Respondents' socio-economic characteristics are presented in Table 4. Educated household heads constituted minor (38.1%) of the sampled people. The labor age (46-60 year) was 40.8%, indicating that a typical farmer interviewed was economically active. There was more households used technology in agriculture (56%). Meanwhile, distribution of household heads access credit and who owned livestock revealed that not considerable of them (17.3% and 26.2%, respectively). Only about 6.3% of household

heads interviewed were engaged in daily labor activities, and majority of interviewed households (84.5%)are engaged in agriculture activities.

Table 4. Scio Economic Characteristics of the Study Area

Scio economic characteristics		N	Marginal Percentage
Education level of HHH	.00	208	61.9%
	1.00	128	38.1%
Credit access of HHH	.00	278	82.7%
	1.00	58	17.3%
Labor age (31-45)	.00	264	78.6%
	1.00	72	21.4%
Labor age (46-60)	.00	199	59.2%
	1.00	137	40.8%
Livestock ownership	.00	248	73.8%
	1.00	88	26.2%
Wealth index	.00	256	76.2%
	1.00	80	23.8%
Technology used in agriculture	.00	148	44.0%
	1.00	188	56.0%
A agriculture land recoded	.00	279	83.0%
	1.00	57	17.0%
Gedarif locality as a dummy	.00	190	56.5%
	1.00	146	43.5%
Farmer employment of HHH	.00	52	15.5%
	1.00	284	84.5%
Daily labor of HHH	.00	315	93.8%
	1.00	21	6.3%
Valid		336	100.0%

Source: Field Survey, 2014.

Food security measure

To better reflect a quality diet, the number of different *food groups* consumed is calculated, rather than the number of different *foods* consumed. Knowing that households consume, for example, an average of four different food groups implies that their diets offer some diversity in both macro- and micronutrients. This is a more meaningful indicator than knowing that households consume four different foods, which might all be cereals. The following set of 12 food groups is used to calculate the HDDS. Table 5 shows the average food groups consumed by household, which reflect the household food security situation; apparent Gedarif is better compare to Rahad locality in most of food groups consumed.

As shown in Table 6, 21.4% of household in the study area was found to be food secures (25.3% in Gedarif and 18.4% in Rahad locality); (33.3%) were found to be mildly food insecure access (45.2% in Gedarif and 24.2% in Rahad); (36.3%) were found to be moderately food insecure access (21.9% in Gedarif and 47.4% in Rahad) ,and only 8.9% were severely food insecure access (7.5% in Gedarif and 10% in Rahad). Gedarif locality exhibits better food security compared to Rahad. This result attributed to the fact that Gedarif locality characterized by off-farm opportunity labor which has a significant impact of reducing food insecurity, compared to Rahad locality which characterized by agricultural activities by means of low earning.

Table 6. Food Security Measure

HDDS Category	Both		Gedarif		Rahad	
	Freq	Percent	Freq	Percent	Freq	Percent
Food secure	72	21.4	37	25.3	35	18.4
Mildly food insecure access	112	33.3	66	45.2	46	24.2
Moderately food insecure access	122	36.3	32	21.9	90	47.4
Severely food insecure access	30	8.9	11	7.5	19	10.0
Total	336	100.0	146	100.0	190	100.0

Source: Field Survey, 2014.

Determinants of Food Security

Table 7 below provides the parameter estimates for the linear regression model. From (OLS) estimates of the model, the R^2 was 0.57 which implies that about 57% of the household being food secure is strongly explained by the independent variables. The marginal effects of the independent variables were estimated because they are very important forpolicy and decision making. Among the 11 variables considered in the model, three were found to have significant impact on household food security. They included access land, credit access, using technology. With the exception of wealth index and education of household head all the explanatory variables had the expected signs.

Agriculture land was negatively (-1.464) and significantly related to the probability of a household being food insecure. Agriculture land is significant at 5%.The coefficient infavour of mildly household food insecure access decreases by the factor (-1.464) when the area under cultivation is increased by one feddan. Credit access was found to be significant at 1% positively related to food security in the study area. Farmers' access to credit will decrease the mildly and moderately food insecurity access of his household by the factor (-2.194 and -2.092), respectively. This may be due to the fact that households which have the opportunity to receive credit would build their capacity to produce more through the use of improved seeds and the adoption of improved technologies. This finding is also consistent with the findings of Bogale (2009) in his study in Ethiopia. However, a household using technology was positively(1.347) and significantly at 1% related to the probability of a household being food secure, so increase productivity through using of technology it is significant policy that might increase food security in the area of study. According to Van Der Veen (2010), food production can be increased extensively through expansion of areas under cultivation. With large farm size households can produce more and also diversify. Thus, land and credit access; and technology using in agriculture are most factors determining household food security in the study area, consistent with the fact that Gedarif state comprised high agriculture area, where the agriculture activities engaged more than 80% of population in rural area get hold of their income and hence manipulate household food security. Furthermore, education of household head and household wealth are insignificant impact the household food security in the study area.

Table 7. Parameter Estimates Of Determinants Of Household Food Security

Independents variables		B	Sig.
Food secure	Intercept	3.722	.074
	Education of HHH	-.192	.766
	Credit access of HHH	-1.351	.228
	Labor age of HHH(31-45)	-.423	.500
	Labor age of HHH(46-60)	-.063	.905
	Lives stock ownership of HHH	.382	.478
	Wealth index of HH	-1.139	.135

	Technology used in agriculture	1.347	.019
	Land recoded	-1.378	.093
	Gedarif dummy variable	.496	.533
	Farmer occupation of HHH	-.648	.400
	Daily labor of HHH	-.676	.516
Mildly food insecure access	Intercept	4.774	.019
	Education of HHH	.459	.460
	Credit access of HHH	-2.194	.041
	Labor age of HHH(31-45)	-.093	.881
	Labor age of HHH(46-60)	-.525	.292
	Lives stock ownership of HHH	.219	.664
	Wealth index of HH	-.815	.263
	Technology used in agriculture	.637	.252
	Land recoded	-1.464	.067
	Gedarif dummy variable	-.903	.237
	Farmer occupation of HHH	-.970	.195
	Daily labor of HHH	.439	.688
Moderately food insecure access	Intercept	3.500	.082
	Education of HHH	1.316	.034
	Credit access of HHH	-2.092	.049
	Labor age of HHH(31-45)	-.344	.567
	Labor age of HHH(46-60)	-.243	.618
	Lives stock ownership of HHH	-.004	.993
	Wealth index of HH	-.556	.466
	Technology used in agriculture	.456	.407
	Land recoded	-1.176	.141
	Gedarif dummy variable	-.123	.871
	Farmer occupation of HHH	.036	.962
	Daily labor of HHH	.973	.347
Severely food insecure access	Intercept	-3.722	.074
	Education of HHH	.192	.766
	Credit access of HHH	1.351	.228
	Labor age of HHH(31-45)	.423	.500
	Labor age of HHH(46-60)	.063	.905
	Lives stock ownership of HHH	-.382	.478
	Wealth index of HH	1.139	.135
	Technology used in agriculture	-1.347	.019
	Land recoded	1.378	.093
	Gedarif dummy variable	-.496	.533
	Farmer occupation of HHH	.648	.400
	Daily labor of HHH	.676	.516
Model Fitting Information	Model Fitting Criteria		Pseudo R-Square
	-2 Log Likelihood		Cox and Snell=.567
Intercept Only	713.648		Nagelkerke=.486
Final	623.023		McFadden=.432

Dependent Variable: Household Dietary Diversity Score (HDDS)

Source: Field Survey, 2014.

Conclusion and Recommendations

The study aims to assess the determinants of household food security among Gedarif and Rahad localities "high agriculture production area" from eastern Sudan. Data used relies heavily on the results of sample survey of 336 households as of small scale farmers (agricultural land holding 20 feddans and less) in 8 villages collected during 2014. Analytical techniques employed included descriptive statistics, and multinomial regression model to examine the determinants of food security among the households surveyed. The study has shown that agriculture land was significantly related to the probability of a household being food secure in favour of mildly household food insecure access decreases by the factor (-1.464). Credit access was found to be significant at 1% positively related to food security in the study area. Farmers' access to credit will decrease the mildly and moderately food insecurity access of his household by the factor (-2.194 and -2.092), respectively, allow households to have opportunity to receive credit would build their capacity to produce more through the use of improved technologies. However, a household using technology was positively (1.347) and significantly at 1% related to the probability of a household being food secure, so increase productivity through using of technology it is significant policy that might increase food security in the area of study.

Thus, land and credit access; and technology using in agriculture are most factors determining household food security in the study area, consistent with the fact that Gedarif state comprised high agriculture area, where the agriculture activities engaged more than 80% of population in rural area get hold of their income and hence manipulate household food security. In the light of the findings from the study, it is recommended that efforts to improve access to land and credit by small scale farmers to improve the household food security situation in rural areas. Policies that will make micro-credit from government and non governmental agencies accessible to rural farmers to improve household food security in Gedarif State. Policy makers should make high efforts in agriculture and livestock sector to create more income and food diversification such as vegetables, fishes and fruits to decrees food insecurity, therefore using technology, extension, training are also be recommended. Policy makers should target the food insecure household groups to combat directly food insecurity and reduces their vulnerability, especially through fitting policies targeting the agricultural sector wherein most of the populations engaged with their livelihoods.

References:

Bickel, G., Nord, M., Price, C., Hamilton, W,.and Cook, J. (2000): *Guide to Measuring Household Food Security*, Revised 2000. U.S. Department of Agriculture, Food and Nutrition Service, Alexandria VA.

Bogale, A. and Shimelis, A.(2009): Household level determinants of food insecurity in rural areas of Dire Dawa, Eastern Ethiopia. *African Journal of Food and Agriculture, Nutrition and Development.* Volume 9, No 9.

Department of Statistics, (2008): 5th Population and Housing Census, Gadarif State, Sudan.

Duffour, K .(2010). *Budget Statement and Economic Policy of the Government of Ghana for the 2011Financial Year.* Pp 49.

FAO, 1998 IFAD and WFP. 2014. The State of Food Insecurity in the World 2014. Strengthening the enabling environment for food security and nutrition. Rome, FAO.

Gebrehiwot T.(2008): *Rural Food Security in Tigray, Ethiopia: Policy Impact Evaluation International Institute for Geo-information Science and Earth observation.* Enschede, The Netherlands.

Gebrehiwot, T., Van der Veen, A. (2010): *Effect of policy interventions on food security in Tigray,* Northern Ethiopia. University of Twente Faculty of Geo-Information Science and Earth Observation, Netherlands. Working Papers Series -Paper 6.

Hailu, A. and Regassa, N.(2007): *Correlates of Household Food Security in Densely Populated Areas of Southern Ethiopia: Does the Household Structure Matter?* Department of Rural Development and Family Sciences, Hawassa University, Ethiopia. Gyamfi S.(2006) : *Food security in Ghana: the development and diffusion of appropriate technologies*, Ghana Statistical Service.

Kaloi,E., Tayebwa, B. and Bashaasha, B. (2005*): Food security status of households in Mwingi District, Kenya .Department of Agricultural Economics and Agribusiness, Makerere University, Kampala, Uganda. *African Crop Science Conference Proceedings*, Vol. 7. pp. 867-873.

LIFT 2013 (Livelihood and Food Security Technical Assistance), FHI 360. 2013. Livelihood and food security conceptual framework. Washington.

UNICEF, 2013. Monitoring the Situation of Children and Women. Multiple Indicator Cluster Survey Manual, New York.

World Bank. 1996. Poverty and Hunger: Issues and Options for Food Security in Developing Countries. Washington.

Appendix

Household Dietary Diversity Score (HDDS)

lease describe the foods (meals and snacks) that you or anyone else in the household ate <u>yesterday</u> during the day and night, whether at home or taken outside the home, starting with the first food eaten in the morning. **_Note: Exclude foods purchased and eaten outside the home_			
no	**Food group**	*Examples*	*1=yes 0=no*
1	**Cereals**	*Any foods made from wheat/millet sorghum grain/flour, rice, maize, , …etc.Kisra, bread, …*	|___|
2	**Roots and tubers**	*potatoes, pampay...etc*	|___|
3	**Vegetables**	*vegetables, including wild vegetables*	|___|
4	**Fruits**	*all fruits, including wild fruits*	|___|
5	**Meat, poultry,**	*beef, lamb, goat, chicken, other birds …*	|___|
6	**Eggs**	*eggs obtained from all poultry*	|___|
7	**Fish and other seafood**	*fresh or dried fish, shellfish*	|___|
8	**Pulses, legumes and nuts**	*beans, peas, lentils, nuts, seeds or foods made from these*	|___|
9	**Milk and milk products**	*milk, cheese, yogurt, ghee, or other milk products*	|___|
10	**Oils and fats**	*oil, fats or butter added to food or used for cooking*	|___|
11	**Sweets**	*sugar, honey, sweetened soda or sugary foods such as, sweets or candies*	|___|
12	**Spices, coffee, tea**	*tea (green, black, herbal), coffee, salt, black pepper, mint, saffron, coriander, cilantro, cardamom…*	|___|

13 Did you or anybody else in the household eat anything (meal or snack) prepared outside of the home yesterday?	**Yes= 1**	**No=2**
	|___|	|___|