REGULAR ARTICLE

FOOD PRODUCTION AND CONSUMPTION IN THE HIGHLANDS OF ETHIOPIA: THE MISSING LINK IN FOOD SYSTEMS

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ABSTRACT

This paper attempted the nexus of food production and consumption, and determinants of food consumption in *Gudo Beret* watershed, central highlands of Ethiopia. The study used cross-sectional data collected from 211 randomly selected households through interview. Descriptive statistics and linear regression were the key analytical techniques. Results revealed that households produced a gross yield of 1.5 ton and a net food supply of 1.1 ton per household which was equivalent to 274 kg of grain per adult per annum. The average food demand per capita was 323.8 kg per adult. It implies food production was inadequate for food consumption. Sex of household head being male, livestock holding, inorganic fertilizer, total land size, and market distance affected household food consumption positively whereas household size had negative impacts on household food energy. One of the current themes of the food systems is balancing food production and consumption. The government of Ethiopia should deliberate population policy with the intention that the rising population need to have adequate subsistence. In addition, women empowerment can enable them access to and control over food resources.

Keywords: Crop production, food energy, grains, Ethiopia, households
JEL: R52, R58, H41

INTRODUCTION

Food system is a wide range of activities that makes certain food production reaches consumers **(Burrows and Kuyper, 2018)**. The main function of food system is food production **(FAO, 2017)**. At household level, the key characteristic of food system is seed exchange despite local seeds are attributable to low yields, lack of quality, mixed varieties and loss of desirable traits **(Asante *et al.,* 2017)**. Access to improved crop varieties is critical to food and nutrition security **(Toledo and Burlingame, 2017)**. Farm households grow more than one variety of a given crop at a time for which no single variety would satisfy their livelihood demands. Varietal selection and farm management are the most crucial actions in agricultural production and genetic conservation. Agricultural production is the main pathway that impacts human nutrition. Globally, there has been a contemporary interest in food and nutrition security to decelerate malnutrition. Much of this interest is focused on sustainable agriculture to produce adequate food for the growing population. Agriculture contributes for 34% of gross domestic product, 80% of export earnings, and 80% of employment opportunities in the Ethiopian economy **(WB, 2013; NPC, 2016; Admasu, 2017)**. Farmers in the highlands of the country depend largely on mixed farming to improve dietary diversity, increase household income, reduce vulnerability to shocks, create job opportunity, minimizes risks and insurance against crop failures

(Liniger et al., 2016; Alexandratos and Bruinsma, 2012; Belay *et al.,* 2012; Darnhofer *et al.,* 2012; Herrero et al., 2012; Moraine et al., 2014). Mixed farming provides a wide range of responses to uncertain conditions and increase household resilience **(Liniger *et al.,* 2016; Kuria *et al.,* 2014)**. In Ethiopia, nearly 14 million households cultivate about 15 million ha of land **(CSA, 2015)**. The average productivity of major crops is 21.5 qt per ha **(FDRE, 2016)**. Crops are the major sources of food while animal products are often low **(Belay *et al.,* 2012, CSA, 2012)**. Livestock generate more than 85% of cash income, 16% of export earnings **(Yayneshet, 2016)**, and 25% of growth domestic product **(FDRE, 2016)**. Households with large herd sizes have better chance to ensure household food security **(Messay, 2010; Mesfin, 2014)**.

In Ethiopia, farm households have long experiences on varietal selection, adaptation and adoption of various crop varieties in the history of crop evolution. For instance, barley is one of the first domesticated cereals since 3000 B.C **(FAO, 2008)**. Farmers are rational decision makers in the processes of production based on their existing knowledge **(Olango *et al.,* 2014)** that aligned with the broader social and ecological landscapes where diverse landraces are maintained in the seed systems **(Samberg *et al.,* 2013)**. A particular crop serves for different purposes as barley grain is used for soup, stew, bread, biscuit, *injera*, and feed for honeybee colonies **(Alemayehu, 2011)**. The supply of malt demand for

breweries is 32.8% from domestic sources of barley while the remaining proportion has been imported from abroad. It implies the subsistence farming system could not supply an adequate level of malt for beer industries.

Crop yields are a function of climate variables, seed varieties, availability of water, soil nutrients, and knowledge of farmers (**God fray, 2010**). Favorable weather conditions of a year results in good harvest whereas severe droughts causes for crop failures that adversely affect agricultural production and consumption patterns. Despite apparent yield increment has been reported in Ethiopia (**Alemayehu, 2011**), the amount of growth is not overwhelming (**Dercon and Hill, 2009; Mekuria et al., 2017**). In the country, large number of people (29.6%) is living below the poverty line (**WFP, 2014)** and significant number of people (35%) is undernourished (**FAO, 2018**). On the one hand, pasturelands and the natural vegetation are converted to croplands and commercial investments in some parts of Ethiopia (**Wily, 2011**). On the other hand, lands allocated for cereals, coffee, fruit, root and vegetable crops are converted to *Khat* and eucalyptus plantation in many parts of the nation (**Yeshaneh et al., 2013; Cochrane and O'Regan,2015; Daniel et al., 2016; Tadesse and Tafere, 2017**). Moreover, there is no policy decree on social protection towards consumption insurance except productive safety net programs in some draught prone areas of the country (**FAO, 2018**).

Ethiopia is vulnerable to the twin threats of natural resource degradation and poverty owing to high population growth, soil loss, and negative impacts of climate changes (**Liniger et al., 2016, WFP, 2014, Badege, 2009; Yitebitu et al., 2010; IFAD, 2013).** Climate shock is one of the leading causes of food crisis situations that 8.5 million people were affected recently by climate shocks and conflict (**FAO, 2018**). Rapidly growing population is one of the key drivers for competitive demands between crop production and livestock husbandry (**IFAD, 2010; Rota and Sperandini, 2010**). One-third of rural households in Ethiopia could not produce adequate food to meet their subsistence needs as they cultivate less than half hectares of land per capita (**Herrero et al., 2012**).The existing agricultural land is unable to feed the growing population and thus many Ethiopians remain trapped in vicious circle of poverty, disease and hunger (**Sahlu, 2004**).Rising in food prices, unemployment, lack of pasture for livestock, and intensive removal of natural vegetation aggravates food shortages. Food and nutrition insecurity, low crop and livestock productivity, excessive land fragmentation, and severe land degradation are among persistent challenges in the highlands (**NPC, 2016, Yeshaneh et al., 2013, IFAD, 2013, Demese et al., 2010; Haregeweyn et al., 2015; Hurni et al., 2016; Guush et al., 2017; Mekonnen et al., 2017**). In the country, 14%, 9%, and 25% of children are stunted, wasted and underweight, respectively (**Birhanu, 2015**). The negative impact of climate change exacerbate land degradation by increasing water stress, soil erosion, soil acidity, landslides, feed shortage, and increase the incidence of animal diseases (**Liniger et al., 2016; Tongul and Hobson, 2013; Bewket, 2015).**

Intensified farming and continuous cultivation with limited soil amendments and conservation practices resulted in soil erosion and nutrient depletion (**IFAD, 2010).** Low adoption of agricultural technologies and feed scarcity are still adversely affecting the livelihoods of farmers and landscape situations of the study area (**Kuria et al, 2014, Mekonnen et al., 2017, Tigist, 2016; Tamene, 2017**). Although research institutions have been developed new crop varieties, improved seeds do not reach farmers at all, or if they do, they get to them late. Lack of improved seed varieties affects both producers and consumers. The supply of raw materials alone could not able to keep with the increasing demands of domestic industries (**Asante et al., 2017**). Despite several researches have been conducted on food security and production efficiencies, studies on food systems in terms of production and consumption linkages is minimal. The assumption is that farm households may not consume what they produce due to several reasons. Therefore, the objectives of this paper are to examine the linkage of food production and consumption and to analyse determinants of food consumption in the study area. The next sections of the paper include materials and methods, results and discussion, and conclusion and policy implications.

DATA AND METHODS

Description of the study area
The study area is located in the highlands of Ethiopia. The site is found in *Gudo Beret Kebele, Bsona Werana* district, and North Shewa zone of Amhara region. (*Kebele* is the lowest geographical administrative unit). The total population size of the study was estimated to be 2070 inhabitants and the population density was about 85 persons per square kilometer. The total number of households in the study catchment was 447. Subsistence rain-fed cultivation, livestock husbandry, and woodlots were the dominant farm activities. The natural vegetation cover has declined over time due to anthropogenic factors. Currently, there is no natural forest except some shrubs and bushes at the upper escarpment of the watershed. Eucalyptus trees are grown around homesteads, hillsides, and gully buffers. A small town (*Gudo Beret*), the local market, *Kebele* agriculture office, human and animal health clinics, rural villages, churches, elementary schools, electricity power line, private mobile telephone, and asphalt road are the main infrastructures and institutions found in the study watershed. The study site is characterized by degraded lands above the tolerable soil erosion limits (**Tamene, 2017).**

Sampling procedures
The study watershed was purposively selected because of high crop-livestock production potential. The area was delineated starting from the bottom confluence point between the two streams (*Feleku* and *Weynabchu*) and reached the upper escarpment of the watershed. The top part of the dividing line of the study watershed is the boundary between the Blue Nile and Awash basins. A total sample size was determined according to **Israel (1992)** (Eq. 1).

$$n = \frac{N}{1+N(e)^2} = 211 \qquad (1)$$

Where: *n* is the total sample size, *N* is the size household in the study watershed, and *e* is a confidence level taking 0.5 as an average level of precision in social science.

Among the total households, 29% were female-headed. The total sample size was selected using systematic random sampling. Four data collectors were employed and household survey was conducted in face-to-face interview through house-to-house visits from end of May to the first week of July 2016. Training was conducted for enumerators on methods of data collection. The interview schedule was prepared by administering different socio-economic, institutional and climatic variables. The questions in the interview schedule were pretested before administering data collection.

Methods of data collection

The collected data were cross-sectional obtained from primary and secondary sources but were not limited to demographic attributes (sex, age, level of education, household size, and social status), economic factors (total land size, household income, crop varieties, livestock breeds, crop yields, consumptions), and bio-physical variables (settlement patterns, distance between households' residence and the local market and asphalt road). In-depth interviews were employed for purposively selected key informants to identify crop-livestock portfolios. Key informants include local level officials, elders, and agricultural experts. Household interviews were conducted using a semi-structured interview schedule. The primary data were collected from selected respondents during household survey. Questions in the interview schedule were pre-tested prior to conducting the formal survey and essential amendments were made on the interview schedule. Training on methods of data collection was employed for enumerators how to collect primary data. All information contained in the interviews was confidential. Personal observation was employed to triangulate landscape situations, settlement patterns, accessibility of infrastructures and institutions as well.

Methods of data analysis

Data processing such as coding, editing, cleaning, verification, and entry were employed prior to data analysis. Depending on the nature of data, descriptive statistics (frequency, percentage, and mean) and inferential tests were employed. Descriptive statistics were mainly employed to compute the food produced and consumed in the study area. Household food balance model was employed to compute the food expenditure and net food supply for household consumption. Consequently, the net available food was converted to food calorie per capita at household level. First, each food item was computed in terms of quintal or ton and then converted to kg (1 ton = 10 qt = 1000 kg). Secondly, food items measured in kg was converted to food calories after multiplying by each conversion factor that was given for each food items. The conversion factors from kg to calories are shown in the Table 1.

Table 1: Conversion factors for per capita calorie consumptions

Available food items	Conversion factors	Available food items	Conversion factors
Food barley	3320	Green vegetables	220
Malt Barley	3680	Apple fruit	480
Wheat	3340	Sheep meat	1230
Faba bean	3420	Chicken eggs	1390
Field pea	3460	Cow milk	610
Lentil	3460	Butter	7170
Linseed	4980	Honey	2980
Potato	670		

Source: **EHNRI (1998)**

Linear regression was employed to examine determinants of food consumption. According to **FAO *et al*. (2018),** food availability is the dietary energy supply expressed in terms of kcal/ person/day. An average food calorie per AE per day was taken as a continuous dependent variable while thirteen independent variables were considered for analysis (Table 2). The linear regression, ordinary least square (OLS) was adapted in Gujarati (**Gujarati, 2003**) (Eq. 2).

$$Y_i = X'\beta_i + U_i \qquad (2)$$

Where; Y_i is a continuous dependent variable; β_i are parameters; X_i are independent variables; U_i is error terms.

RESULTS AND DISCUSSION

Household characteristics

The proportion of female-headed households was 29%. The size of illiterate household heads was 20.9%. About 42.7% of household heads had basic educational levels. Grade 1-4 and 5-8 were 15.2% and 16.1%, respectively while grade 9 and above were 5.2%. The minimum age of household heads was 23 while the maximum age was 82 years old. In the study area, the mean age of household heads was 43.8 years old. The minimum and maximum household sizes were 1 and 10 while the average size of household members and labour force were 4.5 and 2.9, respectively. The average land size was 1.3 ha per household whereas the average livestock holding was 4.0 TLUs per household.

Agricultural production in the study area

In the study watershed, crop production, animal husbandry, and eucalyptus plantation were the major livelihood strategies for rural households. There is inter-household heterogeneity for choice of crops and livestock activities. Limited number of households (5.6%) could not access land use rights and they were dependent on their livestock holdings and non-farm/off-farm activities, while 8% of households did not own livestock. Cattle, equines, sheep, goats, and chicken are the major livestock types in the study area (Table 3).

Table 2: Hypothesis of independent variables in relation to household food consumption

Acronyms	Explanations	Units and measurements	Hypothesis
AGE	Age of household head	A continuous variable measured in years	-
HHSIZE	Household size	A continuous variable measured in number of household members	-
SEX	Sex of household head	It is a dummy variable, 1=male and 0 otherwise	+ (male)
EDUC	Educational level of household head	It is a continuous variable measured in years of schooling	+
INCOME	Household income	It is a continuous variable in ETB	+
LAND	Total land size	It is a continuous variable measured in ha	+
MANURE	Compost used	It is a continuous variable measure in kg	+
LIVES	Livestock holding size	It is a continuous variable measured in TLU	+
FERT	Fertilizer applied	It is a continuous variable measured in kg	+
DMKT	Market distance	A distance between the local market and household's residence measured in walking minutes	-
DROAD	Road distance	A distance between the main asphalt road and household's residence measured in walking minutes	-
EXTEN	Extension contact	Extension contact is the frequency of contact of DAs with household head in per month	+
CREDIT	Access to credit service	It is a dummy variable, 1 =access to credit, 0 otherwise	+

Table 3: Livestock production by sampled households (2016)

Types of livestock	Number	TLU	Proportion (%)
Cow	151	121	3
Ox	288	317	15
Heifer	53	26	38
Bull	50	30	38
Calf	109	22	59
Horse	35	28	5
Mule	4	3	50
Donkey	246	123	25
Sheep	1532	153	22
Goat	115	12	10
Chicken	744	7	52
Total	3327	841	28

Livestock contribute for food, wool, draught power, transportation, manure, hide and skin, fuel, and socio-cultural services such as wedding, dewy, festivities, holidays, and rituals. However, the productivity of livestock per animal such as milk, meat, and egg were relatively low. Sheep and goat accounted for 20% while donkeys represented 15% of the total livestock population in terms of TLU. The highest proportion of cattle was for oxen (38%) followed by cows (14%). The remaining stock (bull, heifer, calf, horse, mule) accounted only 13%. The majority of livestock populations (61%) were cattle followed by sheep and goat (20%), equine (18%) and chicken (1%), respectively. About, 60.2% of households owned cows. The sizes of local and crossbred cows were 1.21 and 1.15 per household respectively, 1.19 on average. Households produced on average 15 kg of eggs, 2280 kg of meat, and 105 kg of milk per year, respectively.

Most recently, animals were prioritized based on land preparations for cultivation purposes and immediate benefits compared to purposes of rearing for permanent household assets. In this regard, households rear livestock for farming operations and selling purposes than keeping them for long-term asset accumulation. According to key informants, the reasons for increment of livestock population were rising demand for household food consumption, market price incentives and increasing number of households. The size of dairy cows was 23.4% of the total cattle population, which is higher than the national average-14.6% (**Aleme and Lemma, 2015**). Three-quarters (75%) of the cattle population were indigenous breeds while 25% were improved breeds. In terms of livestock number, oxen were the highest cattle population while sheep were the highest in livestock population. Sheep and chicken were the largest livestock population in number followed by oxen, donkeys and cows. In the study area, sheep production was the most common practice due to the fact that agro-climates in highlands is suitable for sheep production so that households rear them mainly for selling to earn household incomes.

Almost every household produced annual crops. Among the five major cereals (*tef*, wheat, maize, sorghum, and barley), barley and wheat were the predominant (50%) crops grown in the study area. Faba bean, field pea and lentil were the three major pulse crops grown in the study watershed. Households also produced vegetables, Irish potato, oats and linseed on small plots of land. The majority (96%) of households produce food barley followed by faba bean, field pea and wheat. Food barley, faba bean, and wheat were the three most important crops produced in the study area (Table 4). Households produced 1.7 ton of crops per capita annually. The average crop productivity was 1.34 ton per ha while the total cropland size of households was 1.2 ha.

Table 4: Crops produced by sample households (2015/16)

Crops	Farmers (%)	Land size (ha)	Total production Ton	%
Barley	105	100	174	50
Wheat	55	30	46	13
Faba bean	85	54	68	19
Field pea	66	43	31	9
Lentil	7	11	2	1
Linseed	10	3	1	0
Irish potato	19	7	25	7
Vegetables	15	12	1	0
Total		260	349	

Household food consumption

According to the balance sheet model, the net food supply is the difference between food resources obtained from various sources and food expenditure. Households produced various crops and livestock for different purposes. The yield they produced went to various economic, social and cultural obligations. Locally grown crops and livestock resources were the major sources of food products. Market and social transfers were supplementary food sources. Food items in dietary diversity could be more than 46 types (**Gujarati, 2003**). In the study watershed, households produced fifteen types of food crops. In this paper, food consumption refers to net food supply in terms of calories. According to **Kearney (2010**) food consumption is synonymous with food availability. The annual consumptions of animal products were estimated to be 8, 22, and 75 kg of egg, meat, and milk per household, respectively. The most important meat sources were sheep, goat, chicken, ox, and cow. Several studies overlooked food items obtained from animal products. In this study, the contribution of animal

products for food consumptions was only 10%. Almost 90% of the food sources were crops (Table 5). Household consumed 71.5% of staple foods and 32.9% of leafy vegetables and potato. Lentil, barley and wheat were the major source of food for home consumption. Households consumed fewer amounts of linseed, pea and staple crops. The majority of butter (87.5%), honey (75.4%), and eggs (50.8%) went to market for cash income which were not used for food consumption

The food balance sheet model indicated different food sources, food expenditures and net food supply. Food demand was calculated in accordance with major demographic variables such as sex and age of each household member. Conversion factors for children vary between 0.29 and 0.79 adult equivalent depending on their ages, for women ranges between 0.75 and 0.86 while for men it ranges between 0.98 and 1.18 (**Claro, et al., 2010**). Despite the minimum and maximum amount of food demand is 357 and 536 kg per adult per year is required at global level (**WHO, 2004**), the average grain food consumption demand per capita is 323.8 kg in Ethiopia (**Guush et al., 2017**). In this study, for 844 adults, the annual food supply was estimated 274 kg of grain per adult, which was equivalent to a gross yield of 1.5 ton and a net food supply of 1.1 ton per household. Based on the actual grain yield supply estimation, sample households need an extra 42 ton of grain or 6.7% additional cropland to raise the grain supply to achieve 0.3 ton per capita. Some households purchased food crops both for home consumption and seed resources. The sources for the majority of food consumption were from their own production. Households spent about 70% of the food for own consumption and the remaining 30% went to different expenditures such as selling, social transfer, post-harvest loss, and seed reserves.

Table 5: Food balance sheet model for sample households (2015/16)

Food items	Sources of food (Qt)					Food expenditure (Qt)					Net food (Qt)
	Produced	Purchased	Aid	Gift	Total	Loss	Seed	Sales	Transfer	Total	
Staple crops											
Barley	1748.5	31.1	1.5	0.0	1781.1	103.6	263.7	84.3	6.0	459.6	1321.6
Wheat	462.3	26.1	0.1	0.0	488.4	48.8	63.2	11.5	0.0	123.6	364.8
Faba bean	681.9	23.9	0.0	0.0	705.8	70.6	142.8	74.7	0.0	288.1	417.6
Pea	313.5	11.5	0.0	0.0	325.0	32.5	61.8	43.9	1.5	139.7	185.3
Lentil	15.8	6.4	0.0	0.0	22.2	0.9	2.0	2.4	0.0	5.2	16.9
Linseed	12.9	0.0	0.0	0.0	12.9	1.3	0.9	4.0	0.0	6.1	6.8
Total	3234.8	98.9	1.6	0.0	3335.4	257.7	534.4	222.7	7.5	1022.2	2313.1
Vegetables											
Potato	290.3	7.9	0.0	0.0	298.2	15.0	18.0	187.0	0.0	220.0	78.2
Leafy vegetables	6.0	14.0	0.0	0.0	20.0	0.0	0.0	1.0	0.0	1.0	19.0
Fruits (apple)	0.8	0.0	0.0	0.0	0.8	0.0	0.0	0.2	0.2	0.4	0.5
Total	297.1	21.9	0.0	0.0	319.0	15.0	18.0	188.2	0.2	221.4	97.7
Animal product											
Meat	48.11	0.04	0.0	0.0	48.1	1.9	0.0	0.0	0.0	1.9	46.2
Egg	31.3	1.2	0.0	0.0	32.4	0.0	16.5	0.0	0.0	16.5	15.9
Milk	222.5	3.5	0.0	0.0	226.0	0.0	0.0	4.1	0.0	4.1	221.9
Butter	3.8	0.0	0.0	0.0	3.8	0.0	0.0	3.3	0.0	3.3	0.5
Honey	183	0.0	0.0	0.0	183.0	0.0	0.0	138	0.0	138.0	45.0
Total	488.7	4.7	0.0	0.0	493.3	1.9	16.5	145.4	0.0	0.0	267.4

Determinants of food consumption

Different factors such as demographic attributes, topographic terrains, disposable income, and others affect food consumption (**Aleme and Lemma, 2015**). Linear (OLS) regression was used to identify determinants of household food consumption. The dependent variable is household food energy, which took the value of food in terms of kcal. There was no multicollinearity problem among hypothesized independent variables. Contingency coefficient for discrete variables and variance inflation factor for continuous variables were multicollinearity tests and their values were less than 0.75 and 10.0, respectively. Consequently, all independent variables were entered to the model for analysis. The results of linear regression showed that sex, household size, fertilizer, market distance, and land size were influenced household food consumption significantly (Table 6).

Sex of household head (SEX): The coefficient of sex for household head is positive and significant at 5%. It implies that male-headed households have higher level of calories than female-headed households. Male-headed households increase the food dietary energy by 545 kcal keeping all other variables constant. One probable reason for positive effect of sex on household food consumption is that male-headed households could access to and control over income and other economic resources. In contrast, female-headed households are less likely to practice diversified farm activities. That means male-headed households have less chance of being food anxious than female-headed households. The result is similar with several empirical findings. The sex of a household head being male is significant and has positive relationships with household food energy (**Messay, 2010; Mesfin, 2014; Arega, 2012; Aziz et al., 2016**). It means that female-headed households are more at risk of food than their counterparts.

Table 6: Result of linear regression for household food energy

Variables	Coef.	Std. Error	t-value	Sig.
AGE	-0.70	9.14	-0.08	0.939
SEX	545.18**	235.77	2.31	0.022
HHSIZE	-715.77***	67.96	-10.53	0.000
EDUC	-107.90	95.24	-1.13	0.259
INCOME	0.01	0.02	0.31	0.760
MANURE	1.95	1.79	1.09	0.278
LIVES	117.46**	57.12	2.06	0.041
FERT	6.92***	1.79	3.88	0.000
EXTEN	-64.43	101.35	-0.64	0.526
LAND	498.38**	207.86	2.40	0.017
DMKT	24.24***	7.51	3.23	0.001
DROAD	-10.62	9.48	-1.12	0.264
CREDIT	67.95	227.55	0.30	0.766
Cons	3956.44***	606.10	6.53	0.000

Notes: ***, **, * significant at 1%, 5% and 10%; F=16.65***, R^2=0.524***, St. Error=1425.1

Household size (HHSIZE): Household size has negative relationships with household food consumption and significant at 1%. As household size increases by one member, household food calorie decreases almost by 715.7 kcal. Larger household sizes affect household food availability or food energy adversely. The result of this study agrees with several research findings (**Messay, 2010; Mesfin, 2014; Arega, 2012; Aziz et al., 2016**). Increasing household size deteriorates household food resources (**Bashir et al., 2012**). Low food per capita combined with high population growth are serious challenges of household food security, particularly where import capacity is limited (**Alexandratos and Bruinsma, 2012**). The increment of household size puts pressure on food resources and the share of food among household members will be less.

Livestock holding size (LIVES): The relationship between livestock holding and household food availability is positive and significant at 5%. As livestock size increases by one TLU, household food calories also increases by 117, holding other variables constant. The positive correlation of livestock size with household food energy is in line with some other research findings (**Messay, 2010; Mesfin, 2014; Arega, 2012; Asmelash, 2014; FAO, 2013**).

Inorganic fertilizer (FERT): The relationship between inorganic fertilizer and household food consumption is found to be positive and significant at 1%. The positive relationship indicates that the use of fertilizer increases crop production and productivity per unit area. Household food energy increased almost by seven kcal as a household increases the application of fertilizer by one kg. That means up to the optimum level of fertilizer supply, food increases almost seven kcal per one kg of fertilizer. Households apply different rate of fertilizer depending on the fertility status of the soil and crop varieties. If a household apply 150 kg of fertilizer per ha to produce cereal crops on a given land, the food energy can increase about 1000 calories. The positive relationship of this result agrees with the findings of other studies (**Messay, 2010; Asmelash, 2014; Temesgen et al., 2016**).

Total land size (LAND): The correlation between land size and household food energy is positive and significant at 5%. Land is the source of wealth and has the capacity to reduce risk and bear incomes. Land has an ability to increase capital, production yields, investment and ensure food energy. Keeping other factors constant, household food energy increases by 498 kcal as the total land holding size increases by one ha. The result is in conformity with other findings (**Mesfin, 2014; Asmelash, 2014**). Nonetheless, the result for positive relationship between land and household food energy is not constantly the same.

Market distance (DMKT): The relationship between market distance and household food energy is not as per the prior expectation. The effect of market distance on dietary energy is positive at 1% significant level. As market distance increases by one minute of walking distance, household food energy increases by 24 kcal. About 60% of households travel less than the mean distance (27.5 minutes) of the local market. About 93% of households travel at a distance not more than an hour of walking distance. Despite the relationship between market distance and household food energy is positive, the extent of correlation was weak, i.e., R-value 0.312 or R^2=0.097.

The local market and the small town of *Gudo Beret* are found in the same place. According to personal

observation and key informant interview, the bases of livelihoods for households who reside near to the town or the local market are mainly non-farm/off-farm activities. The information obtained from key informants is consistent with statistical findings. Informants were requested to disclose why market distance was correlated positively with dietary energy. Households who reside near to the market place could have a possibility of selling crop and livestock products often times compared to those who are living far at a distant. Households who reside near to the town or to the local market may misspend their money for alcohol drinking. With the aim of receiving money, those households are expected to sell farm products for their habits. Proximity to the market facilitates selling of farm products (**Rahman and Chima, 2016**). Contrary to near residents, households situated relatively far from the local market may hoard crop products for their subsistence food requirements.

Households who reside farther from market centers can diversify crops and livestock for their household consumption. High transport costs in accessing to local market may discourage supply of agricultural products. Although the accessibility of market is essential for marketing, access to information and other advantages, households who reside far away from the local market have better food energy than that of households who reside near to the local market. In the study of **Sichoongwe *et al* (2014)**, crop diversifiers are located farther distance from the local market.

CONCLUSIONS AND RECOMMENDATIONS

Food production and consumption are the two most important functions of food systems. Food and nutrition insecurity is one of the key and persistence challenges in Ethiopia. The study area was degraded higher than the tolerable soil erosion limits that resulted in low capacity of production and productivity. Households produced crops and livestock for home consumption, market demands and other socio-economic obligations. The yield produced in the study area was not adequate to feed the current population. Crops in general and grains in particular have played significant roles for food consumption compared to animal products. From this empirical findings point of view, the local market is one of the significant variables that affected household food energy positively. With regard to food supply, households who reside far from the local market or the local town had better opportunity to access food for home consumption compared to households that reside near to the local market. Despite market proximity facilitates better access to various agricultural and industrial products; households were not wise and could not manage their crop and livestock products. They have inadequate knowledge on food budgeting so that the nearby households to the local market sold and waste more food resources compared to households who reside at remote areas. One of the current themes of the food systems is balancing food production and consumption. The government of Ethiopia should deliberate population policy with the intention that the rising population need to have adequate subsistence. In addition, women empowerment can enable them access to and control over food resources.

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