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Assessment of farmers' utilization of Soy food in Buno Bedele and Ilu Ababora zones of Southwestern Ethiopia

Samuel Diro[1], Beza Erko[1], Efrem Asfaw[1] and Misganaw Anteneh[1]

[1] Agricultural economics research process, Jimma Agricultural research center

ABSTRACT

The main objective of this study was to assess utilization of soybean based foods in Chawaka, Bedele and Darimu districts of southwestern Ethiopia. Primary data for the study was collected from 185 smallholder farmers of the districts. Descriptive, inferential and econometric models were used to analyze the data. Socio economic factors affecting utilization of soy food was identified using binary logistic model.

The descriptive result of the study showed 62% of respondents use soy food at home. Concomitantly, 93.3% of female headed households use soy food. The study also pointed out only 32% of survey respondents got training on soybean food preparation. Out of the total respondents who got the training, 95.6% of them use soy food at home. Bureau of agriculture and natural resource management, Research centers and NGOs were organizations provided training on soybean food preparation. This enhanced farmers to use soy based foods such as soy milk, Dabo, Kolo and Shiro which are common on the study areas. The econometric result of the study showed that women headed households highly and significantly consume soybean food at home than male headed households. On other hands, both training on soybean food preparation and soybean production affect soy food consumption at home positively and significantly. Based on the findings, the study recommends concerning bodies including media, rural extension workers and NGOs to emphasize on creating awareness regarding nutritional importance of soybean so that production, consumption, processing and marketing of soybean will be promoted.

Keywords: Dabo, Kolo, Shiro, Soy food, Soy milk

***Correspondence to Author:**
Samuel Diro
Agricultural economics research process, Jimma Agricultural research center

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Introduction

Soybean seeds contain about 18% oil and 38% protein. About 95% of soybean oil is edible and the rest 5% is used as a raw material for cosmetic industries as paint removers and plastics (Liu, 2008). Because of that importance, world's soybeans are processed or crushed into soybean meal and oil (Ali, 2010).

Studies estimated human being consumes 2% of its soybean production directly as food (Goldsmith, 2008). Due to the link between animal fats and cardiovascular disease, consumption of soybean oil, especially, is being increased. Fortification and enhancing other food ingredients in protein rich soybean flour is also common for foods such as baked goods, snack bars, noodles, and infant formula. The preference of consumers for soybean food comes from its lower saturated fat content (Glen et.al., 2011). Many protein-rich foods in the diet of children are high in saturated fat. Substituting soy protein for part of the beef or pork protein in a recipe can lead to a decrease in saturated fat and insures child health (Thomas and Lutz, 2001).

Soybean is also rich in isoflavones ingredient. Isoflavones have chemical structure that is similar to the hormone estrogen receptors commonly called phytoestrogens. The consumption of soy isoflavones appears to result in health benefits for cancer, heart disease, osteoporosis and bone health (Kusuma, 2015). The range of soy foods recently has expanded to fresh beans and sprouts, dairy substitutes such as soy milk and cheese, grain products such as soy bread, pasta and flour, meat substitutes and soy spreads and pastes (Thoenes, 2016).

Despite soy foods nutritional quality and economical accessibility, its direct consumption as nutritious food for large part of population is poor in developing countries. Ethiopian farmers, especially, consumes small part of their soybean produce due to different factors including food culture and poor knowledge about health benefits of soy food. On other hands, low level of acceptance of soy products and lack of training on its food preparations are also bottlenecks for slow spreading of soy foods (Samuel *et.al*., 2017). Hence, a significant expansion of soy food consumption is needed for two reasons in rural Ethiopia. The first is to realize food security and to combat malnutrition especially protein energy malnutrition in children. The second is to change food culture in using or adding soybean in daily used food ingredients of every family which increases demand and secure the sustainability of its supply. This balance in demand and supply incentivizes soybean producers who are suffering with soybean marketing and price fluctuations or tremendous low price. The main objective of this study was to assess soybean based foods consumption on the study area. The specific objectives of the study were:

- To investigate soy food consumption trend of the farmers in the study area
- To analyze socio economic and related factors that affects consumption of soy food among farmers
- To suggest policy analysts the way soybean consumption will be maximized to balance the current high soybean supply with the discouraging price and demand

Materials and Methods

Study Area Description

The study was conducted in Chawaka, Bedele and Darimu Districts. Chawaka district is located at a distance of 560 km from Addis Ababa, the capital of Ethiopia. It has 26 administrative peasant associations. The total land area of the district is 52,227 hectares. The district has climate alternates with long summer rain fall and winter dry season with mean annual rain fall of 900 mm. The altitude ranges between 1000-1800 meters above sea level. The minimum and maximum daily temperature of the district is 36 and 41°c respectively

(Chawaka district bureau of agriculture and natural resource development).

The district is located 64 km away from Metu town and 664 km from Addis Ababa, in western direction of the country. It is bordered on the south by Metu, on the west and north by the Kellem Wollega Zone and on the east by Supena Sodo. The total area of the district is 1389 square kilometers. The district lies at longitude $35^0$15' to $35^0$32' and latitude $8^0$30' to $8^0$44' north equator. The altitude of the area ranges from 792-1800 meters above sea level. The agro ecological zone of the district is sub-tropical (54%) and tropical (46%). The mean annual rainfall ranges from 1172-1740 mm and the mean annual temperature of the district ranges from 18-25^0c (Darimu district bureau of agriculture and natural resource development).

Bedele district is located 480 km west of Addis Ababa at an altitude of 2060 meter above sea level. It is bordered on the south by Gechi, on the southwest by Chora, on the west by Dega, on the north by Chawaka district and on the southeast by Gechi districts. The mean annual rain fall of the area is about 1800 mm and the annual minimum and maximum temperatures are 14.5^{o}c and 30.4^{o}c respectively. The main farming system in the area is mixed farming and cattle are the most abundant animal species kept in the area. Coffee is an important cash crop of the district; over 50 square kilometers are planted with the crop (Bedele district bureau of agriculture and natural resource development).

Data Type and Collection Methods

The data for this study was primary data collected from 185 smallholder farmers. The respondents were selected from deliberately chosen districts and randomly picked peasant associations using simple random sampling technique. The districts were intentionally selected for their soybean production potential. Structured questionnaire was used to collect the data from sampled households. Different social, demographic, economic and institutional histories of the respondents were incorporated on the questionnaire. Secondary data was also gathered from different sources to supplement the primary ones. Pretest was undertaken first to evaluate the desirability of the questionnaire.

Data Analysis

The data collected from respondents was analyzed using descriptive, inferential and econometric models. Factors affecting utilization of soy food (utilize and not utilize) was analyzed using binary logistic model. Logistic regression is a linear probability model for binary response where the response probability is evaluated as a linear function of the explanatory variables (Maddala, 1983; Wooldridge, 2003).

Hill and Kau (1973) and Pindyck and Rubinfeld (1998) pointed out for the farmer to use or not to use a specific technology, a reaction threshold of different factors affect. This is modeled as:

$$Y_i = \beta X_i^* + \upsilon_i$$

Where Y_i is equal to one (1) when a choice is made to use and zero (0) otherwise and X^* represents the combined effects of the independent variables (X_i) at the threshold level.

The above binary choice model involves the estimation of the probability of utilization of a given technology (Y) as a function of independent variables (X). The probability of consuming and not consuming is also modeled as:

$$prob(Y_i = 1) = F(\beta' X_i)$$

$$prob(Y_i = 0) = 1 - F(\beta' X_i)$$

Where Y_i is the observed response for the i^{th} observation of the response variable Y and X_i is a set of independent variables such as household head sex associated with the i^{th} individual, which determine the probability of consumption, (P). The function, F may take the form of a normal, logistic or probability function.

The empirical model for the logit model estimation is specified as:

$$z_i = \log(\frac{p_i}{1-p_i}) = \alpha + \beta' X_i + \varepsilon_i$$

Where X_i is the combined effects of X explanatory variables that promote or prevent farmers' decision to use modern agricultural production technologies.

$\log(\frac{p_i}{1-p_i})$ is the log-odds in favor of farm households' decision to use modern agricultural technologies. Using soybean consumption as dependent variable, the model for our case, will be specified as:

$$\log(\frac{p}{1-p}) = \alpha + \beta_1 SEX\_HHH + \beta_2 AGE\_HHH + \beta_3 FAM\_HHH + \beta_4 FRM\_EXP + \beta_5 SOYB\_PROD + \beta_6 TRAIN\_FOODPR + \beta_7 DIST\_MMRKT + \beta_8 DIST\_COOP + \beta_9 DIST\_EXT + \beta_{10} LAND\_SIZE + \varepsilon$$

Results and Discussions

Characteristics of Respondents

Soybean is new crop for Ethiopia. Soybean based food is also unusual and the processed soybean is even rarely consumed in cities and towns. Moreover, it is not common among farmers in the rural part of the country despite promising result seen in recent years. The descriptive result of the study showed that there was no statistically significance difference between soy food consumers and non-consumers in terms of family size, age and soybean farm experience (**table 1**).

Table 1: Socio economic characteristics of soy food consumers and non-consumers

Variables	Soy food Consumers		Soy food Non-consumers		t	P value
	Mean	S.D	Mean	S.D		
Head family size	6.14	1.87	6.77	2.20	-1.46	0.147
Household age	37.66	11.10	36.95	9.83	0.285	0.776
Farm experience	21.39	11.63	18.36	10.07	1.16	0.246

Source: Own computation

Institutional factors affect consumption of agricultural products. As distance to institution such as markets increases, the consumption may increase to save the transport cost of the agricultural produce. On other hands as distance to extension services increases, the demand to consume soybean at home increase because of training and education provided by extension agents. The result of this study showed that no significant difference between soy food consumers and non-consumers in regards to distance to different market outlets and extension services (**table 2**).

Table 2: Institutional characteristics of soy food consumers and non-consumers

Variables	Soy food Consumers		Soy food Non-consumers		t	P value
	Mean	S.D	Mean	S.D		
Distance to main market	5.11	4.75	6.05	5.79	-0.853	0.395
Distance to cooperatives	1.63	2.12	2.69	2.96	-1.620	0.118
Distance to extension service station	1.99	0.94	1.75	1.43	0.376	0.707

Source: Own computation

Livestock ownership of the respondents was also examined based on the categories of soy food consumers and non-consumers. The study showed the existence of significant difference between consumers and non-consumers in terms of number of oxen, bull and sheep (**table 3**). The inferential result showed that soybean food consumers have significantly large number of oxen than non-consumers. Similarly, soybean food consumers have large and significant number of bulls and goat too. The table shows non-significant difference between soy food consumers and non-consumers in regards to land size and other economic variables.

Table 3: Economic status of consumers and non-consumers

Variables	Soy food Consumers		Soy food Non-consumers		t	P value
	Mean	S.D	Mean	S.D		
Land size	1.55	0.94	1.82	1.19	-1.215	0.226
Oxen	1.16	1.21	0.64	0.90	1.959	0.052*
Cows	0.97	1.26	0.86	1.49	0.359	0.720
Heifer	0.78	1.46	0.54	0.86	0.752	0.453
Bull	0.46	1.13	0.18	0.50	2.003	0.05**
Calf	0.68	1.32	0.50	0.91	0.641	0.523
Sheep	0.63	1.74	0.50	0.91	0.347	0.719
Goat	0.58	1.26	0.05	0.21	4.900	0.000***
Donkey	0.34	0.71	0.82	3.20	-0.693	0.496

***** = statistically significant at 1%; ** = statistically significant at 5% ;* =statistically significant at 10%**

Source: Own computation

Soybean Consumption on the area

The study has revealed the rate of consumption of soybean based foods on the study areas. The result showed that 62% of respondents use soybean at home and 38% never consume soybean and any of its processed products. Out of the total 32% of respondents who got training on soybean food preparation 95.6% of them use soybean food at home. This implies the positive contribution of training on adoption and utilization of agricultural technologies. On other hands, of the total respondents who got training on soybean production, 92.7% use soybean food at home.

Soybean meal utilization in terms of household sex showed that 93.3% of female headed households use soybean food and 66.4% of male headed households use soybean food at home. Out of the total adopters (producers) of soybean technology, 92% of them use soybean food at home. Concomitantly, only 25% of non-adopters use soybean meal at home.

Contribution of Soybean for producers

Different types and varieties of crops are produced by the farmers in the study area. Farmers were asked to rank crops in regard to contribution to their income. They ranked soybean fourth. Maize, coffee and sorghum was ranked first, second and third respectively based on contribution to income. Rice, sesame and pepper was also other agricultural produces mention for their contribution to income.

On other hands, farmers were also asked to rank the contribution of different crops in terms of contribution to family food items. Accordingly, maize, sorghum, rice and millet were ranked first to fourth. Soybean was ranked fifth followed by rice and wheat.

Soybean Production and Consumption

Soybean adopters produce for different benefits on the study area. They were asked the reason for production and adoption of soybean on their piece of land. The survey result showed that 54% of them adopted the technology to generate income and for nutrition, and 18% of adopters used soybean as an income generating, nutrition and to rehabilitate the fertility of their land. The rest 28% of them produce soybean solely for nutrition, for income and for soil fertility.

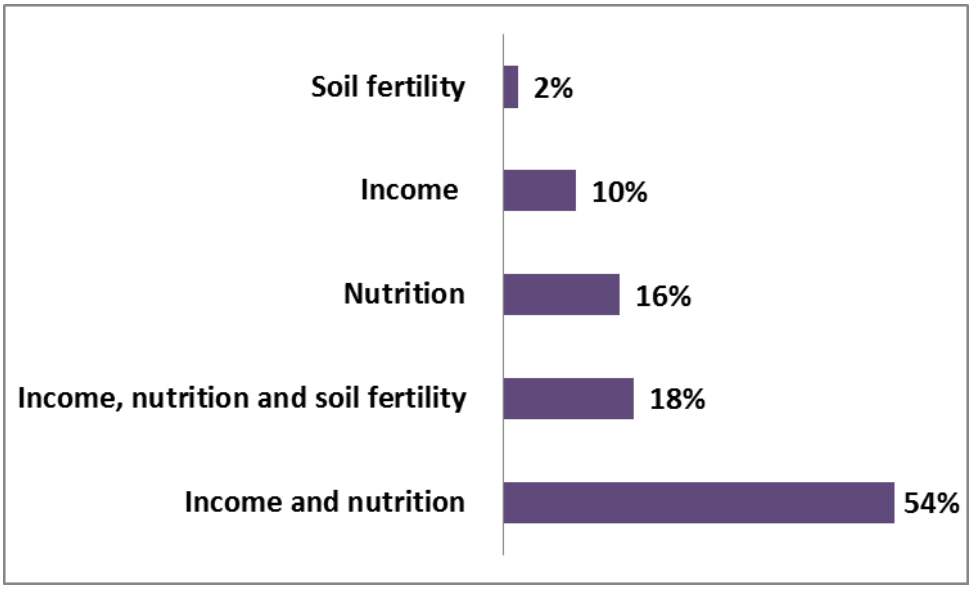

Figure 1: Benefits of production of soybean **Source:** Own computation

Soybean producers were also asked the purpose of production of soybean. The result showed that only 2% of farmers produce soybean for commercial purpose and 21% of them for home consumption merely. The dominating 77% of respondents produce soybean both for consumption and commercial purposes.

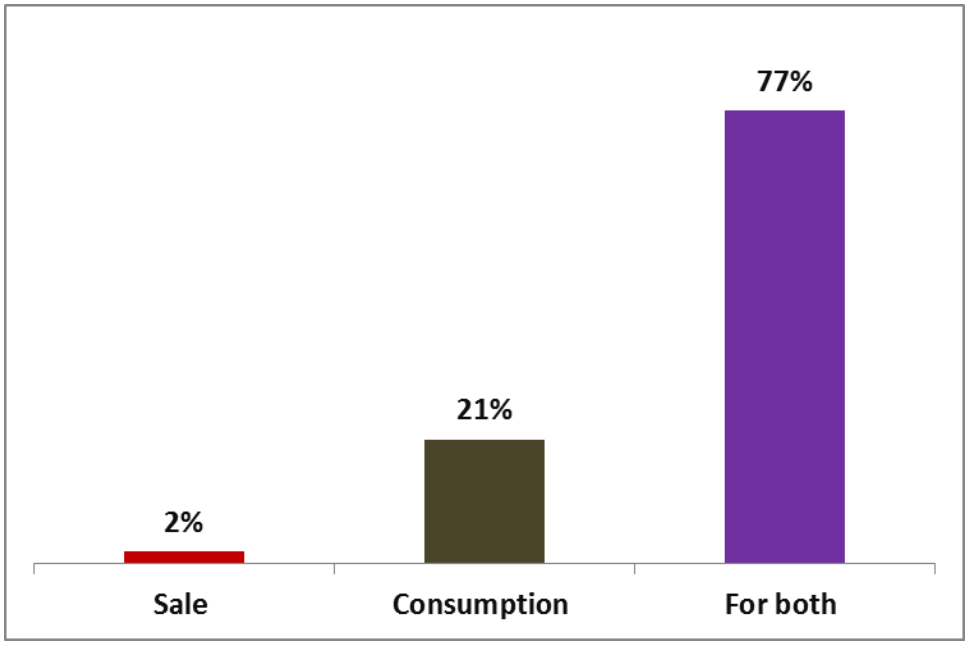

Figure 2: Reason for the production of soybean **Source:** Own computation

Training on soybean food preparation

Different studies conducted on the adoption agricultural technologies revealed that training has positive and significant impact on the adoption of the technologies. The study conducted by Samuel et.al., (2017) revealed that training affects both adoption and intensity of adoption of soybean. This implies the positive contribution of knowledge on adoption and utilization of agricultural technologies. The result of this study also pointed out that only 32% of survey respondents got training on soybean food preparation. The training was given by different government and non-government bodies working on food security and poverty reduction. The contribution of informal bodies such as neighbor farmers was also extraordinary.

The descriptive result of the study showed that 60% of respondents who provided training got the training from bureau of agriculture and natural resource management. Research center, NGO and neighbor farmers also provided soybean food preparation training for 23%, 12% and 5% respectively (**figure 3).**

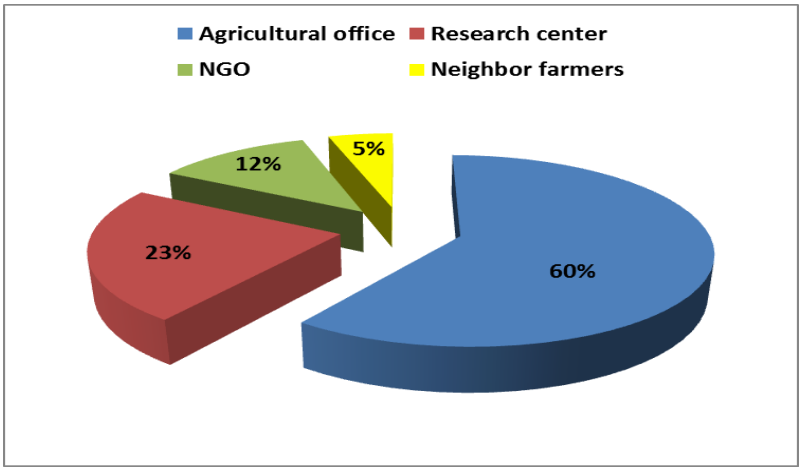

Figure 3: Organization provided training **Source:** Own computation

There are more than 25 food types made up of soybean grain on which Jimma agriculture research center is providing training. The center provides training on all types of soybean food for women every year by preparing soybean preparation recipe which is used as a guide for trainees. At the end of preparation, the food is exhibited for men, children and other community members. This gives farmers the exposure to use different soy based food items such as soy milk, *Dabo* (traditional bread), *Kolo* (Roasted soybean grain) and *Shiro* (a powder used to make wet/Ethiopian stew). Those food types are common among the respondents.

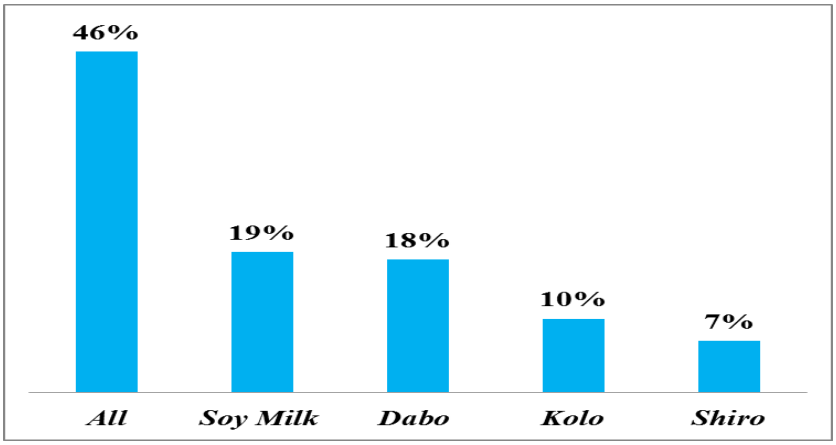

Figure 4: Common soybean foods used by respondents **Source:** Own computation

Soybean production problems

Despite its dominance and contribution, agriculture is a sector with high risk, uncertainty and a lot of challenges. The survey was tried to investigate problems related to production of soybean and the dominating problem among 57% of respondents was market problem which was primarily caused by lack of demand. Disease and pests of soybean plant was another challenge among 13% of respondents. The other most important problem listed by 13% of adopters was lack of improved variety and yield segregation of the existing varieties. Difficulty during threshing soybean, lack of knowledge of consumption of soybean and shortage of land was also soybean production related problems raised by the farmers during the survey.

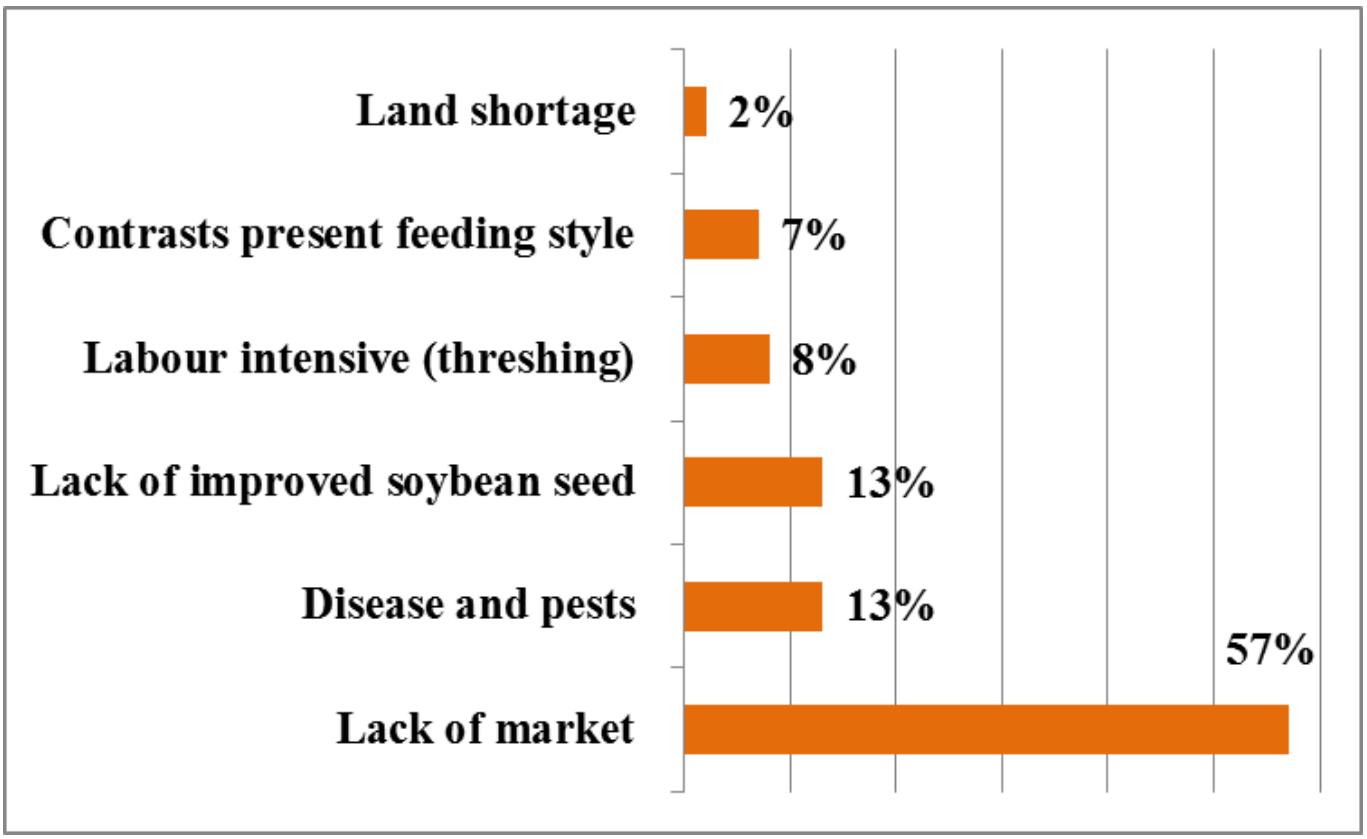

Figure 5: Soybean production problems of the study area

Source: Own computation

Soybean production and Gender participation

Half (50%) of soybean land preparation is performed by males alone in the family. Male and female together and matured children contributes 25% and 20% to land preparation respectively. The contribution of females alone on sowing, fertilizer application, pest and disease surveillance and harvesting is low on the study area. However, females along with males in collaboration on those production activities is growing. The man's domination was also seen on pest and disease surveillance, storage preparation and barn construction (more than 50%). Women alone contribution is high relatively on weeding, hoeing, grading, transporting from fields to barn, storing, selling and cash deposition. Joint collaboration is also relatively higher (more than 50%) on sorting, grading, storing, transporting to the market and selling of soybean grain. The relative high contribution of children was seen on land preparation, pest and disease surveillance and sorting (**table 4**).

Table 4: Participation in soybean production

Activities	Performers in %					
	Female	Male	Male and female	Matured children	Male and matured children	All together
Land preparation	1	50	25	20	1	3
Sowing	1	45	27	1	5	21
Fertilizer application	1	32	34	1	8	24
Weeding	3	27	39	1	16	14
Hoeing	3	40	30	1	5	21
Pest and disease surveillance	0	61	18	10	2	9
Harvesting	1	30	38	1	16	14
Threshing	2	43	30	1	4	20
Sorting	2	32	45	7	4	10
Grading	5	34	46	0	5	10
Barn construction	2	57	29	0	10	2
Transportation from fields to barn	3	46	31	1	6	13
Soybean storage	3	40	45	0	2	10
Transportation to the market	3	38	47	1	2	9
Selling	3	47	41	1	2	6
Depositing/saving money	10	47	35	1	3	4

Source: Own computation

Determinants of Soybean Consumption

The study used logistic model to estimate the probability that whether a given household consumes soy food. Before using the model for hypothesized variables, it was necessary to test the problem of multi collinearity. Bivariate correlation analysis was used to see the degree of multi collinearity among all independent variables. Hoshmand (1999) indicated that a high degree of correlation exists between two independent variables when a bivariate correlation is equal to 0.70. The result witnessed the variables had no problem of multi collinearity. The classification table on logistic regression indicates that coefficients can describe the dependent variable (y) by 89.7%. The fitted logistic regression model has explained 48.9% of the variability in the dependent variable. Out of ten variables used on the model, two of them are categorical and eight are continuous variables. The result shows four variables are significantly affects consumption of soy food at home. All significant variables seen on table (**5**) is elaborated as follows.

Table 5: Determinants of consumption of soybean food

Variables	B	S.E	P value
SEX_HHH [WOMEN]	0.448	1.169	0.002***
AGE_HHH	0.052	0.047	0.2670
FAM_HHH	0.235	0.140	0.2930
FRM_EXP_HHH	-0.084	0.047	0.1720
SOYB_PROD [YES]	1.282	0.630	0.042**
TRAIN_FOODPR	0.370	0.129	0.004***
DIST_MMRKT (KM)	-1.402	0.697	0.044**
DIST_COOP (KM)	-0.039	0.054	0.4690
DIST_EXTN (KM)	-0.320	0.177	0.1700
LAND_SIZE	0.293	0.234	0.2110
Constant	-2.880	1.353	0.033**

-2 Log likelihood = 104.944

Nagelkerke R Square = 0.489

*** = statistically significant at 1%; ** = statistically significant at 5%

Source: Own computation

SEX_HHH (Sex of the Head)

It is the dummy of male and female headed households. The result of the study showed that women headed households highly and significantly consume soybean food at home than male headed households (coefficient=0.448) which was significant at 1% significant level. The result is consistent with the finding seen on the descriptive result which revealed that 93.3% of female headed households use soybean food at home. The result is also in line with Gbemiga (2005) who found widowed women consumed more soybean products than any other single marital group. Two reasons can be raised for this. The first is women headed households are more accessible to training that is related to soybean food preparation which drove them to consume. The second is women are constrained for resources including food item. Since soybean is cheap in rural areas, most of women inclined to consume the crop.

SOYB_PROD (Soybean Production)

The econometric result of the study also showed the positive and significant relation between soybean production and consumption at home. The result corroborate with the finding on the descriptive result. The finding pointed out that 92% of soybean producers use soybean food at home. However, only 25% of non-adopters use soybean meal at home. The result revealed on Samuel et.al., (2017) showed that the main problem of soybean production on the study area was the problem of market. The demand and the price of soybean grain were very low. This could make the producers to consume.

TRAIN_FOODPR (Training on Soybean Food Preparation)

It is the dummy variable which describes the participation of the survey households on soybean food preparation. The regression result showed the positive and significant relationship between soybean consumption and training on soybean food preparation. The coefficient was positive and significant (0.37) which implies that a single training on soybean food preparation increase the consumption by 37%. The result is logical and corroborate with the finding on descriptive result which stated that 95.6% of respondents who got training on soybean food preparation consumes the bean in any form at home.

DIST_MMRKT (Distance to Main Market)

The result of the study also showed the negative relationship between distance to main market and consumption of soybean based foods. The coefficient of the variable is negative (-1.402). The logic behind this could be the problem of transportation and transportation cost would make the local consumption of soybean.

Conclusions and Recommendations

Soybean serves as an important component of many dishes oriented to human nutrition. It is consumed as cooked, sprouted, and processed into soy milk, tofu, miso, tempeh or natto. Many of the healthy benefits attributed to soy intake are due to the high content of these phytochemicals. Soy intake may provide a protective effect against common diseases such as cancer, cardiovascular disease, osteoporosis or even Alzheimer according to epidemiological studies. Soy consumption in rural Ethiopia particularly in the study area is also growing. The study was aimed to assess soy bean consumption in southwest Ethiopia particularly Ilu Ababora and Buno Bedele zones. The result found that 62% of respondents use soybean meal. Out of the total respondents who got training on soybean food preparation, 95.6% use soybean at home. Soy milk, *Dabo* (traditional bread), *Kolo* (Roasted soybean grain) and *Shiro* (a powder used to make wet/Ethiopian stew) were commonly foods made of and used by the consumers. The econometric result of the study also revealed that women headed households highly and significantly consume soybean food at home than male headed households. On other hands, positive and significant relation between soybean production and consumption was also seen. Interestingly positive and significant relationship between soybean consumption and training on soybean food preparation was also found.

Based on the above findings the study recommends:

- Concerning bodies including media (TV, Radio, newspapers and others) and rural extension workers should emphasize on creating awareness regarding the nutritional importance of soybean so that production and marketing will be promoted.
- Governmental and non-governmental organizations working on food security should provide better assistance to the people in increasing the access of soy based foods and in training soybean food preparations since soybean food is still not prominent especially in rural part of the country where malnutrition and nutrient deficiency is common.
- Government to encourage innovative investors and entrepreneurs who could fortify soybean to other crops to enhance the popularity of soybean as a food.

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