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Determinants and Constraints of Pulse Production and Consumption among Farming Households of Ethiopia

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Abstract

In low income countries the agricultural sector is essential to growth, poverty reduction, and food security. Pulse crops are important components of crop production in Ethiopia's smallholders agriculture, providing an economic advantage to small farm holders as an alternative source of protein and other nutrients, cash income, that seeks to address food security. This study sought to gain an understanding of determinants and constraints to production and usage of pulse crops based on data collected in 2013 from 256 households in Oromia region of Ethiopia. Determinants of production and consumption were identified using logistic regression. The result showed that Haricot bean was produced, but not widely consumed. Lentil was widely consumed but not produced. Production of haricot bean was hampered by problems related to weed control, disease, pests, yield and soil quality, a seasonal market, and a shortage of farmland. Consumption of haricot bean was low due to perceived gastrointestinal distress after eating and the culture of it being a taboo food. Logistic regression showed household head educational status and age, land size and household size statistically significantly (p-value<0.05) affected household pulse (haricot bean and lentil) consumption frequency. Agronomic, market, culture and household characteristics related determinants and constraints were identified. Also a mismatch of production and consumption was observed in the study. It is recommended that agronomic and market concerns related to production of haricot bean and other pulses be addressed and that household food preparation techniques for pulses that reduce gastrointestinal symptoms be promoted and evaluated.

Keywords: pulse production, pulse consumption, gastrointestinal distress, haricot bean, lentil

1. Introduction

Pulses have the potential to provide important benefits to small holder farmers (SHFs) as a source of protein and nutrition, and as a potential source of income as a cash crop. Pulses contain a wide range of nutrients including protein, iron and zinc which are lacking in the cereal-based Ethiopian diet (Gibson, *et al*., 2009).

Pulses rank second among ingredients used in national dishes in Ethiopia and are an integral component of the cooking culture of Ethiopians. However, despite their importance, systematic assessment of pulses use in the Ethiopian diet has not yet been carried out at the household or individual level. A few studies suggest usage is very low (Kebebu, *et al*., 2013; Roba, *et al*., 2015). From a community perspective, caloric intake from consumption of pulses and oilseeds combined was reported at 9% for rural and 14% for urban communities (IFPRI, n.d). Of a total of 12.4 million hectares of farmland in Ethiopia, the majority is used for production of cereals (9.16 million hectares); a relatively small area is seeded to pulses (1.41 million hectares) (FAO, 2010).

The diverse and important roles played by pulses in farming systems and in the diets of people make them ideal crops for achieving the Sustainable Developmental Goals of reducing poverty and hunger, improving human health and nutrition, and enhancing ecosystem resilience. Moreover, some pulses (chickpeas, peas) have certain qualities that enhance soils and improve productivity (Campbell, et al., 1992 and Schwenke, et al., 1998).

Nutrition and agriculture are interlinked. In farming households' agricultural products directly inputs for family consumption. Even though community perspective pulse production and consumption discuss the gap no study tried to see agriculture and nutrition side by side and assess bottle necks of pulse production and consumption in the study area. The aim of this study was to identify barriers to production and consumption of pulse crops in the HurufaLole district of Oromia, Ethiopia: a highlands locale.

2. Method

2.1 Study population and Data Source

Oromia is a regional state in Ethiopia. Oromia occupies the largest part of the country and at present consists of 12 administrative zones and 180 woredas. East Shoa zone is one of the 12 administrative zones of the Region and it comprises 18 woredas/ districts. The estimated area of the state of Oromia is about 353, 690Km^2 almost 32% of the country. Hurufalole, one of the kebeles (lowest government administrative division) in Oromia, is the particular site where this study was done inhabiting around 705 households. Household heads were the target population in this study.

2.2 Sampling

The study was conducted from April to May 2013 in the Hurufa Lole kebele of Oromia, Ethiopia. This rural village was selected due to its huge potential of pulse production and a project site for research on increased pulse production funded by Foreign Affairs, Trade and Development Canada (DFATD) and International Development Research Canada (IDRC). Using power analysis, a requirement for 256 households was calculated based on the estimated proportion of households in the region consuming pulses. The households were selected after mapping and house-to-house registration via systematic random sampling.

2.3 Study Design and Data Collection

A cross sectional study design incorporating quantitative and qualitative aspects was employed. Quantitative data included socio-demographic information of respondents and households, economic, pulse production and household consumption. Qualitative information was collected using focus group discussion and key informant interview.

Four focus group discussions, two with male farmers and two with female farmers, were conducted to assess barriers to the production and consumption of pulse crops. Participants (20 male and 20 female) were selected in collaboration with development agents in the area. Notes were taken by a trained research assistant while the principal investigator asked questions using a semi-structured interview guide. Probe questions were asked for clarification and to obtain details. Notes taken during the focus group interviews were transcribed from 'Affan Oromo' to English and then analyzed for common themes. The resulting narrative was used to substantiate quantitative results.

2.4 Data Analysis

Quantitative data were checked for completeness and inconsistencies, cleaned, coded and then entered into SPSS version 20. Predictors of pulse consumption patterns were identified with binary logistic regression.

Haricot bean and lentil weekly consumption frequencies are the dependent variables and socio-demographic and economic information of households and household headswere the independent variables. The independent variables were selected after assessing the existing situation and consulting previous research works. Pulse crop consumption frequency was categorized using mean consumption frequency as high and low consumers.

3. Results

3.1 Socio-Demographic and Economic Characteristics of Households

In total, 256 households were interviewed, with a response rate of 100% (Table 1). However, data from one household was not included in the analysis because of an incomplete response. The majority of the respondents were Muslims from the Oromo ethnic group. Almost all were married. All households owned agricultural land or farmland, holdings were of various sizes, and nearly all were headed by males. Mean values for the age of the household head, household size and land holding size were 37.7 $\pm$ 9.8 years, 6.9 $\pm$ 2.6 and 3.9 $\pm$ 2.1 hectares, respectively. Similar proportions of household heads had 0, 1-5 or $\geq$6 years of formal education. More than 80% of households had monthly incomes $\leq$2500 Birr (equivalent to 120 USD) i.e 1USD=20 Birr. All households used water from a public tap with a mean distance of 1.8 $\pm$ 1.0 km from the water source.

Table 1. Socio-demographic and economic characteristics of respondents and households (n=255).

Socio-demographic and economic characteristics	Frequency	Percent
Respondents' Religion		
Muslim	215	84.3
Orthodox	36	14.1
Other	4	1.6
Respondents' Marital status		
Married	239	93.7
Widowed	16	6.3
Household head		
Male	239	93.7
Female	16	6.3
Household Head Age		
20-30	70	27.5
31-40	103	40.4
≥41	82	32.1
Household head educational status		
None	91	35.8
1^{st}-5^{th} Grade	82	32.1
≥6^{th}Grade	82	32.1
Household Income		
700-1500 Birr	96	37.6
1501-2500 Birr	112	44.0
≥2501 Birr	47	18.4
Household Size		
1-6	120	47.1
≥7	135	52.9
Land size		
0.75-4.00 Hectare	169	66.3
≥4.5 Hectare	86	33.7

3.2 Pulse Production

Only haricot bean was produced to a significant extent in the project area. Haricot bean was produced by 62.7% of households. A large majority of respondents (95.6%) rated growing of haricot bean as "less productive" as compared to other cereals they produced. The previous year's mean farmland used for haricot bean and maize was 0.68±0.71 hectares and 2.47±1.03 hectares, respectively. Seed used by haricot bean producing households was stored from previous production (67.9%) or bought from the market (48.1%).The remainder of the households (37.3%) did not grow haricot bean for the following reasons – shortage of farmland (94.7%), lower productivity of the crop (75.8%), not used as a family food (32.6%) and unable to obtain financing (31.6%), depicted in Figure 1.

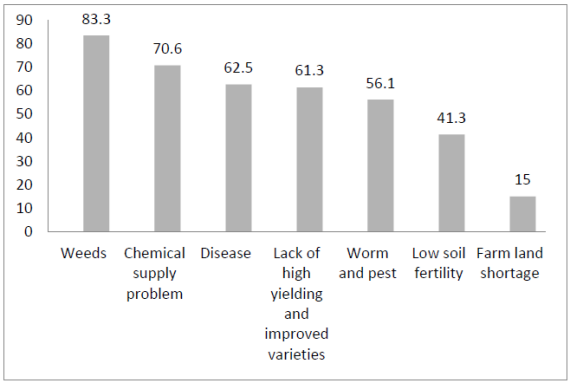

Figure 1. Percentage of households surveyed in HurufaLole, Oromia, Ethiopia, facing various constraints to production of haricot bean

Some male farmers participating in the focus group discussion voiced constraints to haricot bean production in addition to those identified in the quantitative data (figure 1). These included the need to use uncultivated land and the seasonality of the market. Focus group participants also revealed that haricot bean is produced because of its early maturity and funds are obtained from its sale is used to employ labourers to harvest maize. One participant said "Production of haricot been is challenged by weeds, and by a worm which stays in the soil during the daytime and then destroys plants at night." A middle-aged farmer stated "For me, weeds might not be a challenge if the seed is sown in rows, a new practice, because this eases weeding. I practiced this last year. What concerns me is the seasonality of the haricot bean market. No one will look for it in the market after October. The other problem is a seasonal disease, we know it locally as 'waag', which makes the leaves white and spreads throughout the farm." Another older participant in the focus group discussion compared maize and haricot bean by saying "Maize is the king of the poor! It gives more products (up to 30 quintal/per hectare), is one of the important foodstuffs, can be stored for a long period and is marketable throughout the year. Haricot bean needs uncultivated land every year which will compromise our yearly maize production, yields much less product compared to maize (not more than 10-12 quintals/hectare), its market is seasonal, and it will be eaten by pests if stored for a long period."

Focus group discussions with male farmers indicated that the area was unsuitable for the production of broad bean**,** chickpea, pea or lentil. An older farmer stated "Broad bean and pea need moist weather conditions and strong soil, but as you can see the area is hot and the soil is loose. Regarding chickpea, some years back I had seen a farmer trying it and it did not grow up." A young farmer said "Two years back I tried broad bean, pea and chickpea on a small proportion of my farmland. Chickpea did not grow up, pea grew up, had good flowering but grew taller than my expectation, and the same was true for broad bean. Lastly, rather than seed I got green worm inside the seed coat of pea and the production that I got from broad bean was not more than what I had sown. "Another farmer confirmed the earlier discussion by saying "Some years back I also tried to grow broad bean, pea and chickpea. I remember the chickpea did not grow. Plants of broad been were affected by disease which discoloured the leaves, and the yield was too low and the seed was destroyed by a worm. The pea grew up, had good flowering, but it become too tall and fell down after it started setting seed."

3.3 Pulse Consumption

Pea, chickpea and broad bean were not available or consumed in the study area, whereas lentil was widely consumed in the form of a stew or sauce (100% of households) or mixed with vegetables (7.8%). Haricot bean was consumed boiled (98.5% of households) or as a sauce (25.5%) or stew (20.0%).

Both female and male focus groups expressed various concerns related to cultural practices and taboos regarding the preparation and consumption of haricot bean. The following were identified as barriers to haricot bean consumption. One elderly man said "It is known that consumption of haricot bean causes abdominal discomfort like distension, flatulence and diarrhoea, and I think it is because of this that using haricot bean as a foodstuff is considered a sign of over shouldered poverty." Another elderly man supported this idea saying "The locality is hot and we are used to consuming lunch outdoors, but this is not true if we are going to have food prepared from haricot bean due to fear of what passersby will say." A middle-aged member of the female group confirmed this by saying "Consumption of haricot bean is a taboo! Male household heads in particular are not happy to consume it. In my house I use boiled red haricot bean as a snack when my kids come home from school. "Another female participant said "We females are responsible for preparing food and serving the whole family. I feel guilty to prepare and go with food from haricot bean while my husband is farming. If I do, it is certain that everybody sharing the food will be pointing at me and discussing what I prepared and served for him." A relatively young woman opposed this point of view and focused on preparation saying "Even though there is a cultural problem with haricot bean, the main concern of male household heads is abdominal discomfort and what matters is how we prepare the food. As I see it, the problem is because of the seed coat, so we should discard the water used to boil the haricot bean after a few minutes and then boil it again as the seed coat will have come off. "From the above statements, it appears that while gender played a role, the age of the participants also influenced their views about consumption of haricot beans, with females expressing a greater willingness to incorporate them into the diet.

Table 2 suggests a gap between the production and consumption of haricot bean, as it was produced by a majority of households and consumed by only one-fourth of the households. On the other hand, lentil was not produced but was consumed by all of the households surveyed.

Table 2. Pulse (lentil and haricot bean) consumption patterns of households in Hurufalole, Oromia, Ethiopia

Consumption Pattern	Percent
Lentil	
≤ 2 days/Week	21.6
≥ 3days/Week	78.4
Kidney/Haricot Bean	
≤ 2 days/week	52.3
≥ 3 days/week	47.7

Farm size and the educational status of the head of the household had a statistically significant (p-value<0.05) association with households' consumption frequency of haricot bean, i.e. households with land size of 0.75-4.0 hectares consumed haricot bean less frequently than did households with land size of ≥4.5 hectare, and households where the head had no formal education consumed haricot bean less frequently than did households where the head of the household had or more years of formal education.

Table 3. Logistic regression of socio-demographic variables with haricot bean consumption by households in HurufaLole, Oromia, Ethiopia

Socio-demographic and economic characteristics	Haricot bean			
	Haricot bean consumption status			
	Low consumer	High consumer		
	No.(%)	No.(%)	COR(95%CI)	AOR(95%CI)
Household Head				
Male	31(47.7)	29(44.6)	1.4(.22 - 9.01)	1.02(.12-8.69)
Female	3(4.6)	2(3.08)	1	1
Household Head Age				
20-30	6(9.2)	3(4.6)	1	1
31-40	17(26.2)	14(21.5)	0.39(.08 - 1.94)	0.22(.03-1.39)
≥41	11(16.9)	14(21.5)	0.65(0.22-1.86)	0.40(.10-1.58)
Head Education				
0	13(20)	5(7.7)	0.19(.46-.79)	0.13(.03-.67)*
Grade 1-5	15(23.1)	14(21.5)	0.47(.14-1.58)	0.28(.67-1.2)
Grade ≥6	6(9.2)	12(18.5)	1	1
Household Income				
700-1500 Birr	16(24.6)	13(20)	1	1
1501 - 2500 Birr	13(20)	12(18.5)	0.68(.17-2.73)	0.55(.09-3.19)
≥2501	5(7.7)	6(9.2)	0.77(.19- 3.19)	0.48(.09-2.53)
Household Size				
1-6	11(16.9)	14(21.5)	1.72(.63-4.72)	3.11(.8-12.01)
≥7	23(35.4)	17(26.2)	1	1
Land size				
0.75 - 4.0 Hectare	21(32.3)	11(16.9)	0.34(.12-.935)	0.30(.93-.94)*
≥4.5 Hectare	13(20)	20(30.8)	1	1

*p-value is significant at < 0.05. COR=Crude Odds Ratio, AOR=Adjusted Odds Ratio

Age of household head and family size had a statistically significant (P<0.05) association with households' consumption frequency of lentil (Table 4). For example, households with a head of age 31-40 years consumed lentil less frequently than households with a head of age ≥41, and households with a family size of 1-6 consumed lentil more frequently than did those with a family size of ≥7.

Table 4. Logistic regression of socio-demographic variables with lentil consumption by households in HurufaLole, Oromia, Ethiopia, (n=255)

Socio-demographic and economic characteristics	Lentil			
	Lentil Consumption Status			
	Low Consumer	High Consumer		
	No.(%)	No.(%)	COR(95%CI)	AOR(95%CI)
Household Head				
Male	25(9.8)	187(73.3)	0.83(.23-3.02)	0.91(.24-3.52)
Female	3(1.17)	13(5.09)	1	1
Household Head Age				
20-30	12(4.7)	58(22.76)	0.75(.31-1.82)	0.52(.19-1.37)
31-40	32(12.55)	71(27.84)	0.34(.16-.74)	0.29(.13-.66)*
≥41	11(4.31)	71(27.84)	1	1
Head Education				
0	18(7.06)	73(28.63)	1.31(.64-2.69)	1.26(0.56-2.78)
1-5 Grade	17(6.67)	65(25.5)	1.23(.59-2.57)	1.25(.58-2.72)
≥6 Grade	20(7.84)	62(24.3)	1	1
Household Income				
700-1500 Birr	21(8.2)	75(29.4)	0.85(.35-2.03)	0.68(.26-1.80)
1501 - 2500 Birr	25(9.8)	87(34.12)	0.82(.35-1.93)	0.73(.29-1.82)
≥2501	9(3.5)	38(14.9)	1	1
Household Size				
1-6	18(7.06)	102(40)	2.14(1.14-4.01)	2.59(1.27-5.32)*
≥7	37(14.5)	98(38.4)	1	1
Land size				
0.75 - 4.00 Hr	33(12.9)	136(53.3)	1.42(.77-2.62)	1.42(.73-2.78)
≥4.5 Hr	22(8.63)	34(13.3)	1	1

*P.V is significant at < 0.05. COR=Crude Odds Ratio, AOR=Adjusted Odds Ratio

4. Discussion

Several studies conducted in both developed and developing countries have reported on the factors affecting consumption of different foodstuffs, including consumption of pulses by households. Household total monthly income directly affected consumption of food items such as meat, rice, milk, fruit and pulses (Begum, *et al*., 2010). Culture, tradition and food consumption patterns are influenced by each other. An understanding of cultural influences on eating habits is essential for the health promoter who wants to provide realistic educational interventions designed to modify dietary practices (Kaufman-Kurzrock, 1989; Airhihenbuwa, 1995).

Even though increased production of pulses would be expected to increase farm household income and contribute to greater household food security, production and productivity of pulses in Ethiopia are low due to low input usage, especially chemical fertilizers capable of increasing yields in field trials by 10 to 80 percent, limited availability of seed, limited familiarity with the variety of existing pulse types, and limited usage of modern agronomic practices. Marketing is another reason for the low production. Poor linkage between producers and the market has been observed to hinder producers' willingness to produce more pulses (IFPRI, 2010).In this study, both the quantitative and qualitative results showed that production of haricot bean was challenged and constrained by weeds, problems with chemical supply, disease, lack of high yielding and improved varieties, worms and pests, low soil fertility, a seasonal market and a shortage of farm land. A study from India also ranked lack of improved(high yielding and disease resistant) varieties, pest infestations and disease, not using pesticides or chemical fertilizers, lack of knowledge about improved pulse production practices, and high cost of inputs as leading biophysical and socio-economic constraints to pulse production (Roy, 2008).

Haricot bean was produced by a majority of the households in the study area, mainly for the sake of earning money. Another recent study also found that production of haricot bean was limited to about one-fourth of the farm land and for the sake of earning money to harvest maize (Gete, *et al*., 2013). Haricot bean is considered the main cash crop and protein source for farmers in many lowland and mid-altitude zones of Ethiopia. The country's export earnings from haricot bean exceed that of other pulses such as lentil, faba bean and chickpea

(Negash, 2007).

Consumption of haricot bean was reported to be low. Several reasons were given, and these included abdominal distension, flatulence and diarrhoea following consumption, and a culture of considering pulses as a taboo food. Carbohydrates constitute the main fraction of grain legumes, accounting for up to 55-65% of the dry matter. Of these, starch and non-starch polysaccharides (dietary fiber) are the major constituents, with smaller but significant amounts of oligosaccharides (Bravo *et al.*, 1998). Oligosaccharides, which are common in legume seeds, are thought to be the major producers of flatus when consumed in significant quantities (Reddy and Salunkhe, 1980). A study conducted to evaluate the combined effect of soaking, dehulling, cooking and fermentation with *Rhizopusoligosporus* on the oligosaccharides, trypsin inhibitor, phytic acid and tannins of different pulse varieties indicated that soaking, dehulling, washing and then cooking decreased raffinose by 50% and sucrose and stachyose by more than 55-60% (Egounletya and Aworh, 2003).It is not clear, however, whether changing the oligosaccharide component will alter the health benefits of legumes. The sensation of increased gas does seem to modulate with more frequent pulse consumption (Livesey, 2001). After a few weeks of daily pulse consumption, consumers perceived that flatulence occurrence returned to normal levels. Only a small percentage of individuals were bothered by increased flatulence regardless of the length of time they had consumed pulses (Jenkins and Kendall, 2000).

Although some consumers recognize that beans and other pulses are an important protein source or meat substitute, many avoid eating them because they believe that pulse consumption will cause excessive intestinal gas or flatulence. Many may not be aware that like other vegetables, pulses are rich sources of fiber, vitamins and minerals (Fleming *et al*., 1985). An increasing body of research supports the benefits of a plant-based diet, and pulses specifically, in the reduction of chronic disease risks and in improving food security (Christopher E., *et al* 2012; Hosseinpour-Niazi S., *et al* 2012; Mattei, *et al*., 2011 and Celleno , *et al*., 2007). Weekly consumption frequencies of pulses (haricot bean and lentil) were affected by socio-demographic and economic characteristics such as the age and educational status of the household head, household size and farm land size. Even though statistical associations were not calculated, in agreement to finding of this study descriptive survey done in Canada showed differences in pulse consumption frequency related to household size, educational status and income, with pulse consumption less frequent in single-person households, and increasing with increasing educational level from high school to university (Ipsos, 2010).

5. Conclusion

Increased agricultural productivity can improve nutritional intake of households through improving purchasing capacity and consumption from one's own production. Few studies have looked at the two variables, production and consumption.

Findings from this study showed that three varieties (broad bean, chickpea and pea) were tried by different famers some years back and in their trial they identified the unsuitability of the area, worm, disease and unproductiveness as barriers. Only haricot bean was produced covering too limited farm land as compared to other cereal (maize) grown and constrained by weed, lack of chemical supply, disease, lack of high yielding and improved varieties, worm and pest, low soil fertility, seasonal marketability and not being member of food stuffs. Despite the production consumption of haricot bean was too limited because of abdominal discomforts after and culture of considering it as a taboo food especially by male household heads. Household consumption frequencies of lentil and haricot bean were affected by land size, household head education and age, and household size.

Agronomic and market concerns related to production of haricot bean and other pulse crop be addressed and that household food preparation techniques for pulses that potentially reduce gastrointestinal symptoms be promoted and evaluated. Besides looking for production, availability and access to foods influence of culture, tradition, age and gender on utilization/eating habit of a community has to be well understood before nutrition intervention to modify dietary practices.

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Conflict of Interest

The authors declare no conflict of interest.

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