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Role of Pulses in Enhancing Nutritional Status of Rural Poor: Micro-Level Evidence from Semi-Arid Tropics of India

R. Padmaja*, P. Soumitra and M.C.S. Bantilan

International Crops Research Institute for the Semi-Arid Tropics, Patancheru - 502 324, Telangana

Abstract

This paper has presented evidence on the role of pulses in enhancing the nutritional status of the rural communities in the semi-arid tropics (SAT) of India. The paper has used primary data from the ICRISAT VLS nutrition surveys (8 villages from Telangana, Andhra Pradesh and Maharashtra) and the longitudinal panel micro-level data (for 6 villages of Telangana and Maharashtra) from 2009 to 2014. The study has revealed that there has been a decline in the area and production of pulses in the SAT villages of India, even though at the macro-level, pulses production has shown an increase. Pulses do contribute to the diversity in diets but the adequacy of protein from the pulses in the diet has not been analyzed in this paper. The regression analysis has indicated the importance and role of pulses in improving the nutritional status of the rural communities. The paper has concluded that there has to be a concerted policy and program action to reintroduce pulses into the cropping pattern in SAT-India and improve the consumption of pulses to the level that has a positive impact on human nutrition. Empowering women along the entire pulse value chain has been observed as one approach to enhance pulse productivity and consumption. Nutrition education, awareness generation and nutrition-sensitive agricultural interventions for pulses are the ways forward to reduce malnutrition in India.

Key words: Pulses, dietary diversity, semi-arid tropics, village level studies

JEL Classification: D03, I38, Q10, Q12

Introduction

Pulses continue to be a major source of protein in Indian diets and play a vital role in sustaining agricultural growth due to their resource-conserving and environment-friendly characteristics. The increase in pulse production therefore is important for improving and enhancing food availability, soil health, diet quality and nutrition security. The dietary diversity score is one measure or indicator of nutrition to understand and assess diet quality and nutritional status of households as well as individuals. The dietary diversity is usually measured by summing the number of foods consumed more often by counting the number of food groups consumed over a reference period (Ruel, 2003). In the literature, the dietary diversity at household level has been suggested as proxy measure of access to food, while at individual level, it is a reflection of dietary quality which has a link with nutritional status.

Many studies have tried to establish the relationship between production, consumption and nutritional contribution of major food crops, including pulses at different disaggregate levels (Gupta and Mishra, 2014; Sangeetha *et al*. 2013; McCrory *et al*. 2010). Recently Shalendra *et al.* (2013), using 55th and 66th rounds of National Sample Survey data, have concluded that the dietary pattern has shifted from cereals and pulses toward fruits, vegetables, processed foods and food commodities of animal origin. It has also been found that pulse consumption by poor household in the rural areas declines by 0.72 per cent

* Author for correspondence
Email: R.Padmaja@cgiar.org

if the price of pulse rises by 1 per cent and thus revealing that pulse consumption is more sensitive to price changes than cereals and milk consumption. The paper indicates that decline in the consumption of pulses has led to increase in malnutrition of children, women and men and a decline in protein intake.

Papanikolaou and Fulgoni (2008) have reported on the association of consumption of beans (a subgroup of pulses) with dietary quality and obesity risk in more than 8000 adult participants in the National Health and Nutritional Examination Survey (NHANES) 1999–2002 using data from a single, multiple pass, 24-h dietary recall. They had found that individuals who consumed variety-beans or baked-beans had significantly lower body weights than those who had not consumed beans. Interestingly, when variety-bean consumers were analysed separately from baked-bean consumers, the reduced risk of overweight or obesity was no longer observed in the baked-bean consumers compared with who were not consumers.

It is widely recognised that malnutrition remains one of the world's greatest human and economic development challenges. The high prevalence of malnutrition in India has multiple drivers: poor quality and quantity of diets, inadequate maternal and child care, and poor access to health services and unhealthy environments (including poor sanitation). Diet quality at the individual level is also affected by intra-household allocation decisions, in which particularly vulnerable and critical sections of population, such as women and children, sometimes lose out. Agriculture can play a significant role in overcoming these barriers and can enable the Indian households to improve the quality of their diets, and thereby improve the nutritional status in the country. The agriculture can help in improving the following outcomes: diet quality, particularly of women and children, prevalence of micronutrient deficiencies (e.g., anemia), and seasonal prevalence of acute malnutrition.

The literature suggests that there is a growing interest in understanding households and individual dietary diversity and its impact on food and nutritional security, mainly because of its relevance in meeting the nutritional requirements (Nti, 2008; Labadarios et al., 2011; Viswanathan, *et al*., 2015). The dietary diversity indicator is easy to measure and could be used as a practical proxy measure of household or individual food security (Thorne-Lyman *et al*., 2010; Vakili *et al*., 2013). Taruvinga *et al*. (2013) using household socio-economic cross sectional survey data from 181 respondents in South Africa, have identified the following determinants of rural household dietary diversity: participation in irrigation schemes, gender, education, income, ownership of a home garden and small-livestock. A review of developing country research needs has confirmed the consistent pattern of a positive association between diversity measures and nutrient adequacy, previously documented in developed countries. The results are surprisingly consistent, considering the wide differences between studies in definitions of foods, food groups, reference period, dietary assessment method, scoring systems, cutoff points used, as well as age of study subjects and general environmental and socioeconomic characteristics (Ruel, 2003).

Date and Methodology

The study has largely utilized primary household and member level data collected through detailed survey for dietary diversity in the Semi-Arid Tropics region of India conducted by the International Crops Research Institute for the Semi-Arid Tropics. The data have been collected from 8 villages spread over three states, namely Andhra Pradesh, Maharashtra and Telangana (Table 1). The data were rearranged to enable computation of scores for household dietary diversity (HDDS), individual dietary diversity (IDDS) and women dietary diversity (WDDS). The sample size for different computations of the three scores from the eight study villages is presented in Tables 1 and 2. For the

Table 1. Village-wise sample distribution for computation of HDDS, IDDS and WDDS scores

State	Villages	Number of samples		
		HDDS	IDDS	WDDS
Telangana	Aurepalle	65	128	59
	Dokur	58	134	66
Andhra	JC Agraharam	41	99	52
Pradesh	Pamidipadu	40	80	43
Maharashtra	Kanzara	79	206	100
	Kinkhed	50	126	60
	Kalman	69	166	84
	Shirapur	94	265	127
Total	496	1204	591	

Source: ICRISAT VLS nutrition surveys, 2013-14

Table 2. Round-wise sample distribution with respect to HDDS, IDDS and WDDS categories

Dietary diversity category	Round 1	Round 2	Round 3	Round 4
HDDS	492	487	483	488
IDDS	1123	1109	1097	1117
WDDS	546	546	537	549

Note: Round 1: Data collected during the period August to October, 2013, Round 2: Data collected during November 2013 to January, 2014, Round 3: Data collected during February to April, 2014, Round 4: Data collected during June to August, 2014
Source: ICRISAT VLS nutrition surveys

computation of HDDS, dietary information of the households (all members of a household of age 2 years and above) was used. The IDDS data sets considered the dietary information of individual members with age from 15 to 50 years. The WDDS was a subset of the IDDS and only women of 15-50 years age were included in the sample.

For the computation of these three scores, the FAO guidelines (FAO, 2013) have been followed and the classification of different food groups is listed in Table 3.

The Household Diversity Score (HDDS) guide provides an approach to measuring household dietary diversity as a proxy measure of household's food access. To better reflect a quality diet, the number of different food groups consumed was calculated, rather than the number of different foods consumed. The indicator was modified and used as an Individual Dietary Diversity Score (IDDS), which is used as a proxy measure of the nutritional quality of an individual's diet. The HDDS, however, is used as a proxy measure of the socio-economic status of the household. The WDDS (Women's Dietary Diversity Scores) have been proven to be a good measure of household macronutrient adequacy of the diet and household nutrition insecurity.

Results and Discussion

Trends in Pulse Production

The trends in pulse production in India have revealed that area under pulses did not increase

Table 3. Categories of food groups

Sl No.	Food group (Total 16)	HDDS and IDDS food groups (12 food groups)	WDDS food groups (9 food groups)
1	Cereals	Cereals (Sl No. 1)	Starchy staples (Sl Nos. 1 and 2)
2	White roots and tubers	White tubers and roots (Sl No. 2)	Dark green leafy vegetables (Sl No. 4)
3	Vitamin a rich vegetables and tubers	Vegetables (Sl Nos. 3,4 and 5)	Other vitamin A rich fruits and vegetables (Sl Nos. 3 and 6)
4	Dark green leafy vegetables	Fruits (Sl Nos. 6 and 7)	Other fruits and vegetables (Sl Nos. 5 and 7)
5	Other vegetables	Meat (Sl Nos. 8 and 9)	Organ meat (Sl No. 8)
6	Vitamin a rich fruits	Eggs (Sl No. 10)	Meat and fish (Sl Nos. 9 and 11)
7	Other fruits	Fish and other seafood (Sl No. 11)	Eggs (Sl No. 10)
8	Organ meat	Legumes, nuts and seeds (Sl No. 12)	Legumes, nuts and seeds (Sl No. 12)
9	Flesh meats	Milk and milk products (Sl No. 13)	Milk and milk products (Sl No. 13)
10	Eggs	Oils and fats (Sl No. 14)	
11	Fish and seafood	Sweets (Sl No. 15)	
12	Legumes, nuts and seeds	Spices, condiments and beverages (Sl No. 16)	
13	Milk and milk products		
14	Oils and fats		
15	Sweets		
16	Spices, condiments, beverages		

Source: ICRISAT VLS nutrition surveys, 2013-14

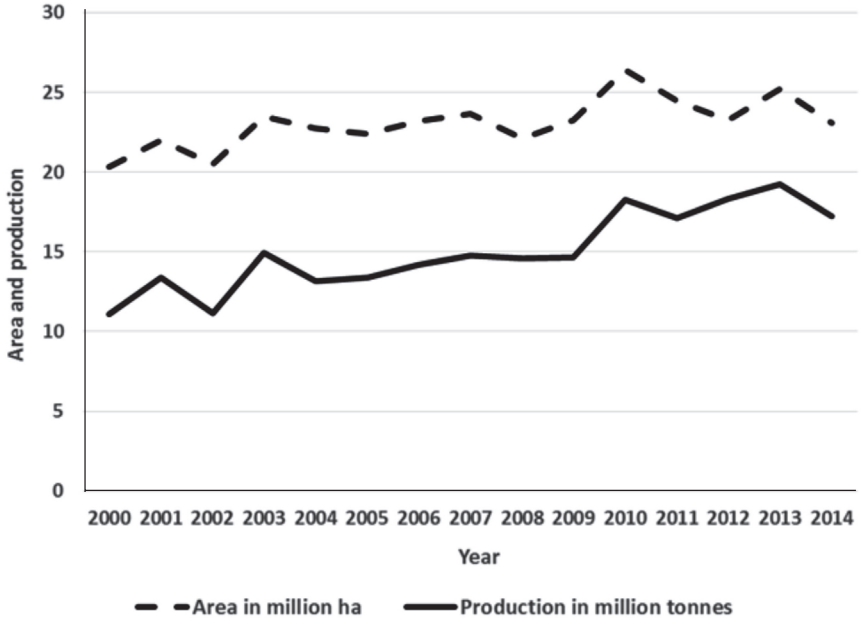


Figure 1. Trends in area and pulse production in India
Source: RBI year book

significantly from 2000 to 2014 though there has been some fluctuations in area under pulses here and there. The production, however, has shown an increasing trend (Figure 1). A closer examination of these trends in the ICRISAT VLS study villages shows a decline in both area and production of the pulses (Figure 2). The production shows a sharp and greater decline compared to the area. This trend indicates that in spite of technological advancements in breeding for higher yield and shorter duration of the crops, the domination of cereals in the cropping pattern and the shift from food crops to cash crops like cotton have resulted in this declining trend. There is therefore a need to re-introduce pulses into the cropping pattern, at least as an intercrop, to improve both human nutrition and soil health.

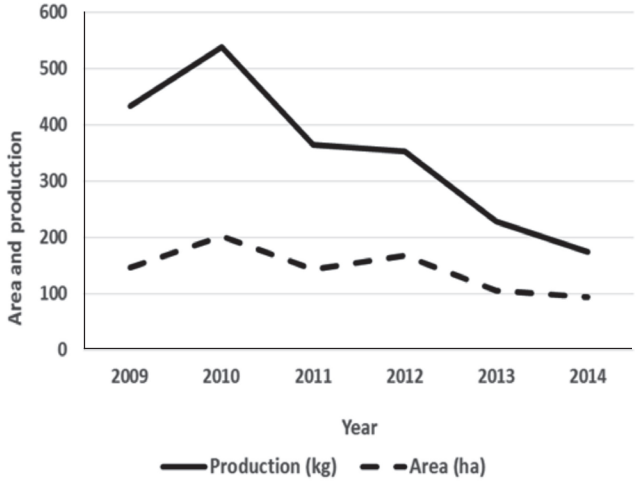


Figure 2. Trends in area and production of pulses in VLS study villages
Source: ICRISAT VLS-VDSA data base

Dietary Diversity and Commonly Consumed Foods in Rural Areas in SAT-India

Using dietary diversity as an indication of nutritional status of rural population, the results from the ICRISAT nutrition surveys in 2013-14 in 8 villages of India indicate that households and the individuals in the sample households have a high dietary diversity score all the year round (Tables 4 and 5). This implies that households consume foods from more than five food groups (refer to Table 3 for food groups). However, this does not imply nutrient adequacy in the diets but the capacity of the households (socio-economic) to diversify their diets.

The WDDS scores on the other hand present a different picture (Table 6). Women's diets have shown low, medium and high diversities across different periods of time (seasonality). The medium level diversity in diets has been noticed (consumption of foods from 4-5 food groups) in women's diets. This indicator has reflected the micronutrient adequacy of

Table 4. Round-wise categories of households with respect to HDDS scores in sample villages

(in per cent)

Village	Round 1		Round 2		Round 3		Round 4	
	Medium	High	Medium	High	Medium	High	Medium	High
Aurepalle	21.54	78.46	12.31	87.69	6.15	93.85	6.15	93.85
Dokur	5.36	94.64	3.70	96.30	0.00	100.00	1.75	98.25
JC Agraharam	0.00	100.00	0.00	100.00	0.00	100.00	2.50	97.50
Pamidipadu	5.00	95.00	2.50	97.50	2.50	97.50	0.00	100.00
Kanzara	0.00	100.00	0.00	100.00	0.00	100.00	3.80	96.20
Kinkhed	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
Kalman	1.45	98.55	0.00	100.00	0.00	100.00	4.48	95.52
Shirapur	1.06	98.94	5.32	94.68	0.00	100.00	4.40	95.60
Over All	4.27	95.73	3.29	96.71	1.04	98.96	3.28	96.72

Source: ICRISAT VLS nutrition surveys, 2013-14

Table 5. Round-wise categories of respondents with respect to IDDS scores in sample villages

(in per cent)

Village	Round 1			Round 2			Round 3		Round 4	
	Low	Medium	High	Low	Medium	High	Medium	High	Medium	High
Aurepalle	0.00	24.11	75.89	0.00	17.80	82.20	8.47	91.53	3.28	96.72
Dokur	0.00	11.76	88.24	0.00	4.72	95.28	0.00	100.00	6.56	93.44
JC Agraharam	0.00	0.00	100.00	0.00	0.00	100.00	2.38	97.62	3.33	96.67
Pamidipadu	0.00	13.24	86.76	1.41	2.82	95.77	1.33	98.67	2.67	97.33
Kanzara	0.51	0.00	99.49	0.00	0.52	99.48	0.51	99.49	5.18	94.82
Kinkhed	0.00	0.00	100.00	0.00	0.87	99.13	0.00	100.00	0.00	100.00
Kalman	0.00	3.75	96.25	0.00	0.00	100.00	0.00	100.00	1.94	98.06
Shirapur	0.00	2.77	97.23	0.00	5.12	94.88	0.39	99.61	3.72	96.28
Over All	0.09	5.61	94.30	0.09	3.88	96.03	1.37	98.63	3.49	96.51

Source: ICRISAT VLS nutrition surveys, 2013-14

Table 6. Round-wise categories of respondents with respect to WDDS scores in sample villages

(in per cent)

Village	Round 1			Round 2			Round 3			Round 4		
	Low	Medium	High	Low	Medium	High	Low	Medium	High	Low	Medium	High
Aurepalle	11.11	66.67	22.22	10.53	68.42	21.05	5.26	57.89	36.84	1.75	56.14	42.11
Dokur	13.56	69.49	16.95	5.56	59.26	35.19	2.08	47.92	50.00	6.67	51.67	41.67
JC Agraharam	0.00	63.04	36.96	2.17	60.87	36.96	4.88	46.34	48.78	24.44	37.78	37.78
Pamidipadu	11.11	63.89	25.00	5.26	73.68	21.05	2.38	54.76	42.86	4.88	39.02	56.10
Kanzara	4.17	73.96	21.88	0.00	40.43	59.57	6.19	52.58	41.24	19.35	62.37	18.28
Kinkhed	10.34	67.24	22.41	1.75	36.84	61.40	7.55	56.60	35.85	16.07	48.21	35.71
Kalman	7.59	49.37	43.04	1.23	49.38	49.38	1.28	52.56	46.15	5.19	59.74	35.06
Shirapur	7.63	78.81	13.56	10.92	74.79	14.29	3.31	70.25	26.45	8.33	78.33	13.33
Over All	7.88	67.95	24.18	4.95	57.69	37.36	4.10	56.80	39.11	10.75	58.47	30.78

Source: ICRISAT VLS nutrition surveys, 2013-14

Table 7. Round-wise distribution of food items consumed with respect to HDDS scores

Village	Items consumed (No.)	Percentage of households				Common food items
		Round 1	Round 2	Round 3	Round 4	
Andhra Pradesh villages	4 to 5	2.50	1.25	1.28	1.25	Cereals, **White tubers and roots**, Vegetables, Fruits, Pulses, Milk and milk products, Oils and fats, **Sweets**, Spices, condiments and beverages
	6 to 7	31.25	18.75	14.10	22.50	
	8 to 9	57.50	62.50	80.77	68.75	
	10 to 12	8.75	17.50	3.85	7.50	
Maharashtra villages	4 to 5	0.69	1.74	0.00	3.50	Cereals, **White tubers and roots**, Vegetables, Fruits, Pulses, Milk and milk products, Oils and fats, **Sweets**, Spices condiments and beverages
	6 to 7	27.15	22.92	25.00	39.86	
	8 to 9	65.98	67.71	70.49	52.80	
	10 to 12	6.19	7.64	4.51	3.85	
Telangana villages	4 to 5	14.05	8.40	3.42	4.10	Cereals, Vegetables, Fruits, Pulses, Milk and milk products, Oils and fats, Spices condiments and beverages
	6 to 7	58.68	57.14	42.74	36.07	
	8 to 9	25.62	34.45	48.72	52.46	
	10 to 12	1.65	0.00	5.13	7.38	

Source: ICRISAT VLS nutrition surveys, 2013-14

the diets of women specially, but also of the households in general. The result — the diets even though diverse still continue to be low in terms of micro-nutrient content. The commonly consumed food groups for HDDS, IDDS and WDDS, presented in Tables 7, 8 and 9, respectively show the domination of foods rich in carbohydrates in the diets. Pulses are the major source of protein in these diets, as meat and meat products (rich sources of protein in the diets) do not feature in the list of commonly consumed foods. This clearly indicates that pulses continue to be the major source of protein in the diet. Protein consumption is essential for improving nutrition of all members of the households and especially in children to reduce stunting

Table 8. Round-wise distribution of food items consumed with respect to IDDS scores

Village	Items consumed (No.)	Percentage of individuals				Common food items
		Round 1	Round 2	Round 3	Round 4	
Andhra Pradesh villages	1 to 3	0.00	0.62	0.00	0.00	Cereals, **White tubers and roots**, Vegetables, Fruits, Pulses, Milk and milk products, Oils and fats, **Sweets**, Spices, condiments and beverages
	4 to 5	5.63	1.24	1.89	3.03	
	6 to 7	35.63	29.81	23.90	25.45	
	8 to 9	56.88	65.84	74.21	70.30	
	10 to 12	1.88	2.48	0.00	1.21	
Maharashtra villages	1 to 3	0.14	0.00	0.00	0.00	Cereals, **White tubers and roots**, Vegetables, Fruits, Pulses, Milk and milk products, Oils and fats, **Sweets**, Spices, condiments and beverages
	4 to 5	1.78	2.07	0.28	3.11	
	6 to 7	38.25	30.66	30.01	46.89	
	8 to 9	57.38	62.57	65.98	46.33	
	10 to 12	2.46	4.70	3.73	3.67	
Telangana villages	4 to 5	17.75	11.61	4.65	4.92	Cereals, Vegetables, Fruits, Pulses, Milk and milk products, Oils and fats, Spices, condiments and beverages
	6 to 7	68.40	66.07	54.42	46.72	
	8 to 9	12.55	22.32	40.47	45.49	
	10 to 12	1.30	0.00	0.47	2.87	

Source: ICRISAT VLS nutrition surveys, 2013-14

Table 9. Round-wise distribution of food items consumed with respect to WDDS scores

Village	Items consumed (No.)	Percentage of individuals				Common food items
		Round 1	Round 2	Round 3	Round 4	
Andhra Pradesh villages	2 to 3	4.88	3.57	3.61	15.12	Starchy staples, Dark green leafy vegetables, Other vitamin A-rich fruits and vegetables, Other fruits and vegetables, Pulses, Milk and milk products
	4 to 5	63.41	66.67	50.60	38.37	
	6 to 9	31.71	29.76	45.78	46.51	
Maharashtra villages	2 to 3	7.12	4.27	4.30	11.85	
	4 to 5	68.95	53.56	59.31	65.03	
	6 to 9	23.93	42.17	36.39	23.12	
Telangana villages	2 to 3	12.39	8.11	3.81	4.27	
	4 to 5	68.14	63.96	53.33	53.85	
	6 to 9	19.47	27.93	42.86	41.88	

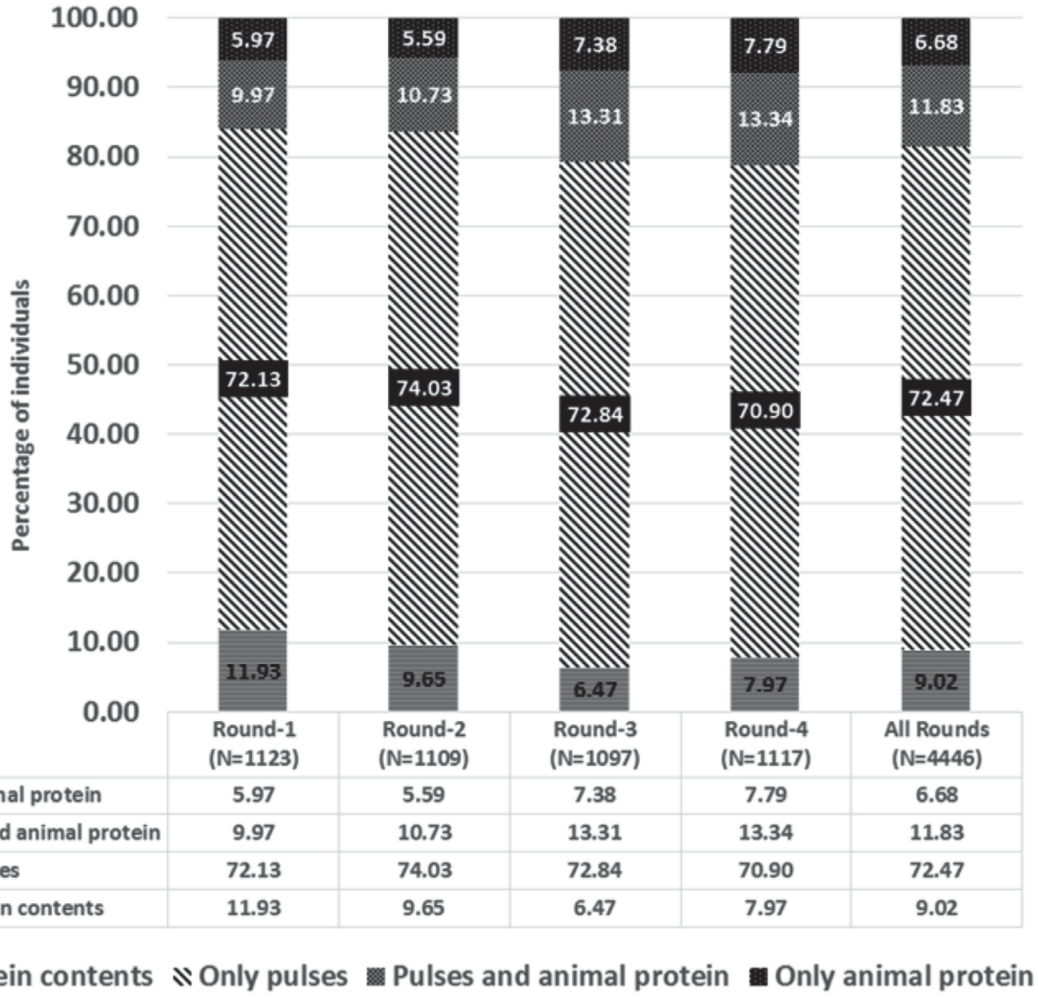
Source: ICRISAT VLS nutrition surveys, 2013-14

and wasting. The importance of pulses in the diets of the rural population cannot be ignored. Proteins from animal sources cannot be accessed by all members of the community because of their high price, ease of availability, processing time in cooking and also social, cultural and religious norms and behaviours. The diets, if are to be rich in protein, the protein should come from vegetable sources i.e., pulses and legumes. This shows the role of pulses in improving and enhancing human nutrition and reduce malnutrition – both under and over nutrition. These are elaborated in the succeeding sections.

Sources of Protein in the Diets of Rural SAT, Pulse Consumption and Nutritional Status

Food security refers to the production of sufficient quantities of both high-quality protein and dietary energy. Protein is the major food content which has an important role in making individuals healthy. The animal protein (meat, egg, fish, etc.) and plant protein (pulses, legumes and nuts) are the two main sources of protein in general. Figure 3 indicates the consumption of protein from plant and animal sources and also the distribution of consumption of protein in different rounds among the sample members (IDDS members). The results indicated that pulses were the main sources of protein for the individuals in all the rounds and overall 72 per cent individuals depended only on pulses as their source of protein. There were about 9 per cent individuals whose source of protein was other than pulses and animal source in any round (for details, see Walker and Ryan, 1990). The consumption of protein from animal sources was very rare among the sample members and overall only about 7 per cent consumed protein from animal sources and about 12 per cent consumed protein from pulses and animal sources.

In rural India, pulse is the main source of protein. It has been found that about 80 per cent individuals consume pulses in their daily diets as the source of protein. Therefore, there was a need to investigate the causal relation between pulse consumption and nutritional status. In this section we have considered body mass index (BMI) as a proxy of nutritional status. Also, we have considered only those sample members who were present in all the four rounds of survey (N=1070). The interaction between consumption of pulses and nutritional status, i.e., BMI is presented in Table 10. About 65 per cent of the individuals in the sample tended to be having normal BMI, of which only 37 per cent consumed pulses all through the year. About 4.39 per cent consumed pulses only for a quarter of the year, 15 per cent consumed pulses for three quarters of a year. The remaining 35 per cent of individuals were either under- or over- nourished (weight). From the Table 10 it can also be understood that low consumption of proteins in the diet can lead to either under or over nutrition. It has also been found that the individuals who consumed pulses more frequently were nutritionally more secure than the remaining groups of individuals.



	Round-1 (N=1123)	Round-2 (N=1109)	Round-3 (N=1097)	Round-4 (N=1117)	All Rounds (N=4446)
Only animal protein	5.97	5.59	7.38	7.79	6.68
Pulses and animal protein	9.97	10.73	13.31	13.34	11.83
Only pulses	72.13	74.03	72.84	70.90	72.47
No protein contents	11.93	9.65	6.47	7.97	9.02

Figure 3. Distribution of sources of protein in the diets of IDDS members
Source: ICRISAT VLS nutrition surveys, 2013-14

Table 10. Interaction between consumption of pulses and nutritional status of individuals

BMI category	Percentage of individuals			
	Consume 1 round	Consume 2 rounds	Consume 3 rounds	Consume all 4 rounds
Normal	4.39	8.69	14.86	36.92
Under weight	1.31	1.03	4.49	15.51
Over weight	10.09	2.71	-	-
Total sample	N=1070			

Source: ICRISAT VLS nutrition surveys, 2013-14

Relationship between Consumption of Pulses and Nutritional Status of Individuals in SAT-India

To establish linkages between pulse consumption and individual's nutritional status, a logistic regression model was constructed. In the model the dependent variable was normal BMI and equaled to 1, who had normal BMI and zero otherwise. To control the model we introduced some socio-economic characteristics such as age, sex, marital status, etc. We have run two different regression models as model-1 and model -2 to establish the relation of consumption of pulse,

Table 11. Pulse consumption and nutritional status of individuals — A logistic regression analysis

Variable	Model 1	Model 2
Constant	-3.371***	-6.594***
Pulse consumption dummy (consume any of the round =1, otherwise 0)	0.553*	
Frequency of pulse consumption (Values range from 1 to 4)		3.305***
Square of frequency of pulse consumption		-0.518***
Average IDDS value	-0.102**	-0.287***
Gender dummy (Male=1, otherwise 0)	0.280	0.212
Marital status dummy (Married=1, otherwise 0)	-0.133	-0.190
Age in years	0.242***	0.273***
Age square	-0.003***	-0.003***
log likelihood	-701.50	-600.33
LR chi^2	48.68	186.73
Prob > chi^2	0.00	0.00
Pseudo R^2	0.03	0.13
Number of observations	1116	1070

Source: ICRIST data base and ICRISAT VLS nutrition surveys, 2013-14

Note: *, ** and *** indicate significance at 10 per cent, 5 percent and 1 per cent levels, respectively

frequency of consumption and nutritional status (Table 11). From the regression output of model-1 it has been found that there is a strong and significant positive relation between the consumption of pulses and nutritional status. The individuals who consumed pulse in any of the rounds were likely to enjoy more normal BMI compared to those who did not consume pulses at all, as indicated in the regression coefficient 'Pulse consumption dummy' which is 0.553 and statistically significant.

Model-2 established the linkage between frequency of pulse consumption and nutritional status. The regression coefficient of 'Frequency of pulse consumption' indicated that those who consumed pulses more frequently had a higher tendency of having a normal BMI compared to those who consumed pulses less frequently. The frequency of consumption of pulses has a threshold point, after which it has a negative impact on the individuals BMI status which have been indicated by coefficient of 'Square of frequency of pulse consumption' (-0.518) is negative and statistically significant. Therefore, it can be concluded that the pulse consumption has an important role in the individual's nutritional status but there is a threshold level of the frequency of consumption and when the level is crossed, it has an inverse impact.

Conclusions

The study has presented the importance of pulses in improving the nutritional status of the rural population in semi-arid tropics of India. There has to be technological and policy enhancements in increasing the area, production and consumption of pulses, including price volatility and fluctuations. Also, affordability, availability, and absorption of the nutrients are to be considered. Diet diversification, behavioural change and awareness about the role of pulses in the diets are of great importance and campaigns towards these are the need of the hour. Pulses improve the nutritional status of all the members of the society – women, men, adolescents and children. The women will have to be empowered through providing access to new knowledge, and technological interventions (better varieties, extra short-duration varieties, etc.) about pulse production and consumption. Skill enhancement for women for post-harvest processing and value addition as well as involving women in all stages of the value chain are avenues for empowering them in the pulse value chain. Empowering women will improve the production and consumption of pulses and thereby enhance the nutritional status of all the members of the community. The study has concluded that pulses do play an

important role in human nutrition and therefore more emphasis on pulses is necessary.

References

Arimond, M., Wiesmann, D., Becquey, E., Carriquiry, A., Daniels, M., Deitchler, M. and Martin-Prével, Y. (2011) Dietary diversity as a measure of the micronutrient adequacy of women's diets in resource-poor areas: Summary of results from five sites. Washington, DC. Food and Nutrition Technical Assistance II Project (FANTA-2) Bridge, FHI, 360.

Gupta, A. and Mishra, D. (2014) Food consumption pattern in rural India: A regional perspective. *Journal of Economic and Social Development*, **9**(1): 1-16.

FAO (Food and Agriculture Organization of United Nations) (2013) *Guidelines for Measuring Household and Individual Dietary Diversity*. Available at: www.fao.org/fileadmin/.../FAO-guidelines-dietary-diversity2011.pdf

Labadarios, D., Steyn, N.P. and Nel, J. (2011) How diverse is the diet of adult South Africans? *Nutrition journal*, **10**(1): 1.

McCrory, M.A., Hamaker, B.R., Lovejoy, J.C. and Eichelsdoerfer, P.E. (2010) Pulse consumption, satiety, and weight management. *Advances in Nutrition: An International Review Journal*, **1**(1): 17-30.

Nti, C. A. (2008) Household dietary practices and family nutritional status in rural Ghana. *Nutrition Research and Practice*, **2**(1): 35-40.

Papanikolaou, Y. and Fulgoni III, V.L. (2008) Bean consumption is associated with greater nutrient intake, reduced systolic blood pressure, lower body weight, and a smaller waist circumference in adults: results from the National Health and Nutrition Examination Survey 1999-2002. *Journal of the American College of Nutrition*, **27**(5): 569-576.

Pitt, M.M. (1983) Food preferences and nutrition in rural Bangladesh. *The Review of Economics and Statistics*, 105-114.

RBI (Reserve Bank of India) (2016) *Handbook of Statistics on Indian States–2015-16*. Occasional Papers Series No 1.

Ruel, M.T. (2003) Is dietary diversity an indicator of food security or dietary quality? A review of measurement issues and research needs. *Food Nutrition Bulletin*, **24**(2): 231-2.

Sangeetha, V., Sharma, J.P., Burman, R.R., and Lenin, V. (2013) Food Security Vs Nutritional Security—need for Multi-sectoral Convergence. *International Journal of Agriculture and Food Science Technology*, **4**(6): 621-625.

Shalendra, Gummagolmath, K.C., Sharma, P. and Patil, S.M. (2013) Role of pulses in the food and nutritional security in India. *Journal of Food Legumes*, **26**(3and4): 124-129.

Taruvinga, A., Muchenje, V. and Mushunje, A. (2013) Determinants of rural household dietary diversity: The case of Amatole and Nyandeni districts, South Africa. *International Journal of Development and Sustainability*, *2*(4): 1-15.

Walker T.S. and Ryan J.G. (1990) *Village and Household Economies in India's Semi-Arid Tropics*. John Hopkins University, Baltimore.

Thorne-Lyman, A.L., Valpiani, N., Sun, K., Semba, R.D., Klotz, C.L., Kraemer, K. and Bloem, M.W. (2010) Household dietary diversity and food expenditures are closely linked in rural Bangladesh, increasing the risk of malnutrition due to the financial crisis. *The Journal of Nutrition*, **140**(1): 182S-188S.

Vakili, M., Abedi, P., Sharifi, M. and Hosseini, M. (2013) Dietary diversity and its related factors among adolescents: A survey in Ahvaz-Iran. *Global Journal of Health Science*, **5**(2): 181.

Viswanathan, B. (2015) *Farm Production Diversity, Household Dietary Diversity and Women's BMI: A Study of Rural Indian Farm Households*. Madras School of Economics, Monograph 34/2015. 112 p.

Viswanathan, B., David, G., Vepa, S. and Bhavani, R.V. (2015) *Dietary Diversity and Women's BMI among Farm Households in Rural India*. Leveraging Agriculture for Nutrition in South Asia (LANSA) working Paper Series. 2015(3):35 .