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Impact of Grain Legume (Groundnut) on Energy and Nutritional Levels of Tribal Farm Households in Koraput (Orissa)

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Abstract

The introduction of groundnut through the support of IFAD & ICRISAT in the tribal areas of Koraput in Orissa has been able to supplement the nutritional levels of farm households in the area. The protein intake due to groundnut consumption has been found to be around 20 per cent in the IFAD-participants and 11 per cent in the non-participants. The study has observed a perceptible contribution of groundnut (grain legume) in meeting the protein and energy needs of the tribal farm households in the study area. Further, groundnut has been found as the cheapest source of protein and energy among different food items like fish, meat, egg, etc., consumed by the tribal households. This low-cost energy-rich grain legume (groundnut) may be popularised to increase the frequency and quantity of intake to achieve nutritionally secured human resource (tribal people). This strategy will also enhance the sustainable crop production due to inherent advantage of legumes in the cropping system like soil health improvement, low external input addition, atmospheric nitrogen fixation by beneficial microorganisms and reduced soil and environmental pollution.

Introduction

Groundnut is one of the important oilseed crops of Orissa, accounting for about 25 per cent (77200 ha) of the total oilseed crops area (2003-04). The crop is grown mainly under three situations, *kharif*, *rabi*/summer and residual moisture conditions on riverbeds (Satish Kumar *et al.* 2004). Though the state is endowed with high rainfall and other agro-climatic conditions suitable for groundnut cultivation, it is highly inconspicuous in the tribal regions like Koraput.

The groundnut-seed contains 25-29 per cent protein and 47-50 per cent oil (Basu, 2004). The groundnut oil is considered stable and nutritive as it contains right proportions of saturated fatty acid, namely, oleic acid (40-50%) and unsaturated fatty acid like linoleic acid (25-35%) (Dwivedi and Nigam, 2005). Groundnut also contains essential constitutients like fibres, vitamins, minerals and amino acids (Gopalan, 1996). It is consumed in different forms (raw, roasted, fried and boiled) and is added in sweets and other culinary preparations. Therefore, to increase the nutritional security of tribal people and improve their standard of living, ICRISAT-NRCG (International Crop Research Institute for Semi-Arid Tropics and National Research Centre for Groundnut) had introduced the groundnut crop in the tribal-dominated Koraput district of Orissa during 2002-03 with the financial assistance of IFAD (International Fund for Agricultural Development) (Project IFAD-TAG 532) and continued till 2004. The main thrust of IFAD was on 'Farmers Participatory Varietal Selection' (FPVS), inclusion of grain legumes in the existing cropping pattern and improving the nutritional status as well as standard of living of tribal people.

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Although several macro economic studies have been conducted on evaluating the nutritional status of people across states and regions using NSSO data, micro level studies especially among the tribal population are limited. The present study has presented the significance of grain legume (groundnut) in improving the nutritional status of tribal households and the cost effectiveness of these protein-rich grain legume vis-a vis other protein-rich food consumed by the tribals in the Koraput district of Orissa. The specific objectives of the study were to:

(i) Study the nutritional status and determinants of nutritional security of the tribal households in the study area,

(ii) Examine the impact of groundnut consumption on nutritional level (energy and protein), and

(iii) Evaluate the economics of grain legume (groundnut) consumption vis-á-vis other protein- rich foods consumed by the tribal households in the study area.

Methodology

The nutritional status of the participant and non-participant farm households in the IFAD-adopted villages in the Koraput district of Orissa was studied through the consumption survey technique. A total of 120 farm households (60 participating and 60 non–participating in the IFAD project) were selected by random sampling from the three IFAD implemented villages of Sundhipongar, Daleiguda and Mali-Doliamma. From each village, 20 participating and 20 non-participating families were selected randomly. The energy addition in terms of kilocalories per capita per day and protein addition per capita per day was calculated using the standard nutritional content of commodities, published by the National Institute of Nutrition, Hyderabad (Gopalan *et al.*, 1996), in the consumption basket of the participants and non-participants on 30-day recall basis. The calculated energy and protein status, was compared with the Below Poverty Level (BPL) energy norms to ascertain the status of energy consumption of the tribal households. The significance difference between the participant and non-participant household's per capita energy and protein addition due to consumption of groundnut was tested using Equations (1) and (2) (Panse and Sukhatme, 1989):

$$t = \frac{\text{Difference}}{\text{S.E. of difference}} \qquad \ldots(1)$$

$$t = \frac{(m_1 - m_{2)}\sqrt{(n/2)}}{\sigma} \qquad \ldots(2)$$

where,

m = Mean nutritional level (energy/protein) of participants

m_2 = Mean nutritional level (energy/protein) of non-participants

$$\text{Pooled } \sigma_s = \sqrt{[(n_1 - 1)\, s_1^2 + (n_2 - 1)\, s_2^2] / (n_1 + n_2 - 2)}$$

where,

s_1 = Standard deviation of participant

s_2 = Standard deviation of non-participants

tested at 2(n-1) degrees of freedom.

The determinants of nutritional status of the tribal households were evaluated using double log regression function. The calorie intake was considered as the nutritional status for the tribal households (Haddad and Kennedy, 1994).

$$\ln N = b_0 + \sum_{i=1}^{i=3} b_i \ln x_i + \mu_i$$

where,

N = Consumption per household (kcal/day)

X_1 = Total consumption expenditure per household (Rs/month)

X_2 = Total cultivable land (acres)

X_3 = Share of homegrown to total nutrients

b_i = Coefficients

μ_i = Error-term

The social status and ownership of milch animals were not considered in estimating the determinants since most of the tribal households belong to the same social group (ST) and own cows for draught purpose and not for milching. The costs

of 100 kcal of energy and 50g of protein for different energy-rich foods consumed by tribal households vis-à-vis groundnut were evaluated using standard nutritional content and current market prices of these commodities in Koraput, Orissa.

Results and Discussion

The nutritional status and its determinants were analysed separately for the IFAD participants and non-participants in the selected villages. The results have been discussed separately for energy contribution and protein addition due to groundnut intake. The cost on energy derived through consumption of groundnut and other energy-rich and protein-rich products like egg, meat, fish and chicken was calculated separately. Most of these tribal households consume very little amount of pulses and depend more on products like eggs, meat, fish and chicken for their protein requirement; but the high cost of these products restricts the quantity and frequency of their consumption by the tribal households, resulting in protein deficiency.

Determinants of Nutritional Status

The village-wise study on nutritional status revealed that in the Sundhipongar village, a significant variable that determines the nutritional status of the family among the participants was land ownership. Among the non-participants, the significant variables were total consumption expenditure per household per month and the share of homegrown to total nutrients (Table 1). It implies that among the non-participant households, higher monthly expenditure of money earned through farm and off-farm sources had significant and direct effect on their nutritional levels. These observations are in consonance with those of Musebe and Kumar (2002). Hence, besides imparting agro-techniques for increasing productivity of crops, off-farm employment generation will also uplift economic and social status of these tribal households. In the Daleiguda village, among the participants, the total consumption expenditure per household per month (Rs) determined the nutritional status, whereas land ownership (acres) determined the nutritional status of the non-participants. It implies that higher consumption expenditure of a household or more landholding (thereby more income) determined a higher nutrition level. It corroborates the Engel's law, since most of the tribal households in the project site are poor and a large share of their income earned from land and off-farm sources was directed on food commodities (Table 1).

In the Mali-Doli amma village, the expenditure per household and share of homegrown nutrients had significant effect on nutritional level of participants. The pooled analysis revealed that among the participant households, the consumption expenditure

Table 1. Nutritional status determining variables in Koraput district of Orissa

Variables	Villages							
	Sundhipongar		Daleiguda		Mali-Doli amma		Pooled	
	P	NP	P	NP	P	NP	P	NP
Intercept	6.732***	3.916***	5.869***	6.652***	2.979	3.778**	5.861***	5.056***
	(0.987)	(0.853)	(1.351	(1.404)	(1.883)	(1.394)	(0.797)	(0.781)
Total consumption	0.068	0.378***	0.275*	0.083	0.317**	0.141	0.131*	0.158*
expenditure(Rs)	(0.166)	(0.114)	(0.128)	(0.175	(0.136)	(0.169)	(0.070)	(0.089)
Land ownership	0.175**	0.098	0.144	0.220**	0.149	0.109	0.135**	0.154**
(acre)	(0.072)	(0.124)	(0.102)	(0.097)	(0.101)	(0.11)	(0.054)	(0.066)
Share of homegrown	0.017	.317*	-0.044	-0.014	0.643*	0.656**	0.168	0.314**
to total nutrients	(0.169)	(0.162)	(0.278)	(0.212)	(0.342)	(0.269)	(0.155)	(0.13)
R square	0.57	0.651	0.547	0.363	0.409	0.432	0.278	0.276

P = Participants in the IFAD project, NP = Non-participants in the project

***Significant at 1 per cent level, **Significant at 5 per cent level, * Significant at 10 per cent level

Note: Figures within the brackettes are standard errors of the estimates

per month and land ownership were the significant variables, whereas land ownership and share of homegrown to total nutrients were the significant variables among non-participant households. Based on the *a priori* and estimated results, it was concluded that expenditure per household per month, total land ownership per household and homegrown nutrients had significant effect on the nutritional status of the tribal people in the study area.

Household Energy Status

The study on household energy status revealed that in the Sundhipongar village, the energy (kcal per capita per day) derived from the food commodities was 1567 by the IFAD participants and 1690 for non-participants. The difference between energy status of participants and non-participants in this village could be due to difference in their food consumption pattern, as non-participants consumed more energy-rich foods like fish and egg as compared to participants. The energy addition per capita per day due to consumption of groundnut was 247 kcal for the participants and 165 kcal for non-participants. Around 13.6 per cent of the total energy intake (1814 kcal per capita) was through groundnut consumption among the participants, whereas it was 8.9 per cent in the case of non-participants (Table 2). Conversely, in the Daleiguda village, energy (kcal per capita per day) derived from food commodities was 1741 by the participants and 1354 by non-participants. The energy addition per capita per day due to consumption of groundnut was 266 kcal for the participants and 63 kcal for the non-participants. Around 13 per cent of the total energy intake (2001 kcal per capita) was through groundnut consumption in the participants and 4.4 per cent in the non-participants. Across the villages, most of the farmers consumed less nutrients than the minimal requirement of 2400 kcal, depicting a hidden nutritional hunger. However, the introduction of groundnut in the study area has supplemented nutrition to not only the IFAD participants but also the non-participants through consumption of groundnut earned through kind wages. Many of the non-participants own land, but at the time of harvesting groundnut, they work as labourers in the fields of IFAD-participants to get groundnut as kind wages. Hence, promotion of groundnut cultivation and creating awareness about its nutritional importance in daily diet can provide nutritional security to these tribal households.

Similarly, in the Mali-Doli amma village, the energy addition due to groundnut consumption among the participants was 11.6 per cent of the total

Table 2. Nutritional status of tribal households after introduction of groundnut under IFAD project

Name of village	Types of households	Energy from food (kcal/ capita/ day)	Energy from groundnut (kcal/ capita/ day)	Total energy (kcal/capita/ day)	BPL (kcal/ capita)	Energy obtained from groundnut (%)
Sundhi Pongar	Participants	1567.5	247.0	1814.4	2400	13.6
	Non-participants	1690.0	164.8	1854.9	2400	8.9
t-test			**			
Daleiguda	Participants	1741.1	260.1	2001.2	2400	13.0
	Non-participants	1353.8	62.7	1416.5	2400	4.4
t-test			***			
Mali-doli amma	Participants	2035.9	266.3	2302.1	2400	11.6
	Non-participants	1712.3	91.4	1803.7	2400	5.1
t-test			***			
Pooled	Participants	1781.5	257.8	2039.3		12.6
	Non-participants	1585.4	106.3	1691.7		6.2
t-test			***			

Note: *** and ** represent levels of significance at 1 per cent and 5 per cent, respectively

energy intake (2302 kcal per capita) and among the non-participants, it was 5.1 per cent of the total energy intake (1804 kcal per capita) (Table 2). The total energy obtained from all the food commodities, including groundnut, in all the adopted villages (both participants and non-participants) was lower than the normal energy requirement of 2400 kcal per capita per day. Across the villages, most of the tribal households consumed less nutrients than the minimal requirement of 2400 kcal. It was mainly due to lack of awareness among the tribal farm households regarding nutritional contribution of groundnut. For them the aim was immediate sale of fresh groundnut at a premium price in the market to get cash and utilize this income for some non-agricultural purpose. However, the consumption of groundnut modestly supported the daily energy needs of both the participant and non-participant tribal households.

Protein Status

In the Sundhipongar village, the protein intake from food was 40.9g by the participants and 40.3g by non-participants. The protein addition per capita per day due to consumption of groundnut was 11.1g among the participants and 7.4g among non-participants. Around 21.4 per cent of the total protein intake (52 g/capita) was solely through groundnut consumption in the participants and 15.5 per cent in the non-participants (Table 3). In the Daleiguda and Mali-Doli amma villages, the protein addition in the total protein consumption due to groundnut intake was almost same (about 20 per cent) among the participants, whereas in the non-participants' diet, it was 7.7 per cent in Daleiguda and 8.4 per cent in Mali-Doli amma villages (Table 3). The pooled results revealed that contribution of groundnut in the protein intake was about 20 per cent among participants and around 11 per cent among non-participants. Hence, it can be concluded that the contribution of groundnut to the protein needs of the tribal households was significant.

Economics of Consumption of Groundnut vis-á-vis other Energy-rich Foods

The groundnut supplemented 11-14 per cent of energy among the project participants and 4-9 per cent among the non-participants. The non-participants received groundnut as kind wages from the IFAD project participants and its consumption resulted in horizontal nutritional spread (for non-project participants). The economic evaluation revealed that the cost of 100 kcal energy supplied through groundnut was Re 0.45, and much higher for other energy-rich foods consumed by tribals, viz.

Table 3. Nutritional status of tribal households after introduction of groundnut under IFAD project

Name of village	Type of	Protein intake households from food (g/capita/ day)	Protein intake from groundnut (g/ capita/ day)	Total protein intake (g)	Protein required (g/capita/ day)	Protein contribution from groundnut (%)
Sundhi Pongar	Participants	40.9	11.1	52.0	55.0	21.4
	Non-participants	40.3	7.4	47.7	55.0	15.5
t- test			**			
Daleiguda	Participants	47.1	11.7	58.8	55.0	19.8
	Non-participants	33.7	2.8	36.5	55.0	7.7
t- test			***			
Mali-doli amma	Participants	47.9	11.9	59.8	55.0	19.9
	Non-participants	44.7	4.1	48.8	55.0	8.4
t- test			***			
Pooled	Participants	45.3	11.6	56.9		20.3
	Non-participants	39.5	4.8	44.3		10.8
t- test			***			

Note: *** and ** represent significance at 1 per cent and 5 per cent levels, respectively

Table 4. Economics of different high nutrient and energy supplements at Koraput,Orissa

Food commodity	Cost incurred to obtain 100 kcal of energy (Rs)	Cost incurred to obtain 50 g of protein (Rs)
Groundnut	0.45	3.20
Fish	0.75	10.25
Egg	2.31	15.03
Meat	9.74	23.20
Chicken	4.58	11.50

Note: Current market prices for different items at Koraput were considered for calculating the cost of 100 kcal of energy and 50 g of protein

Rs 2.31 for egg, Re 0.75 for fish, Rs 9.74 for meat and Rs 4.58 for chicken (Table 4). The interaction with farm households revealed that the frequency and quantity of consumption of egg, fish, meat and chicken were minimal. Similarly, the cost incurred to obtain 50 g of protein was only Rs 3.50 from groundnut and much higher for other foods, viz. Rs 10.25 for fish, Rs15.03 for egg, Rs 23.20 for meat and Rs 11.50 for chicken.

Conclusions

The cereals have been the major nutrient supplements in the tribal region of Koraput in Orissa and a shortfall has been observed in the minimum energy requirements of 2400 kcal across the IFAD project-adopted villages. The introduction of groundnut through the IFAD project has supplemented the energy and protein levels of not only the participants but the non-participants also through consumption of groundnut earned through kind wages. Hence, it may be concluded that there is a perceptible contribution of groundnut in meeting the protein and energy needs of these tribal farm households. The study has suggested that the groundnut crop may be promoted in the tribal areas of Koraput district to supplement their nutritional needs. Groundnut has been observed to be the cheapest source vis-á-vis other protein and energy rich foods like fish, meat, egg, etc. consumed by the tribal farm households. This low-cost energy-rich grain legume (groundnut) may be popularised in this area to increase the frequency and quantity of its intake to develop a nutritionally-secured human resource (tribal households).

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