Coll. Antropol. **38** (2014) 3: 847–853
Original scientific paper

Deficiency and Sources of Nutrition among an Indian Tribal Population

Sudipta Ghosh

North-Eastern Hill University, Department of Anthropology, Shillong, Meghalaya, India

A B S T R A C T

This paper is an attempt to explore the relationship between protein consumption and BMI for the adult Santhals, a tribal community of West Bengal, India. For this purpose, a cross sectional sample of 1262 adult Santhals were measured. A high incidence (46.9%) of chronic energy deficiency (CED) is observed. A low production of protein rich food items such as pulses, poultry and fishing within their own economy reveal that the barter system fails to provide enough protein rich food items for the community. Along with this, low income earning opportunities lead to a low consumption of protein rich food and hence a high incidence of undernutrition. The occupational pattern reveals that the Santhals who derive livelihood by the means of hard physical activities are more prone to develop CED. The study suggests that the overdependence on forests and their own economy for consumption needs may not be helping this community in attaining a better health status.

Key words: *nutritional status, pulse consumption, santhals, tribes, India*

Introduction

Nutrition is essential for a healthy life i.e. for proper growth, development and to remain active. The role of macronutrients in daily diet for maintaining health has been well understood and documented. Macronutrients are nutrients that provide calories or energy and needed in large amounts for survival. Nutrients are substances needed for growth, metabolism, and for other body functions. There are three macronutrients, which are Carbohydrate, Protein and Fat.

Importance of protein for human body

Protein is a part of every cell in human body, and no other nutrient plays as many different roles as protein does in keeping a human alive and healthy. Protein is needed in our bodies for our muscles, skin, hair and internal organs. Protein plays an important role in the biochemical, biophysical and physiological processes. Protein is required for all most all functions of the body as well as the structural integrity of the cells. Protein regulates gene – the basic code of life and is present in enzyme – the catalyst used in different chemical activity in the body and hormone – the substances that control and stimulate organs. A few important sources of protein are various kinds of meats, fish, cheese, milk, nuts, pulses, and in smaller quantities in starchy foods and vegetables[1].

Importance of pulses as a source of protein

Pulses, commonly defined as »the edible seeds of leguminous plants cultivated for food, as peas, beans, lentils etc.«, are excellent food choices for protein intake because of their health promoting benefits[2]. A 100 g pulse contains 24.5 g protein, whereas the same amount of rice contains only 7.5 g protein[1]. In India, the contributions of various food items in the total intake of protein vary across income groups and states due to differences in tastes and preferences as well as purchasing power. As compared to other states, total protein consumption is very low in West Bengal, where contribution of pulses and milk in total protein consumption is the lowest amongst all the states in India. In West Bengal, cereals are the main contributors (approximately 69%) in total consumption of protein[3]. This is not a healthy trend as cereal proteins lack essential amino acids that are present in the pulses. This unhealthy trend is more prominent in the rural areas and especially amongst the tribal communities. It is observed that the contribution of cere-

Received for publication August 27, 2012

TABLE 1
NUTRITIONAL STATUS AMONG ADULT SANTHALS

BMI categories	Males		Females		Total	
	No.	%	No.	%	No.	%
CED grade III (severe)	57	8.2	78	13.7	135	10.7
CED grade II (moderate)	77	11.0	54	9.5	131	10.4
CED grade I (mild)	173	25.1	153	26.8	326	25.8
Normal	354	51.2	253	44.4	607	48.1
Overweight	31	4.5	32	5.6	63	5.0
Total	692	100.0	570	100.0	1262	100.0

χ^2=13.687, p=0.008

als in total protein consumption declines as income increases[3].

The Indian council of medical research has recommended 60 g of protein per day for a healthy adult man and 55 g of protein per day for a healthy adult woman in India[4]. According to the National Institute of Nutrition, (in short NIN) 2010, about 40% of adult men and 49% of the women in tribal communities have a Body Mass Index (BMI) (Weight in kg / Height in meter^2) below 18.5, which indicates Chronic Energy Deficiency (in short CED)[5]. The Santhals of Bankura, West Bengal are no exception to this (see Table 1). Deficiency in the protein intake could be one of the main reasons for this.

Environmental advantages of pulses

Another important point worth considering in this context is that pulses are not perishable. Whereas, other sources of protein such as animal protein and milk are highly perishable. Santhals like many other tribal communities in India, reside in places where the benefits of modern technology like electricity or refrigerator have not reached yet. Therefore, for them pulses can be an important source of protein as it can be bought (must be bought from markets outside their economy as they do not produce pulses) and stored for a considerably longer period of time.

Keeping these objectives in mind, the present paper focuses on protein intakes measured in terms consumption of pulses and other animal protein amongst the Santhals of West Bengal, with special reference to its consequences on their nutritional status. Further, the paper provides evidence that sources of »money« income for the people in this community are very limited, which contributes in their low purchasing power.

Materials and Methods

Data sources and sampling techniques

The data set for the present study consists of a cross sectional sample of 400 Santhal households, consisting of 1262 adult Santhals. These data were collected from eighteen villages of Ranibandh block of Bankura district of West Bengal, using multi-stage cluster random sampling method. The investigated cohort includes 692 males, aged 18–87 years (mean 44.4 years) and 570 females, aged 18–83 years (mean 41.5 years). All the relevant variables for this study come from this sample. Socio-economic and nutritional data for 400 households was collected through interviews and the 24 hour recall methods respectively.

The reason for selecting this particular region is that Ranibandh is predominantly a Santhal inhabited region. In fact some of the villages are exclusively inhabited by this community. The Santhals have been living in the western part of West Bengal for at least five hundred years. It has been found that some of the Santhal villages in Bankura district are over three hundred years old[6].

Body mass index (BMI)

In order to assess nutritional status, anthropometric measurements like height and weight were taken on each participant following internationally accepted standards[7]. BMI was calculated by the formula: body mass (kg) / stature (m^2). The BMI classification used in the present study is shown in Table 2[8].

TABLE 2
BMI CLASSIFICATION USED IN THE PRESENT STUDY

Classification	BMI cut-off points (kg/m^2)
CED Grade III (Severe)	<16.00
CED Grade II (Moderate)	16.00–16.99
CED Grade I (Mild)	17.00–18.49
Normal weight	18.50–22.99
Overweight	>23.00

All the statistical computations have been done using SPSS 15.0 for Windows. Linear regression technique has been used to assess the effect of various factors on BMI. The measure of the pulse consumption in the regression is (pulse taken/week)/7.

Categorical or nominal variables like economic status, educational status and sex have been incorporated into

regression model by means of dummy variables, »E«, »D« and »Z« respectively.

$$\text{Where, } E = \begin{cases} 1 \text{ if low economic group} \\ 0 \text{ if high e conomic group} \end{cases}$$

Here, the Santhals belonging to the primary occupational categories »Labourer« and »Owner cultivator cum labourer« are referred as »Low economic group« (henceforth LEG) and the Santhals belonging to the primary occupational categories »Owner cultivator«, »Govt. employee« and »Businessman« are referred as »High economic group« (henceforth HEG).

$$D = \begin{cases} 1 \text{ if Illiterate} \\ 0 \text{ if Literate} \end{cases}$$

Here, the category »Literate« includes the Santhals whose educational level is any of the following: »Primary«, »Lower secondary«, »Secondary«, »Higher secondary«, »Graduate/post graduate«. The highest level of education in this population is post graduate.

$$\text{and } Z = \begin{cases} 1 \text{ if Male} \\ 0 \text{ if Female} \end{cases}$$

Results and Discussion

First we look at the nutritional status of this community. From Table 1, a high prevalence (46.9%) of undernutrition (BMI<18.50 kg/m^2) is evident. This phenomenon is more apparent in females (50.0%) as compared to the males (44.4%), differences are statistically significant at 1% probability level (χ^2=13.687). A higher percentage of severe chronic energy deficiency (CED III) is observed amongst the Santhal females (13.7%) as compared to the males (8.2%). A mild chronic energy deficiency (CED I) is observed in almost equal percentages for both the males (25.1%) and the females (26.8%). The occurrence of obesity is nil in this population and prevalence of overweight is low.

Age group-wise distribution of nutritional status amongst Santhals suggests a crucial relation between age groups and chronic energy deficiency (CED) (Table 3). It is evident that the percentage of severe chronic energy deficiency (CED III) increases from younger age groups to older age groups. A similar trend is noticed in CED II, i.e. moderate chronic energy deficiency. While, percentage of mild chronic energy deficiency (CED I) remains more or less equal across the age groups with a marginal increment towards the older age groups. On the other hand, percentage of the Santhals falling under the BMI category »normal« decreases steadily from the younger age groups to the older age groups (Figure 1).

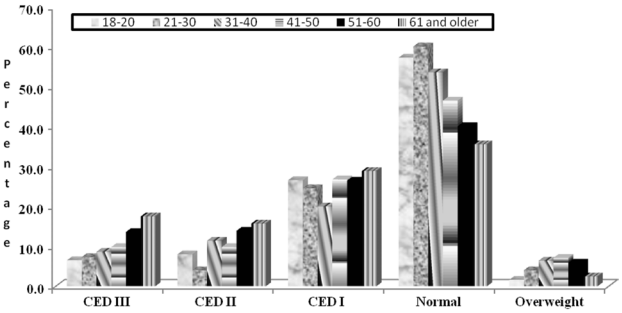

Fig. 1. Age group-wise distribution of nutritional status among Santhals.

Educational status of the Santhals is examined for the older and younger generations separately, to identify the interactive impact of education and age on body composition amongst the adult Santhals (Table 4). In older generation, majority (65.5%) of the Santhals are illiterate, whereas in younger generation only 19% of Santhals are illiterate. Considerable percentages of the Santhals from younger generation have formal education and are qualified up to lower secondary (26.7%) and secondary (24.8%), while negligible percentages of Santhals from the older generation have formal education, up to the lower secondary (10.0%) or the secondary (7.3%). Both

TABLE 3
AGE GROUP-WISE DISTRIBUTION OF NUTRITIONAL STATUS AMONG SANTHALS

Age groups	BMI Categories										Total
	CED III (severe)		CED II (moderate)		CED I (mild)		Normal		Overweight		
	No.	%	No.	%	No.	%	No.	%	No.	%	No. (100%)
18–20	8	6.5	10	8.0	33	26.6	71	57.3	2	1.6	124
21–30	18	7.3	10	4.0	61	24.6	149	60.1	10	4.0	248
31–40	12	8.6	16	11.4	28	20.0	75	53.6	9	6.4	140
41–50	29	9.8	29	9.8	80	26.8	138	46.5	21	7.1	297
51–60	39	13.6	40	13.9	76	26.5	115	40.1	17	5.9	287
61 and older	29	17.5	26	15.7	48	28.9	59	35.5	4	2.4	166
All Santhals	135	10.7	131	10.4	326	25.8	607	48.1	63	5.0	1262

χ^2=65.378, p=0.000

TABLE 4
DISTRIBUTION OF EDUCATIONAL STATUS AMONG SANTHALS

Educational level	18–35 years						35–90 years					
	Males		Females		Total		Males		Females		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Illiterate	27	6.8	123	30.8	150	18.8	174	43.5	350	87.5	524	65.5
Literate	6	1.5	13	3.3	19	2.4	22	5.5	21	5.3	43	5.4
Primary (1^{st} – 5^{th})	46	11.5	80	20.0	126	15.8	75	18.7	20	5.0	95	11.8
Lower secondary (5^{th} – 8^{th})	99	24.8	114	28.5	213	26.6	73	18.3	7	1.7	80	10.0
Secondary (8^{th} – 10^{th})	145	36.3	53	13.3	198	24.6	56	14.0	2	0.5	58	7.3
Higher secondary (10^{th} –12^{th})	47	11.5	11	2.6	58	7.3	0	0.0	0	0.0	0	0.0
Graduate/Post graduate	30	7.6	6	1.5	36	4.5	0	0.0	0	0.0	0	0.0
Total	400	100.0	400	100.0	800	100.0	400	100.0	400	100.0	800	100.0

χ^2=242.8, p=0.000

men and women from the younger generation are better educated as compared to the older generation, where the difference is statistically significant at 1% probability level. In higher education, like higher secondary and graduate/post graduate level, representation from the older generation is nil, against 7.3% and 4.5% from the younger generation respectively. Thus, this low level of education in older generation as compared to the younger ones along with the higher incidence of CED particularly in older generation (Table 3) perhaps indicates that education or in other words knowledge has an important role in dietary habits and consequently body composition of an individual.

The distribution of the Santhals according to their primary occupations and dietary intakes is represented in Table 5. The majority (72.5%) of the Santhals are self-cultivator cum daily-wagers. Santhals falling under this category own only a small piece of cultivable land, which is generally not sufficient to sustain livelihood. Therefore, to substantiate, they work as daily wage laborers in the construction or agricultural sectors. However, the total wage income is low because opportunities are erratic. Table 5 shows that in this group only 18.62% consume pulses seven days a week and only 2.07% consume animal protein once a week. Given the hard physical life they have these numbers are very low. Some of them (6.8%) serve the government, whereas for a small percentage (1.5%) of the Santhals daily wage is the only source of income, as they do not own any land. A negligible percentage (0.5%) of this community is in business. Interestingly businessmen and govt. employee (the number of which is very low, see Table 5) can afford to consume pulses seven days (50.0% and 55.56% respectively), indicating important role of purchasing power in the consumption of pulses in this population.

The results of linear regression, which evaluates the effects of socio-economic and dietary factors on BMI, are presented in Table 6. It is expected that pulse consumption has an important influence on BMI. However, it is important to observe that a fixed quantity of pulse consumption can have different effect for different income groups. It is because people who earn livelihood through sedentary works require relatively less calorie than the ones who depend more on hard physical labor. Educational status, age and sex have been controlled for the sake of the robustness of the model.

The result (Table 6) reveals pulse consumption to have a positive influence on BMI (significant at 1% probability level). Purchasing power and economic status of the Santhals is captured by the dummy variable »E«. The negative coefficient of economic status suggests that the Santhals belonging to LEG are more prone to develop chronic energy deficiency than the Santhals belonging to HEG (significant at 10% probability level). The negative coefficient of the variable representing interaction between pulse intake and economic status suggest that pulse consumption of the Santhals belonging to LEG is not sufficient enough to compensate for the calories that they use in their daily hard physical labor (significant at 1% probability level). This result from the regression analysis, along with the earlier observation that nearly half of the population is underweight suggests that the low income earning opportunities have an adverse effect on their health. The negative coefficient of educational status suggests that the illiterate Santhals are more prone to become chronic energy deficient than the literate ones (significant at 5% probability level).

In a nutshell from the above findings it can be concluded that the Santhals do not have enough income earning opportunities in their own society. Their daily meals consist of boil rice and green vegetables. As a result, they don't consume the required amount of protein everyday, which is 60 g and 55 g per day for man and woman respectively[4]. This nutritional dearth is prominently reflected in their body composition. Nearly half of them are undernourished. Given that the hard physical labor they need to do for their daily survival such a low consumption of protein may not only affect the present but also the future generations. However the Santhals of West Bengal is not the only community to be

TABLE 5
DISTRIBUTION OF SANTHALS BY PRIMARY OCCUPATION AND DIETARY HABITS

Primary occupation	No.	Dietary habits		No.	%
Owner cultivator	75 (18.7%)	Pulse taken / week	One day	17	22.67
			Two days	24	32.00
			Three days	7	9.33
			Four days	6	8.00
			Seven days	21	28.00
		Green vegetables / day	Once	3	4.00
			Twice	27	36.00
			Thrice	45	60.00
		Meat or fish / month	Once	46	61.33
			Twice	16	21.33
			Thrice	10	13.34
			Four times or more	3	4.00
Laborer	6 (1.5%)	Pulse taken / week	One day	1	16.67
			Two days	2	33.33
			Three days	0	0.00
			Four days	1	16.67
			Seven days	2	33.33
		Green vegetables / day	Once	2	33.33
			Twice	4	66.67
			Thrice	0	0.00
		Meat or fish / month	Once	5	83.33
			Twice	0	0.00
			Thrice	1	16.67
			Four times or more	0	0.00
Govt. employee	27 (6.8%)	Pulse taken / week	One day	1	3.70
			Two days	2	7.41
			Three days	4	14.81
			Four days	5	18.52
			Seven days	15	55.56
		Green vegetables / day	Once	0	0.00
			Twice	7	25.93
			Thrice	20	74.07
		Meat or fish / month	Once	15	55.55
			Twice	5	18.52
			Thrice	5	18.52
			Four times or more	2	7.41
Businessman	2 (0.5%)	Pulse taken / week	One day	0	0.00
			Two days	0	0.00
			Three days	0	0.00
			Four days	1	50.00
			Seven days	1	50.00
		Green vegetables / day	Once	0	0.00
			Twice	1	50.00
			Thrice	1	50.00
		Meat or fish / month	Once	1	50.00
			Twice	0	0.00
			Thrice	0	0.00
			Four times or more	1	50.00
Owner cultivator cum Laborer	290 (72.5%)	Pulse taken / week	One day	74	25.52
			Two days	81	27.93
			Three days	18	6.21
			Four days	63	21.72
			Seven days	54	18.62
		Green vegetables / day	Once	5	1.72
			Twice	184	63.45
			Thrice	101	34.83
		Meat or fish / month	Once	213	73.45
			Twice	68	23.45
			Thrice	3	1.03
			Four times or more	6	2.07

TABLE 6
RESULT OF LINEAR REGRESSION: EFFECT OF FACTORS ON BMI FOR SANTHAL ADULTS

Parameters	Coefficients	t	p>|t|
E	–0.447	–1.870	0.062
Pulse intake	0.491	2.397	0.017
Pulse intake* E	–1.132	–3.871	0.000
D	–0.378	–2.146	0.032
Age	–0.020	–3.968	0.000
Z	0.089	0.556	0.578
Constant	20.28	71.107	0.000

E, D and Z are Dummy variables for economic stratus, educational status and sex respectively

found with such a low protein intake. Similar low nutritional status is also evident in the neighboring tribal communities like Shabars of Orissa[9], Munda[10] and Kora Mudi of West Bengal[11].

Possible causes of deficiency in nutrition

The causes of deficiencies could be multidimensional. For instance, it is possible that the Santhals in this region are not informed enough about what a proper diet should be. Given a low level of their education, especially in older generation this definitely is a possibility (Table 4).

The agricultural practice of the Santhals reveals that they do not produce enough food items that are rich in protein. Nor do the forests provide them with pulses and other sources of protein such as animal protein and milk. For instance, they do not produce pulses at all. Hence, their own economy, which is predominantly a barter one, is not a good source of protein rich food items. In terms of resources utilization, the Santhals rely upon three main sources for their biotic resources. They procure fruits from the forest and green vegetables from their neighboring areas where they grow wildly. In fact the productivity in their economy is low. One of the reasons could be as follows. The areas where they live are characterized by lateritic reddish soil with low water retention ability and are low fertile land. Further the dependence on the rain water for irrigation and primitive agricultural technology is not at all helpful.

The Santhals get milk and poultry from animal husbandry. However, due to the implementation of primitive technology in rearing their domestic animals and dependence mostly on their natural reproduction, the productivity is not sufficient for their subsistence. Resultantly, they cannot consume milk or any poultry items on regular basis, even though they relish them. Due to scarcity, consumption of milk is restricted to only those who can afford after feeding their calves.

The low productivity has also contributed in being an isolated economy. For instance, Santhals cultivate only rice and vegetables with low surplus remaining after their own consumption. Hence, the income from selling the surplus is negligible in terms of the money they receive. They exchange vegetables for other vegetables or poultry items through barter system in the local weekly market. This does not generate enough money income. Since they do not generate either enough produce or enough money income possibility of trade or exchange with markets outside of their own gets reduced substantially.

Hence, a state of isolated society as well as an isolated economy sets in. From the earlier observation on their occupational pattern it is further evident that they do not have enough money income. This and the previous observation that they do not produce enough protein rich food together should imply that the consumption of protein rich food is low in this community. In particular, it is observed that the consumption of pulses is very low because they need to buy it from market outside their own. Thus, the positive and significant coefficient of pulse in the regression also indicates that integration with other economies may have positive influence on their health status.

Conclusion

From this paper it is evident that the Santhals, in West Bengal consume a very low protein rich food. In particular they consume very low amount of pulses. However, it does not mean that they have a good substitution for pulses. In fact, it is noticed that production and consumption of other protein rich food is also low. In this context a low consumption of pulses reflect that Santhals in this region do not have enough sources of money income. Since money income can be generated only from trade and other kind of economic interactions with the economy outside of their own, low consumption of pulses in their context suggests an economic isolation. Because they are economically isolated and their own economy is not productive enough to produce enough protein rich food this has caused poor nutritional status for them.

Acknowledgements

I gratefully acknowledge the financial assistance rendered by the Ministry of Tribal Affairs, Govt. of India, for this investigation. I am thankful to all my Santhal informants for their co-operation. I express my special gratitude to Mridu Prabal Goswami for his critical evaluations and valuables suggestions throughout this work.

REFERENCES

1. INDIAN COUNCIL OF MEDICAL RESEARCH, Nutrient requirements and recommended dietary allowances for Indians. In: Proceedings (Indian council of medical research, New Delhi, India, 1989), accessed 20. 12.2011. Available from: URL: www.icmr.nic.in. — 2. ANDERSON JW, MAJOR AW, British Journal of Nutrition, 88 (2002) 263. DOI: 10.1079/BJN2002716. — 3. REDDY AA, Economic and Political Weekly, 39 (2004) 4854. — 4. INDIAN COUNCIL OF MEDICAL RESEARCH. Nutrient requirements and recommended dietary allowances for Indians. In: Proceedings (Indian council of medical research, New Delhi, India, 2010), accessed 20.12.2011. Available from: URL: www.icmr.nic.in. — 5. NATIONAL INSTITUTE OF NUTRITION. Dietary guidelines for Indians. In: Proceedings (National Institute of Nutrition, Hyderabad, India, 2010), accessed 14.12.2011. Available from: URL: www.ninindia.org. — 6. CULSHAW WJ.: Tribal Heritage: A study of the Santhals. (Lutterworth Press, London, UK, 1949). — 7. MARTIN R, SALLER K, Lehrbuch der Anthropooigie. (Gustav Fischer Verlag, Stuttgart, 1957). — 8. WORLD HEALTH ORGANIZATION, Obesity: preventing and managing the global epidemic. Report of a WHO Consultation. WHO Technical Report Series No. 894, World Health Organization, Geneva, Switzerland, 2000. — 9. CHAKRABARTY S, BHARATI P, Annals of Human Biology, 37 (2010) 149. DOI: 10.3109/03014460903234742. — 10. GHOSH R, BHARATI P, Health Care for Women International, 26 (2005) 194. DOI: 10.1080/07399330590917753. — 11. BISAI S, BOSE K, Food Nutr Bull, 30 (2009) 63.

S. Ghosh

North-Eastern Hill University, Department of Anthropology, Mawkynroh-Umshing, Shillong 793022, Meghalaya, India
e-mail: ghosh.sudiptaa@gmail.com

NEDOSTACI I IZVOR PREHRANE KOD POPULACIJE INDIJSKOG PLEMENA

SAŽETAK

Ovaj rad istražuje odnos između konzumacije proteina i indeksa tjelesne mase (BMI) kod plemenske zajednice Santhals u Zapadnom Bengalu u Indiji. U svrhu istraživanja provedena je cross sectional studija na uzorku od 1262 odraslih pripadnika plemena Santhals. Primijećen je visok postotak (46,9%) kroničnog nedostatka energije (CED). Niska proizvodnja hrane bogate proteinima poput mahunarka, peradi i ribe unutar njihove ekonomije ukazuje kako sistem razmjene dobara ne uspijeva osigurati dovoljno hrane bogate proteinima za zajednicu. Usporedno sa time, niska primanja članova zajednice dovode do slabog konzumiranja hrane bogate proteinom i prema tome više stope pothranjenosti. Radni uzorak otkriva kako su članovi zajednice Santhals, koji zarađuju za život radeći teške fizičke poslove, skloniji razvijanju kroničnog nedostatka energije. Studija navodi kako preveliko oslanjanje na šumske predjele i na vlastitu ekonomiju za prehrambene potrebe ne pomaže istraženoj zajednici u postizanju boljeg zdrastvenog stanja.