

Nutritional Status of Tribal Children: A Cross-sectional Study among Tribal Community of Odisha

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Abstract

This study was undertaken to assess the prevalence of under nutrition and health status among the tribal children of Gajapatidistrict of Odisha. The total sample for the cross-sectional study was randomly selected 76 tribal children under 16 years of age. The nutritional indices such as weight for age (WAZ), height for age (HAZ) and BMI for age (BAZ) were calculated and compared with the World Health Organization reference standards. More than half (61.20%) of the children were found to be underweight while about one-third (31.80%) were having normal weight as per their age. Majority (73.53%) were having normal BMI scores. Prevalence of stunting was more among girls (77.78%), and were found to be more moderately undernourished (16.67%) than boys. In age group 11-15 years, stunting was more prevalent in girls (88.89%) than in boys (41.67%). Statistical significance of difference among the nutritional status of the selected respondents across age and gender was ascertained. Across gender, no significant difference was observed among weight for age and BMI score of boys and girls. But significant difference was observed (p -value= 0.003) in height for age scores across gender. It is suggested that a focused multi-sectoral approach to address inequalities in social and economic well-being within the tribal populations would contribute to reducing nutritional inequalities to a large extent.

Keywords: Food and nutrition, health, tribal children, stunting, wasting and chronic energy deficiency

Introduction

Undernutrition continues to be a primary cause of ill health and mortality among children in developing countries. Developing countries like India, accounts for about 40 per cent of undernourished children in the world and it is largely due to the result of inadequacy in relation to their nutritional needs^[4]. It is a well-established fact that nutritional status is a major determinant of the health and well-being among children and there is no doubt regarding the importance of study of child nutrition status across the spatial and temporal dimensions. Children living in the backward and drought prone rural areas, urban slums and those belonging to

socially backward groups like scheduled castes and tribal communities are highly susceptible to malnutrition. The condition becomes worse among the tribal communities because of their isolation from the mainstream and lifestyle^[8,10].

India has the second largest concentration of tribal population in the world next to Africa (67.8 million). Among all the states of India, Odisha has the largest number of tribes^[14], as many as in terms of percentage they constitute an impressive 24 percent of the total population of the state. Odisha is a small and predominantly rural state of India which occupies an important place in the

country having a high concentration of Scheduled Tribe and Scheduled Caste population. India's tribal people are among the poorest in the country. This dismal situation is reflected in the health and nutritional status of tribes. Geographical isolation, primitive agricultural practices, socio-cultural taboos, lack of formal education, poor infrastructure facilities, improper health seeking behaviour, poverty etc. has always lead to the development of various morbidities and under-nutrition. In general, data are scanty on the anthropometric and nutritional status of various tribal populations of India^[2,7,9,13]. Knowledge of the nutritional status of a community or a region is necessary to have a comprehensive idea about its development process, as under

Materials and Methods

This study was undertaken to understand the prevalence of under nutrition and health status among the tribes of southern district, Gajapati of Odisha. Gajapati is a remote tribal area with more than half of its population being from tribal community. Literacy rate in the district are among the lowest in the state, just over 50% as compared to the Odisha average of 73%. Atribal remote villageadopted under tribal sub-plan scheme namely K.M.Bhaliasahi village inGajapati district (19°08'N and 84°25' E)

nutrition is one of the major health problems in developing countries. It is reported that the basic cause of under nutrition and infection of people are poverty, poor hygienic condition and little access to preventive health care. It has been recently suggested^[2], that there is an urgent need to evaluate the nutritional status of various tribes of India as each tribal population has its unique food habits. With this backdrop, the present survey has been carried out to record the anthropometric profile of the tribal children and to assess their nutritional status. The implications of the discussed research will help in formulating better recommendations for further research so as to reduce this nutritional burden.

was selected purposely for the study considering the tribal population residing in the region. A total of 42 children including 21 male and 21 female belonging to age group 0 to 10 years and 34 children including 16 male and 18 females belonging to age group 11 to 16 years were randomly assessed for their nutritional status. The total sample for the cross sectional study was randomly selected 76 tribal children of upto 16 years of age comprising of 37 male and 39 female.

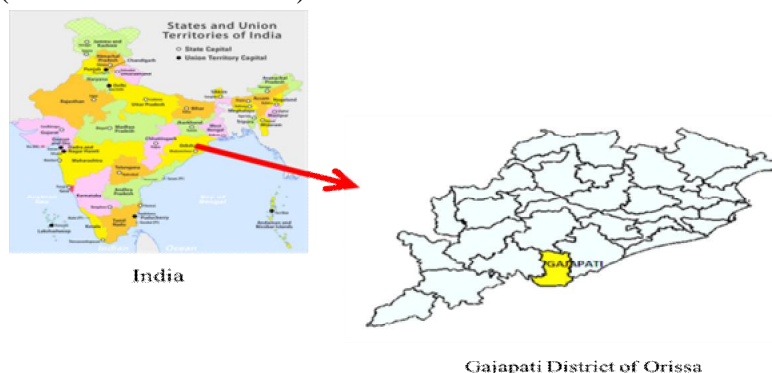


Fig 1: Locale of the study

The present investigation was conducted using pre-tested structured interview schedule and simultaneously, group discussion and informal interview methods were used. Observation was conducted through semi-participant method. Anthropometric measurements were taken using standard procedure^[8]. Nutritional status of children as measured by anthropometric measurements were assessed from height for age (stunting), weight for age (underweight) and BMI for age indicators. The nutritional status of the children was evaluated according to weight-for-age and height-for-age tables identifying stunting and wasting. The anthropometric indices were expressed as z-scores. Children who fall more than -2 standard deviation (sd) below reference median are malnourished and those -3SD below reference median are severely

malnourished. Underweight is a composite measure which measure chronic and acute malnutrition. Stunting or Height-for-age index measures linear growth retardation among children and is a measure of long term effects of malnutrition. Wasting, the weight for height measure is an index reflecting body mass in relation to body length. Wasting is used to detect cases of severe acute malnutrition (SAM) –children with - 3SD of the median being SAM cases. Mean intake of protein and energy was calculated individually and grouped according to ages and finally compared with Recommended Dietary Allowances (RDA) for Indians. To find out statistical significance of difference among the nutritional status of the selected respondents across age and gender, Chi square test was conducted by using SPSS. Cramer’s V was calculated as;

$$V = \sqrt{\frac{\chi^2}{n.df^*}}$$

Where, df = min(r – 1, c – 1) and r = number of rows in the contingency table

and c = number of columns in the contingency table.

Results and Discussion

Demographic profile

The farm families of K. M. Bhalia Shahi village in Gajapati belong to Sabar tribes. They had an average farming experience of 20 years and possessed maximum land holding size of 1.2 acres. In a year, they were employed for 265 days with an average annual income of Rs. 41,125/- from different sectors such as 38 % from crop production, 24% from livestock, 21% from wage earning and 17% from other sectors including forest produces. The analysis of gendered access to assets (land, house, livestock, farm implements, and capital) revealed that 94%

of the assets were with male; and almost 60% of the activities in crop production and 85% of activities in livestock management were performed by women. In this tribe also, the women were more involved in productive activities with less control over assets in compared to their male counterparts. Different nutritional anthropometric indices and nutrient consumption were examined to determine the nutritional status of children and adolescents in two age groups namely 0-10 years and 11-19 years.

Table 1 Distribution of respondents according to Age and Sex

Age group (in years)	Male	%	Female	%	Total
1-5	14	58.33	10	41.66	24
6-10	7	38.88	11	61.11	18
1-10	21	50	21	50	42
11-15	12	70.58	5	29.41	17
16-19	4	22.22	13	72.22	18
11-19	16	47.05	18	52.94	34

Out of 76 respondents, 37 were males and 39 were females. Further, among the males, 50% male and 50%

Height and weight of tribal children

Table 2 indicates that the mean height (cm) of males and females in age group 1-10 years was 95.24 cm and 142.74 cm, respectively. In 11-19 years age group, the mean height of males and females were

females were under 10 years and 47 % males and 53 % females fell into 11-19 year age group.

143.52 and 142.71 cm, respectively. The mean weight of males and females of 11-19 years, it was 37.75 kg and 40.61 kg respectively.

Table 2 Distribution of Height (cm) and Weight (kg) of Sabar tribes

Age group (in years)	Height		Weight		BMI	
	Male	Female	Male	Female	Male	Female
	Mean ±S.D.	Mean ±S.D.	Mean ±S.D.	Mean ±S.D.	Mean ±S.D.	Mean ±S.D.
1-5	87.75±13.88	89.1±28.34	11.07±2.67	11±14.87	14.63±3.07	13.80±1.60
6-10	110.21±7.61	119.55±22.56	16.86±3.13	21.72±12.24	13.75±1.01	15.02±1.96
11-15	138.64±6.9	134.7±11.74	33.17±7.48	29±10.95	17.23±3.14	18.04±3.44
16-19	159.05±9.85	145.83±6.83	51.5±6.19	45.07±8.46	20.35±1.44	21.32±3.73

Nutritional status of tribal children and adolescents

To assess nutritional status of children of under 10 year age, the nutritional indices such as weight for age (WAZ), height for age (HAZ) and BMI for age(BAZ) were calculated and compared with the World Health Organization reference standards. It is indicative from Table 3, out of total sample, more than half (61.20%) of the children were found to be underweight while about one-third (31.80%) were having normal weight as per their age. Among these, more than half, i.e. 66.67% boys and 57.14% girls were under weight while rest 33.33% boys

and 42.86% girls had normal weight. As indicated by Height for age (HAZ) scores, half of the children attained normal height while half of them were stunted. Stunting was more prevalent among girls (66.67%) than boys (33.33%).Data pertaining to BMI scores for age shows that out of the total sample studied, 69 per cent had normal nutritional status, followed by 21 per cent moderately malnourished, and 2 per cent each as severely malnourished and overweight children as reported prevalence of chronic energy deficiency (43.5%) among Sabar tribe of Odisha.

The age-wise pattern of under nutrition is an important dimension of the problem in India, and indeed all over the world. Growth retardation originates early in life, and most of this early damage is irreversible. The results indicate that malnourishment is higher in under10 years age group, both in terms of stunting and

wasting. The period “early years” i.e. first two years of life is the major “window of opportunity” in which most of the growth-faltering occurs. To address under nutrition and efforts to fight under nutrition need to focus on this age group, if they are to be successful.

Table 3 Per cent prevalence of malnutrition according to standard deviation classification in children (under 10 years)

Indices	Boys (>5)	Girls (>5)	Total (>5)	Boys (6-10)	Girls (6-10)	Total (6-10)	Boys (>10)	Girls (>10)	Total Children (>10)
	n ₁ =14	n ₂ =10	N ₁ =24	n ₃ =7	n ₄ = 11	N ₂ =18	N ₃ =21	N ₄ =21	N=42
Weight for age									
Normal	5 (35.71)	2 (20)	7 (29.17)	2 (28.57)	7 (63.64)	9 (50)	7 (33.33)	9 (42.86)	16 (38.10)
Underweight	9 (64.29)	8 (80)	17 (70.83)	5 (71.43)	4 (36.36)	9 (50)	14 (66.67)	12 (57.14)	26 (61.90)
Height for age									
Normal	11 (78.57)	1 (10)	12 (50)	3 (42.86)	6 (54.55)	9 (50)	14 (66.67)	7 (33.33)	21 (50)
Stunted	3 (21.43)	9 (90)	12 (50)	4 (57.14)	5 (45.45)	9 (50)	7 (33.33)	14 (66.67)	21 (50)
BMI for age									
Normal	11 (78.57)	6 (60)	17 (70.83)	5 (71.43)	7 (63.64)	12 (66.67)	16 (76.20)	13 (61.90)	29 (69.05)
Moderately undernourished	1 (7.14)	2 (20)	3 (12.50)	2 (28.57)	4 (36.36)	6 (33.33)	3 (14.29)	6 (28.58)	9 (21.43)
Severely malnourished	1 (7.14)	1 (10)	2 (8.33)	0	0	0	1 (4.76)	1 (4.76)	2 (4.76)
Overweight	1 (7.14)	1 (10)	2 (8.33)	0	0	0	1 (4.76)	1 (4.76)	2 (4.76)

Note: Figures in parenthesis indicate percentage

Table 4 Per cent prevalence of malnutrition according to standard deviation classification in children (11-19 years)

Indices	Boys (11-15)	Girls (11-15)	Total (11-15)	Boys (16-19)	Girls (16-19)	Total (16-19)	Boys (11-19)	Girls (11-19)	Total Children (11-19)
	n ₁ =12	n ₂ =9	N ₁ =21	n ₃ =4	n ₄ = 9	N ₂ =13	N ₃ =16	N ₄ =18	N=34
Height for age									
Normal	7 (5.33)	1 (11.11)	8 (38.10)	3 (75)	3 (33.33)	6 (46.15)	10 (62.50)	4 (22.22)	14 (41.18)
Stunted	5 (41.67)	8 (88.89)	13 (61.90)	1 (25)	6 (66.67)	7 (53.85)	6 (37.50)	14 (77.78)	20 (58.82)
BMI for age									
Normal	9 (75)	5 (55.56)	14 (66.67)	4 (100)	7 (77.78)	11 (84.62)	13 (81.25)	12 (66.67)	25 (73.53)
Moderately undernourished	2 (16.67)	3 (33.33)	5 (23.81)	0	0	0	2 (12.50)	3 (16.67)	5 (14.71)
Overweight	1 (8.33)	1 (11.10)	2 (9.52)	0	2 (22.22)	2 (15.38)	1 (6.25)	3 (6.67)	4 (11.76)

Note: Figures in parenthesis indicate percentage

Table 4 reveals the prevalence of stunting, wasting and chronic energy deficiency among respondents in 11-19 years age group. For assessing nutritional status of respondents in 11-19 years age group, the nutritional indices such as height for age (HAZ) and BMI for age(BAZ) were calculated using World Health Organization standards. Out of total sample, more than half (58.82%) respondents were stunted and 14.71 per cent were moderately undernourished. Only a few(11.76%) were overweight. Majority (73.53%) were having normal BMI scores. Prevalence of stunting was

more among girls (77.78%) and were found more moderately undernourished (16.67%) than boys. In age group 11-15 years, stunting was more prevalent in girls (88.89%) than in boys (41.67%).

Similar trend was observed for BMI scores where girls (33.33%) were found moderately undernourished. In 16-19 years age group, stunting (66.67%) was prevalent among girls than boys. In all the age groups, stunting and undernourishment was more prevalent among girls than boys. The study indicates that stunting was more prevalent among girls than boys, which is indicative of long term malnourishment.

Nutritional status difference across age and gender

The statistical significance in difference among boys and girls and within the age groups in nutritional status of the tribal children was examined using chi-square test of statistical significance. Gender differences were observed as girls (28.58%) were found moderately malnourished and the prevalence was almost twice of that of boys (14.29%). Only a few, i.e. 4.76 per cent of boys and girls were found to be severely malnourished. Similar trend was observed for children for being overweight. In age group under 5 years, more girls were found

underweight (80%) and stunted (90%) in comparison to their male counterparts. As per BMI scores, girls were found more chronic energy deficient than boys. In age group 6-10 years, wasting (71.43%) and stunting (57.14%) was more observed in boys while girls were found as moderately undernourished (36.36%). The reason for girls being malnourished than boys is that girls are often served last and the least in the families which has its roots in the ascribed reproductive roles of women members in the families.

Table 5 Differences in nutritional status of tribal children across age and gender

Parameters	Chi-square	Degrees of freedom	p- value (2 tailed)	Cramer's V	Significant difference
Difference across gender					
WAZ	0.404	1	0.751	.098	No
HAZ	10.271	1	0.003	.368	Yes
BAZ	4.114	4	0.391	.391	No
Difference across age group (under 5 and 6-10 years age group)					
WAZ	1.893	1	0.210	-.212	No
Difference across age group (within under 10 and 11-19 years)					
HAZ	19.962	5	0.001	.513	yes
BAZ	17.275	4	0.002	.477	yes

Table 5 shows the difference in nutritional status of tribal children across

age and across gender. Across gender, no significant difference was observed among

weight for age and BMI score of boys and girls. But significant difference was observed (p-value= 0.003) in height for age scores across gender. Phi and Cramer's V were also applied as a measure of effect size and association based on chi-square and it was found that the effect size is medium. Girls were significantly stunted than boys. Weight for age scores of children of age group under 5 and 6 to 10 years did not differ significantly across age. Significant difference was observed for height for age and BMI for age scores of children across age i.e. within the scores

Food consumption and dietary pattern

The dietary pattern and living condition of the tribes is different from the general population. Their food intake is influenced by vagaries of nature, with

of children under 5 years and 6 to 10 year age group. It indicates significant difference in height and BMI scores of children within age group and significant difference in height of boys and girls. Stunting was significantly more prevalent in age group 11-19. Same trend was observed for BMI scores within the age groups. Children of 11-19 year age were found to be significantly more chronic energy deficient than those of age group under 5 years. In both the cases effect size were large.

large seasonal variations, depending upon availability of agricultural and forest produce.

Table 6 Food consumption pattern of the respondents

Meal	Food item
Morning	Water rice/puffed rice/rice flakes/potato/biscuit
Daytime	Rice/vegetable/potato
Evening	Biscuit/puffed rice/potato
Dinner	Water rice/fish/vegetable/potato/meat/green vegetables

Most of the households consumed three meals in a day. Breakfast was mainly composed of tea with biscuit, puffed rice, water rice and potato. Finger millet (ragi) is also consumed by some of the households in morning in the form of porridge called *manduajau (ragi malt)*. Lunch was normally composed of rice, dal, green vegetables, and potato for most households. Many households consume tubers, and roots but dal was consumed too little that also in some households only. The evening meal was mostly composed of puffed rice, biscuit and tea. Rice was the main staple food and the main source of energy in this area. Rice is soaked in

water overnight and served next day with a vegetable dish, and sometimes with fish. Rice being the staple food was found to be consumed 3 or 4 times a day. Older children reported of eating meat and meat products once a week in form of dry fish. Except for potatoes, other vegetables were consumed by a small number of respondents which may lead to sub clinical micro-nutrient deficiency. Milk consumption was seemed to be very negligible in all age groups. Pulses consumption was too meagre as it is not cultivated in the fields. Diet was found to be rich in carbohydrates and deficient in protein sources. Lime is available in plenty

but is not used regularly in diet due to lack of awareness about its nutritive value and

role in absorption.

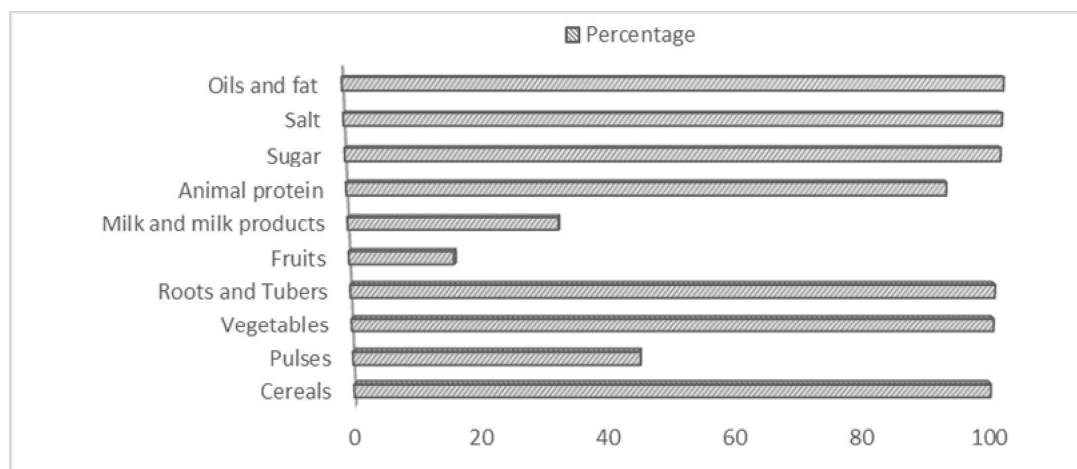


Fig. 2: Households consuming different food items during last week

Table 7 depicts the average daily intake of tribal respondents of both age groups. It is evident that cereals and pulses intake of tribal respondents were not satisfactory and their deficit ranges even upto 30 percent when compared with Recommended Dietary Intake (RDI). Diet was found more deficit in pulses which ranged from 33 to 70 per cent of RDI. Milk and meat products intake also was much less than RDI. Fruits, vegetables,

fats, sugar, fish and meat were not taken frequently in the study area. Among the sampled community, in early years, the children were exclusively breast-fed. No other supplementary feeding practice was observed. Study by Sahoo and Pal (2006) are also in line with the present study that dietary intake was very poor nutritionally and much below the recommended dietary intake.

Table 7 Average daily intake (gm) of selected tribal respondents

Age (years)	Cereals (gm)		Pulses (gm)		Fruits (gm)		Fats (gm)		Milk & milk products (gm)		GLVs		Other veg (gm)	
	Mean	% of RDI	Mean	% of RDI	Mean	% of RDI	Mean	% of RDI	Mean	% of RDI	Mean	% of RDI	Mean	% of RDI
2-3														
Boys	57	-5	16	-47	4.4	-96	9.6	-62	137	-73	10.5	-79	24.6	-51
Girls	55	-8	15	-50	6.2	-94	8.5	-66	150	-70	11.8	-77	26.5	-47
4-6														
Boys	117	-3	20	-33	13.4	-87	9.7	-61	78.9	-84	11.6	-77	35.5	-29
Girls	110	-8	19	-37	18.5	-82	19.7	-21	80	-84	10.8	-78	37.5	-25
7-9														
Boys	155	-14	21	-65	29.0	-71	9	-70	85	-83	42	-58	48	-52
Girls	140	-22	18	-70	13.0	-87	9	-70	23.3	-95	46	-54	51.6	-49
10-12														
Boys	218	27	27	-55	34.0	-66	2.8	-92	90	-82	47.5	-53	65	-35
Girls	221	-8	20	-67	28.0	-72	2.4	-93	46	-91	49.0	-51	67	-33

13-15														
Boys	300	-29	30	-60	26.7	-73	2.1	-95	46	-91	56.5	-44	68.6	-31
Girls	230	-30	21	-65	25.5	-75	2.7	-93	25	-95	58.6	-41	74.0	-26
16-18														
Boys	400	-11	31	-66	22.6	-77	3.4	-93	85	-83	61.6	-38	80.5	-20
Girls	318	-4	22.5	-70	20.5	-80	2.4	-93	80	-84	64.8	-35	78.8	-21

Malnutrition among tribes is a major public health problem in Odisha. In this study more than half (58.82%) respondents were found stunted and 14.71 per cent were moderately undernourished. The children were shorter and lighter than the reference population and their food intake was also inadequate. Stunting and chronic energy deficiency was significantly more prevalent among girls. It was reported that 52 per cent of tribal children were undernourished^[6]. More than half of the female infants were suffering from malnutrition, though all the male infants were of normal nutritional status, indicating lack of proper care of female children right from the first year of life^[1]. The results are also in line with studies by many others which found adolescent girls to be significantly thinner than boys (69.8 per cent in girls and 40.7 per cent amongst boys) in rural Wardha. Many studies suggest adolescence and late childhood; the girls are found to be undernourished in comparison to their male counterparts.

The dietary intake among the tribal children was found to be very poor in comparison to recommended dietary intake^[12,13]. The reason for the deficit in dietary intake was that the tribes were only consuming the locally available food

Conclusion

Our findings suggest that a focused multi-sectoral approach to address inequalities in social and economic well-being within the tribal populations would

resources and were not aware of balanced diet and food groups. Whatever was available was consumed, irrespective of the dietary requirements. For example, the tribes were not cultivating pulses, so it was found deficient in their diet. It was also stated that the consumption of nutritious foods like other vegetables, oils and fats, fish and meat was still much lower, mainly due to poor purchasing power of households. Among these households, there were serious deficiencies in the intake of pulses, legumes, milk and milk products, fats and oils, and sugars and jiggery^[13].

Rice was consumed as staple food and pulses consumption was found to be meagre. Milk intake was absent in majority of the cases. The vegetable intake was significantly less than RDA but intake of green leafy vegetable was fairly good among the tribal children. Fats and oil intake was also found to be very less than recommended dietary intake for Indians. Seasonal fruit consumption was also less. Though intake of meat and chicken was poor; consumption of small fish, dry fish was observed to be better than any other food stuff^[5].

contribute to reducing nutritional inequalities to a large extent. The phenomenon termed as nutrition transition is particularly prevalent among indigenous

peoples, who tend to suffer higher rates of health disparities and lower life expectancy, regardless of geographical location^[5]. it becomes more imperative to develop and implement strategies and programmes which ensure accessibility and availability of nutritious food to the indigenous communities.

Women and girls can be specially targeted for improving the nutritional status of the tribal communities, both as beneficiaries and as change agents. Special nutrition education programmes can be run in the tribal vicinities and non-formal education on good nutritional practices can be organised for women including women farm schools, demonstration of recipes from locally available food, and nutritious recipe competitions and *melas* (fairs). The role of women as the custodians of biodiversity must be recognised and promoted by rewarding their contribution in actively promoting the conservation and sustainable use of biodiversity for food and nutrition. Low cost, indigenous and locally available food products shall be mapped in their ecosystem and tribal women shall be made aware of their nutritive value. Interventions using wild edibles to improve nutritional status shall be planned as the tribes generally have a good understanding of wild edibles from the forests. The government must safeguard rights of tribes for exploring and utilising forests for edibles. The biodiversity mapping must be supplemented with quantitative dietary assessments, so that the edible biodiversity

References

1. Banarjee, B. (2005). Gender differences in nutritional status. *Indian Paediatrics*, 42:400.
2. Bose, K. and Chakraborty, F. (2005). Anthropometric characteristics and nutritional status based on body mass index of adult Bathudis: A tribal

may be used effectively for promoting nutrition.

Nutrition sensitive approaches require behaviour change approaches like creating awareness, continuous reinforcements and conditioning mechanisms through messages, trainings and campaigns on good nutritional practices. Need is to bring behaviour change interventions along with farming interventions. Multi-sectorial approaches like health, nutrition education, safe cooking practices etc shall go parallel so that the nutritional security of these tribes can be ensured for a healthy lifestyle. Backyard is a place which is usually used for cultivating and tending the crops and livestock which are consumed in daily living and can serve as a platform for incorporating nutritious food in the family's diet. Homestead nutrition gardening can be introduced among the community as the tribal families were consuming the wild edibles only, the nutritive value of which is not known. Green leafy vegetables, vines, orange fleshed sweet potatoes and quality protein maize can be recommended to grow in the gardens in the backyard. As non-vegetarian diets are common among tribes, backyard poultry can be promoted. Animal health camps for healthy animals and human health camps also be made an integral part of the interventions to ensure good health and prevention of communicable diseases among the community.

- population of Keonjhar District, Orissa, India. *Asia Pacific Journal of Clinical Nutrition*, 14: 80–82.
3. Chakraborty, S.J. and Bharati, P. (2008). Physical growth and nutritional status of the Sabar tribal adolescents of Orissa, India: a cross-sectional study. *Malaysian Journal of Nutrition*.14:101-112.
 4. Deshmukh, P.R., S.S. Gupta, M.S. Bharambe, A.R. Dongre, C. Maliye, S. Kaur and Garg, B.S. (2006). Nutritional Status of Adolescents in Rural Wardha. *Indian Journal of Pediatrics*. 73:27-29.
 5. Egeland, G.M. and Harrison, G. (2013). Health disparities: promoting indigenous peoples' health through traditional food systems and self-determination. In: HV Kuhnlein, B Erasmus, eds. *Indigenous Peoples' Food Systems & Well-being: Interventions and Policies for healthy communities*. Food and Agriculture Organization of the United Nations, Rome.
 6. Ghosh, R., P.K. Das and Bharati, P. (2001). Health and nutritional status of Ho preschool children of Odisha. *Journal of Human Ecology*, 12: 109-113.
 7. Gogoi, A.P. and Sengupta, S. (2002). Body mass index among the Dibongiya Deoris of Assam, India. *Journal of Human Ecology*, 13: 271-273.
 8. Jelliffe, D. B. (1966). Assessment of the nutritional status of the community. Monograph. Series No. 53. Geneva: WHO.
 9. Khonngsdiar, R. (2002). Body mass index of adult and morbidity in adult males of the war Khasi in northeast India. *European Journal of Clinical Nutrition*, 56:484-489.
 10. Parimalavalli, R. (2012). A study of socio-economic and nutritional status of the tribal children. *Studies on Tribes and Tribals*,10:183-187.
 11. Rao, K.M., N. Balakrishna, A. Laxmaiah, K. Venkaiah and Brahman, G.N.V. (2006). Diet and nutritional status of adolescent tribal population in nine States of India. *Asia Pacific Journal of Clinical Nutrition*, 15: 64-71.
 12. Sahoo, L. and Pal, S. (2006). Dietary pattern of tribal girls: data from a small city in Eastern India. *Studies of Tribes and Tribals*, 4: 93-97.
 13. Kumari, Veena, R.K.P. (2006). Food security in rural Bihar: A village level study. *Journal of Rural Development*, 25: 579-594.
 14. Yadu, P., B. Reddy and Rao, A.P. (2000). Body Mass Index (BMI) among the Sugalis-A tribal population of Cuddapah District, Andhra Pradesh. *Journal of Human Ecology*, 11: 409-410.