

## Original Article

# Diet and nutritional status of adolescent tribal population in nine States of India

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Tribal population constitutes about 8% of the total population in India. They are particularly vulnerable to undernutrition, because of their geographical isolation, socio-economic disadvantage and inadequate health facilities. Recognizing the problem, Government of India launched different programmes for their welfare. Adolescence is a significant period of growth and maturation. The nutritional status of adolescent girls, the future mothers, contributes significantly to the nutritional status of the community. Therefore an attempt was made to assess the diet and nutritional status of adolescent population from the different tribal areas of India. The available database collected by National Nutrition Monitoring Bureau (1998-99) was utilized for this purpose. Data on a total of 12,789 adolescents (10-17 yrs) was included for the analysis. Four percent of the adolescent girls were married and less than 1% were either pregnant (0.4%) or lactating (0.7%) at the time of the survey. The mean intake of all the foodstuffs, especially the income elastic foods such as Pulses, Milk & Milk products, Oils & fats and Sugar & Jaggery were lower than the recommended levels of ICMR. The intake of all the foodstuffs except green leafy vegetables was lower than that of their rural counterparts. The intake of all the nutrients were below the recommended level, while that of micronutrients such as iron, vitamin A and riboflavin were grossly inadequate in all the age and sex groups. About 63% of adolescent boys and 42% of girls were undernourished (<5<sup>th</sup> BMI age percentiles of NHANES). A significant association between undernutrition and socio-economic parameters like type of family, size of land holding and occupation of head of household was observed. Therefore, there is a need to evolve comprehensive programmes for the overall development of tribal population with special focus on adolescents.

**Key Words:** adolescents, tribe, diet, nutritional status, body mass index, India

## Introduction

Scheduled Tribe people constitute about 8% of the total population in India, with varying proportions in different States. They live in unique physical, socio-economic and cultural environment, isolated from general population. In view of their habitat and food habits, they form a distinct group compared to other populations. Their food intake is influenced by vagaries of nature, with large seasonal variations, depending upon availability of agricultural and forest produce. Several studies have documented a close relationship between the tribal ecosystem and their nutritional status.<sup>1-3</sup> Inadequate health care facilities and ecological degradation further aggravate the situation.

Recognizing these problems, the Government of India has been implementing several programmes in these areas for overall development of the tribal communities. For this purpose, the Community development Blocks with more than 50% of the tribal population are grouped and covered under Integrated Tribal Development Projects (ITDP), while Modified Area Development Approach (MADA) is adopted to cover smaller areas having tribal communities. In India, currently, there are 194 ITDPs and 259 MADA pockets functioning in the country. In addition, there are

75 micro projects for the development of primitive tribal groups living in secluded regions of the country.

Though, women and preschool children are known to be the most vulnerable groups for undernutrition, adolescents girls are also being recognized as a potential group, attracting the attention of both the nutritionists and public health professionals. The period of adolescence is significant in view of rapid growth and maturation, during which the nutrient requirements are relatively high. Undernutrition during adolescence, confounded by childhood marriages, leads to higher mortality and morbidity among women and young children, thus perpetuating the vicious cycle of undernutrition. Studies carried out by National Nutrition Monitoring Bureau (NNMB) in the rural population revealed that the prevalence of undernutrition, as assessed by weight for age is about 40-50%<sup>4</sup> and that of iron deficiency anaemia is about 70%.<sup>5</sup> There is a paucity of information

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on nutritional status of adolescent children among the tribal population. Therefore, an attempt was made to assess the dietary intake and nutritional status of the adolescent population from tribal areas of certain States in India. The present communication is based on the data collected by NNMB from 9 States during the years 1998-99.

### Material and methods

The NNMB, located in the National Institute of Nutrition, Hyderabad under the aegis of the Indian Council of Medical Research (ICMR) has been carrying out regular surveys on diet and nutritional status of different population groups since 1972. For the purpose of the present investigation, the data collected during 1998-99 on diet and nutritional status in the tribal areas of nine States viz., Andhra Pradesh, Gujarat, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Tamilnadu and West Bengal was utilized. Trained Medical officers, Nutritionists and Social workers, conversant with the local language were involved in collection of the data, using standard equipments and procedures.<sup>6</sup>

### Sampling

In each State, 120 villages were selected randomly from the list of ITDP villages. From each selected village, a total of 40 households (HHs) were covered, by adopting probability proportion to size of different tribes. For this purpose in each village, households were grouped according to tribe and from each tribe required number of households was covered for the survey. The survey was carried out during a period of 12 months to capture the seasonal variation.

### Investigations

Oral informed consent was obtained for carrying out the survey from the head of household. Demographic and socio-economic particulars were collected from all the HHs selected for the survey. Anthropometric measurements such as weight, height, mid-upper arm circumference and fat fold at triceps were made on all the available individuals in the selected HHs by using standard equipment. They were also examined for presence of clinical signs of nutritional deficiency. In addition, the 24 hour recall method of diet survey was carried out for one day, in a sub-sample of 10 HHs selected by systematic random sampling procedure to assess the food and nutrient intakes of all the individuals who had partaken the meals on that day.

### Statistical analysis

Using SPSS windows version 11.5, statistical analysis such as arithmetic mean, standard deviation and percent distribution of households/Individuals according to different variables was carried out. The average daily intake of foods by adolescent boys and girls according to age groups of 10-12 years, 13-15 years and 16-17 years were computed and compared with the suggested levels of intake.<sup>7</sup> The average daily intakes of nutrients were calculated using food composition tables<sup>8</sup> and compared with the recommended daily allowances.<sup>9</sup>

The adolescents were categorized in to different grades of nutritional status according to weight for age,

height for age and weight for height, by Standard Deviation (SD) classification using NCHS standards.<sup>10</sup> The nutritional status was also assessed using age and sex specific BMI percentiles of NHANES, WHO, 1995.<sup>11</sup> Association of undernutrition with socio-economic parameters was studied using the chi-square test. In addition, multiple logistic regression was used to identify the set of variables significantly associated with the nutritional status.

### Results

Data on a total of 4,772 households having adolescents were included in the analysis. Anthropometric data on 12,789 adolescents (6088 boys and 6701 girls) and dietary information on 5,562 adolescents (2,701 boys and 2,861 girls) was utilized for the analysis.

### Socio-economic profile

A majority of the households (98%) were Hindus. About 82% of the families were nuclear, while about 8% were joint families. The average family size was 4.6 (Table 1). Sixty one percent of the houses were *semi pucca* and 38% were *Kutch* houses, while *Pucca* houses accounted for only one percent. A majority of the households (44%) were marginal farmers, about 14% were small farmers and 7% were large farmers, while about a third of the HHs did not possess any agricultural land (35%).

**Table 1.** Socio-economic profile of tribal households

Particulars	%
Religion	
<i>Hindu</i>	98.3
<i>Others</i>	1.7
Type of family	
<i>Nuclear</i>	81.9
<i>Joint</i>	7.8
<i>Extended Nuclear</i>	10.3
Family size	
1-4	47.8
5-10	50.7
≥ 10	1.5
Ownership of the house	
<i>Owned</i>	98.2
<i>Not owned</i>	1.8
Type of house	
<i>Kutch</i>	38.0
<i>Semi pucca</i>	61.3
<i>Pucca</i>	0.7
Land holdings (acres)	
<i>No land</i>	35.4
<2.5 acres	43.6
2.5 – 5.0 acres	13.6
≥ 5 acres	7.4
Occupation	
<i>Labourers</i>	41.5
<i>Cultivator</i>	48.3
<i>Artisan/Business/Service</i>	7.8
<i>Others</i>	2.4
Annual Per capita income (Quartiles)	
I (Rs. 1371)*	15.9
II (Rs. 2722)	21.4
III (Rs. 4321)	28.4
IV (Rs. 9141)	34.3

\* Mean per capita income of that quartile

The major occupation of the head of the household in about 41% of the households was agricultural or other labour, while 48% were cultivators. The average annual per capita income of the HHs was Rs.4391/-. The mean per capita income in the lowest quartile was Rs.1371/- while it was Rs 9,141/- in the highest quartile, indicating wide variation in the socio-economic status among the households surveyed.

#### Age at marriage

Adolescent pregnancies contribute significantly to higher incidence of maternal mortality, delivery of LBW babies and foetal wastage. The present study revealed that, about 1.6% of boys and 4.1% girls were married before the age of 18 years, which is relatively lower as compared to their rural-counterparts (23%). The proportion of married adolescent girls ranged from about 2% below the age of 12 years to about 18% at the age of 17 years. However, only about 1% of the adolescent girls was found to be either pregnant (0.4%) or had delivered the first child (0.7%).

#### Food and nutrient intake

The average intake of cereals & millets among tribal adolescents was lower than in rural adolescents, except for 16-18 Yrs age group (Table 2). The intake of qualitative foods such as pulses, milk & milk products, oils & fats and sugar & jaggery was lower among tribal adolescents of all age groups. However, the average intake of green leafy vegetables was relatively higher among the tribal adolescents compared to their rural counterparts, while that of other vegetables were similar. The consumption of milk & milk products among tribes was grossly inadequate.

The average intake of all the nutrients by adolescent boys and girls of the tribes was below the Recommended Dietary Allowances (RDA) in all the age groups (Figs. 1-3). The extent of deficit in the intake of micronutrients such as vitamin A (80-85%), iron (70-80%), free folic acid (50-55%) and riboflavin (40-50%) was relatively more, compared to that of energy (10-40%) and protein (20-30%). The deficit in the intake of energy was higher among boys than girls in older adolescents (13-17 years) compared to younger adolescents (10-12years). Compared to their rural counterparts, the intake of all nutrients except for vitamin A and vitamin C were lower.

Distribution of adolescents according to intake of various nutrients expressed as per cent of RDA revealed that more than 50% of boys and girls had intakes of less than 70% of RDI (Table 3). The proportion was higher with regard to iron (96% for boys and 90% for girls), followed by riboflavin (88% for boys and 80% for girls) and vitamin A (78% each for boys and girls). Significant gender differentials were observed with regard to the intake of energy, iron, thiamin, riboflavin and niacin, with higher proportion of boys consuming less than 70% of RDI.

#### Nutritional status

##### Prevalence of nutritional deficiency signs

The prevalence of conjunctival xerosis and Bitot spots, the signs of vitamin A deficiency were found to be 4.9% and 2% respectively. About 3% of the adolescents had angular stomatitis, indicative of B-complex vitamin deficiency. The prevalence of goitre was 3.5%, which was relatively higher among girls (5%) than boys (1.8%).

**Table 2.** Mean intake of different food stuffs (g/day) by age group and gender

Age group (Years)	Type of population	Mean & SD	Cereals & Millets	Pulses	Green Leafy Vegetables	Other Vegetables	Roots & Tubers	Nuts & Oil seeds	Fruits	Fresh foods	Milk & Milk products	Fats & Oils	Sugar & Jaggery
<b>Boys</b>													
10 – 12	Tribal (N=1077)	Mean	345	21	26	34	27	6	17	8	13	5	12
		SD	146	24	60	53	47	17	70	27	36	6	16
	Rural	Mean	371	26	15	34	39	10	20	17	66	11	19
		SD	159	29	40	49	53	22	47	42	102	15	22
13 – 15	Tribal (N =819)	Mean	418	23	31	42	31	7	18	12	17	6	12
		SD	166	28	80	61	53	17	83	32	45	6	18
	Rural	Mean	428	28	12	47	49	15	35	22	65	11	19
		SD	185	30	35	72	66	28	54	45	105	10	19
16 – 18	Tribal (N =805)	Mean	561	25	38	48	44	8	16	13	17	7	13
		SD	222	31	104	71	72	17	60	40	46	8	16
	Rural	Mean	515	32	23	58	52	20	24	29	68	13	19
		SD	211	35	62	73	62	42	50	55	101	14	19
<b>Girls</b>													
10 – 12	Tribal (N=1102)	Mean	339	21	27	37	28	6	13	10	14	6	13
		SD	126	23	69	57	81	28	47	28	39	12	20
	Rural	Mean	348	24	14	38	41	11	21	14	53	9	19
		SD	150	28	46	54	53	22	52	35	83	9	20
13 – 15	Tribal (N =877)	Mean	399	23	27	42	32	7	12	11	15	6	12
		SD	139	29	66	63	63	17	31	32	36	7	13
	Rural	Mean	399	26	16	44	54	11	16	18	56	9	18
		SD	168	31	42	59	153	23	30	45	89	9	23
16 – 18	Tribal (N =882)	Mean	484	23	34	51	36	9	16	12	17	6	13
		SD	238	30	77	79	67	19	49	33	41	7	20
	Rural	Mean	443	27	13	50	57	18	22	21	71	11	19
		SD	183	29	36	64	67	35	48	47	110	10	20

**Table 3.** Distribution of adolescents according to intake of nutrients less than 70% of RDI

Nutrients	Boys	Girls	P value
Protein	59.5	57.4	Ns
Energy	52.0	35.9	0.001
Calcium	75.5	76.0	Ns
Iron	95.8	90.0	0.001
Vitamin A	78.3	78.5	Ns
Thiamin	55.5	40.4	0.001
Riboflavin	88.0	89.7	0.001
Niacin	59.6	49.8	0.001
Vitamin C	52.6	53.0	Ns

NS: Not significant

**Anthropometry**

The mean heights and weights of adolescents were below the NCHS standards among all age/sex groups and were comparable with rural adolescents. The median body mass index (BMI) by age/sex though comparable with their rural counterparts, was below the median NHANES reference values. The overall prevalence of stunting (height for age <Median -2SD) was 42% among boys and 46% among girls, which was higher than that reported for their rural counterparts (39% each for boys and girls) (Table 4). The overall prevalence of under-weight (weight for age <Median-2SD) was significantly higher (51%) among boys than girls (43%). The prevalence of underweight among tribal boys was comparable with that of rural boys, while it was relatively higher (43%) among tribal girls compared to rural girls (39%). About 63% of

boys and 42% of girls had BMI values less than the 5<sup>th</sup> centile of age/sex specific BMI values of NHANES, indicating high prevalence of under-nutrition. While the prevalence of undernutrition was marginally lower among tribal boys compared to rural counterparts, it was similar in girls (Table 5).

**Association between socio-economic status and under-nutrition**

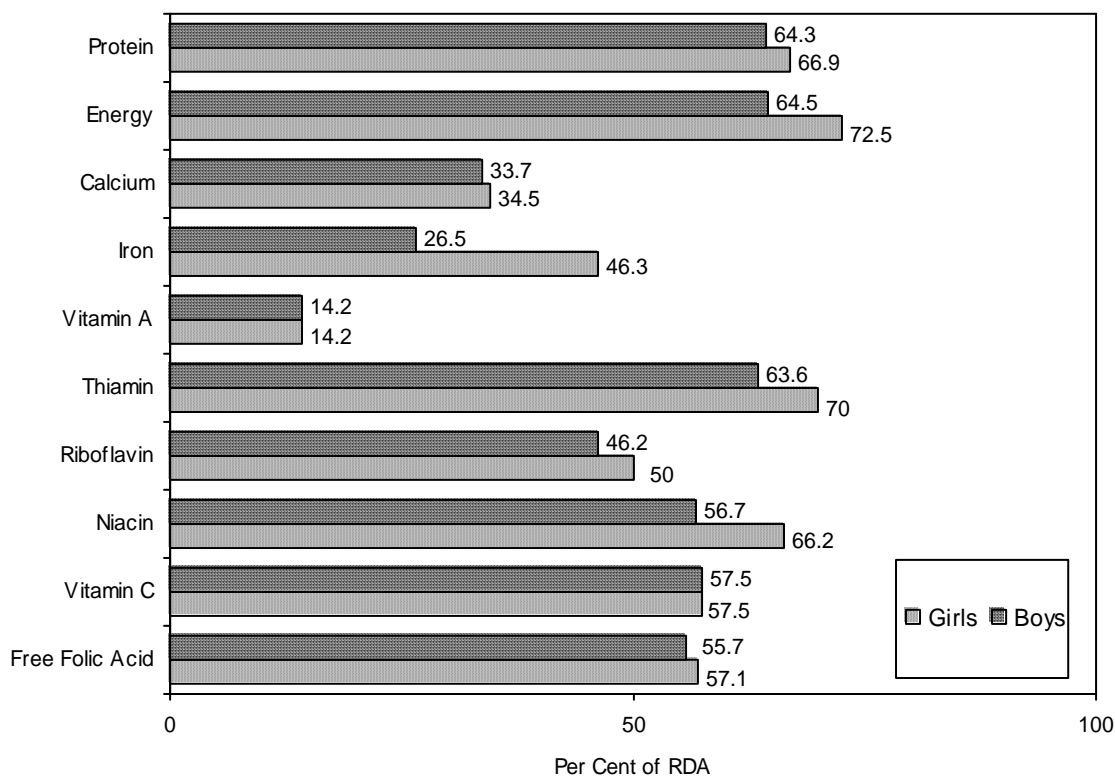
Significant association was observed between stunting and socio economic indicators such as type of family, size of land holdings and occupation (Table 6). The stunting was significantly higher among the children of joint families (46.8%) compared to nuclear (44.5%) or extended nuclear families (40.6%). The prevalence of stunting tended to decrease with increase in size of land holdings. The proportion of children with stunting was relatively more (47%) among the households engaged daily wages compared to other occupational groups. Similar associations were observed with respect to prevalence of underweight.

Stepwise logistic regression analysis using family size, type of family, type of house, size of land holding, and occupation of head of the households as independent variables and underweight (weight for age <median-2SD) and stunting (height for age <median-2SD) as dependent variables revealed that landless agricultural labourers had higher risk (OR: 1.34 with 95% confidence intervals of 1.18-1.53) of having underweight compared to those possessing agricultural land. Similarly, the adolescents from households with family size of  $\geq 5$  had higher risk (OR:1.16 with 95% confidence intervals of 1.07-1.27) of having underweight compared to those with <5. Similarly, adolescents from HHs engaged in labour and those from joint families had higher risk of stunting (OR: 1.1 with 95% confidence intervals of 1.0-1.3)

**Table 4** Prevalence (%) of stunting and underweight among adolescents by gender

Age (Yrs)	Boys					Girls				
	Stunting (<Median - 2SD)		Underweight (<Median - 2SD)			Stunting (<Median - 2SD)		Underweight (<Median - 2SD)		
	N	Tribal	Rural	Tribal	Rural	N	Tribal	Rural	Tribal	Rural
10+	1123	36.6	34.7	43.9	41.6	1156	34.0	32.5	42.0	37.8
11+	722	38.2	31.2	48.8	42.1	782	40.8	37.4	46.9	42.4
12+	1083	40.2	32.8	49.1	51.6	1083	46.2	44.7	42.4	45.3
13+	702	38.0	32.1	50.7	51.2	813	54.9	46.7	41.0	37.6
14+	683	37.5	36.3	49.9	55.8	839	55.7	41.2	36.8	35.7
15+	722	42.9	48.9	50.1	58.5	711	46.0	37.9	43.7	39.0
16+	602	53.0	51.8	57.0	66.1	783	44.8	34.1	43.0	39.0
17+	451	67.6	59.7	73.4	68.6	534	52.6	37.2	48.3	37.6
Pooled	6088	42.4 ***	39.0	51.1 ***	53.1	6701	46.0	39.0	42.7	39.5

\*\*\* P&lt;0.001 compared to girls in tribals



**Figure. 1** Mean intake of nutrients as % of RDA among 10-12 year adolescents

**Table. 5** Distribution of (%) tribal adolescents with BMI below 5<sup>th</sup> percentile of (NHANES)\* by age and gender

Age (Years)	Boys	Girls
10+	68.6	61.3
11+	75.9	61.5
12+	70.3	52.1
13+	67.9	45.3
14+	63.5	31.0
15+	52.1	25.0
16+	46.0	18.3
17+	41.7	16.7
Pooled	62.9	41.7
Rural	66.9	40.1

\* WHO, 1995

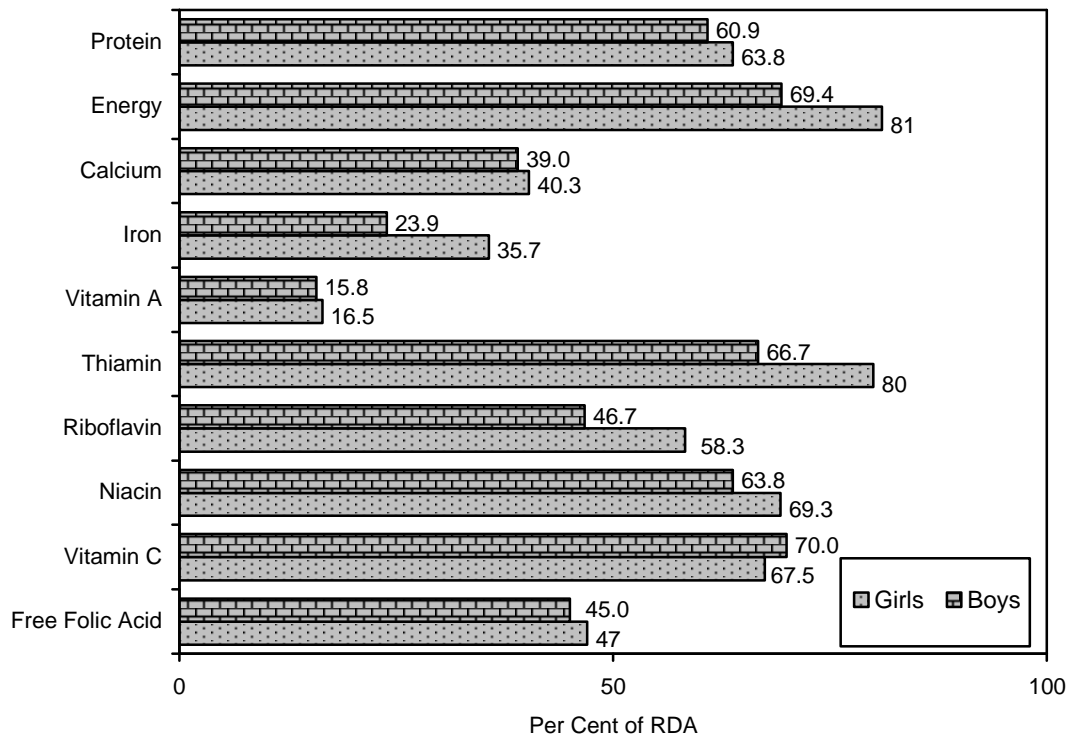
compared to those engaged in agriculture, or those belonging to nuclear families, respectively.

#### Discussion

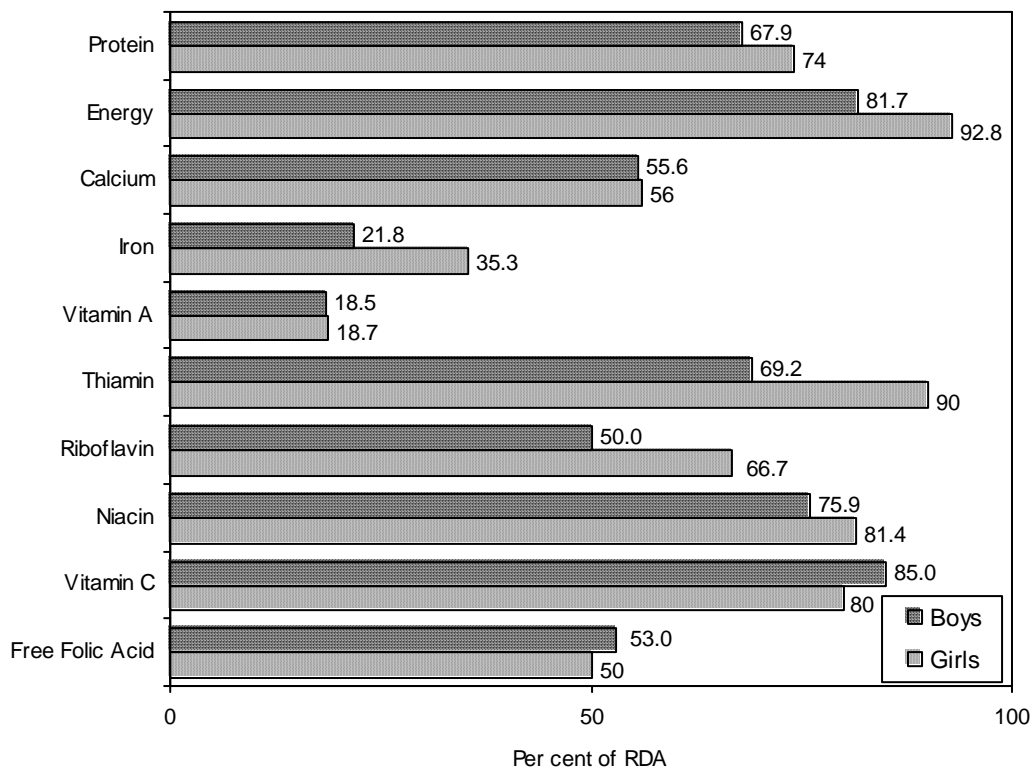
The physical growth of adolescents, especially that of girls, has now been identified as one of the key determinants in the vicious lifecycle of undernutrition. The period of adolescence contributes to more than 20% of total growth in stature and up to 40-50% of body weight with respect to somatic growth.<sup>12</sup> In India, about 65% of girls are identified to be at obstetric risk (by height and weight criteria) in their 15<sup>th</sup> year compared to 20% in their 19<sup>th</sup> year.<sup>13</sup> The mean age at first conception in six large north Indian states is reported to be 15.3 years.<sup>14</sup> There is close association between adolescent undernutrition, maternal malnutrition, and low birth weight.

**Table 6.** Prevalence (%) of Stunting and Underweight versus socio-economic status

Variable	Description	Stunted (<Median 2SD)	P value	Underweight (<Median-2SD)	P value
Type of family	<i>Nuclear</i>	44.5	0.01	47.0	NS
	<i>Joint</i>	46.8		45.2	
	<i>Ex. Nuclear</i>	40.6		45.0	
Family size	<i>1-4</i>	44.2	NS	44.7	0.05
	<i>5-10</i>	44.5		47.5	
	<i>≥ 10</i>	41.3		44.2	
Type of house	<i>Kutcha</i>	42.6	0.01	45.5	NS
	<i>Others</i>	45.2		47.3	
Land holdings (acres)	<i>Nil</i>	46.4	0.01	49.8	0.001
	<i>&lt;2.5</i>	43.6		45.7	
	<i>2.5 - 5.0</i>	41.8		44.3	
Occupation	<i>≥ 5 acres</i>	43.0	0.001	43.0	0.001
	<i>Labour</i>	46.7		49.1	
	<i>Cultivator</i>	42.4		44.6	
	<i>Others</i>	44.1		47.1	



**Figure 2.** Mean Intake of Nutrients as % of RDA among 13-15 Year adolescents



**Figure 3** Mean intake of nutrients as % of RDA among 16-18 year adolescents

The tribal population is at a higher risk of under-nutrition, because of the socio-cultural, socio-economic and environmental factors influencing the food intake and health seeking behaviour.<sup>15</sup> Low female literacy (14.5% against 47%)<sup>16</sup>, high maternal (992 against 195) and infant mortality (85 against 64) have been reported among tribal populations as compared to their rural counterparts.<sup>17</sup>

The present study of tribal adolescents indicates that food and nutrient intakes were low compared to RDI, as well as that of their rural counterparts. The extent of deficit was relatively more with respect to micronutrients such as iron, vitamin A, riboflavin and free folic acid. The prevalence of undernutrition was also relatively more among tribal adolescents compared to their rural counterparts.

Higher prevalence of undernutrition (underweight or BMI <5th centile) among boys could be attributed to the fact that a higher proportion of them were found with energy intakes of <70% RDA.

A study on health profile of pregnant adolescents in the tribal population of Rajasthan<sup>18</sup> revealed that almost all the mothers were anaemic. A recent study carried out by the National Nutrition Monitoring Bureau in rural areas of India on haemoglobin status indicated that the overall prevalence of anaemia among the rural adolescent girls was about 70% (NNMB 2003). Micronutrient deficiencies cause nutritional insult before most women know they are pregnant.<sup>19</sup> Thus, adolescence with poor nutritional status enter womanhood and are exposed to the risks of bad obstetric outcomes. Inadequate health care facilities, illiteracy and socio-economic disadvantage among tribal populations perpetuate the vicious cycle of undernutrition. Therefore, there is a need to evolve comprehensive programmes for the overall development of tribal populations with special focus on adolescents.

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### 印度个州青春期部落人口的膳食和营养状况

部落人口约占印度总人口的 8%，这些人口由于处于地理隔绝、不利社会、经济状况，没有充足的卫生设施，特别容易遭受营养不良的影响。认识到这个问题，印度政府发起了不同的计划，以改善这些人的福利。青春期是人成长和成熟的重要时期，青春期的女孩是未来的母，其营养状况对社会人口的营养状况有重要影响。因此，一项青春期人口的膳食和营养状况评估在印度的部落地区展开。该评估涉及 12, 789 名 10—17 岁青少年，评估所有的数据由印度国家营养管理局于 1998—1999 年采集。调查期间，4% 的青春期女孩为已婚，少于 1% 的女孩处于怀孕期（0.4%）或哺乳期（0.7%）。所有食物的平均摄入量，尤其是奶和奶制品、油脂、食糖和粗糖、弹性食物如植物的可食性种籽的摄入量低于 ICMR 的推荐水平。除绿叶蔬菜，部落青少年其他各种食物的摄入水平都低于与其年龄相当的乡村非部落青少年。部落青少年所有营养素的摄入量都低于推荐水平，其中，铁、维生素 A、核黄素的摄入水平在所有年龄和性别的部落青少年中都严重缺乏。约有 63% 的青春期的男孩和 42% 的青春期女孩为营养不良（ $<5^{\text{th}}$  BMI age percentiles of NHANES）。营养不良与家庭类型、土地占用量、家族首领的任期这些社会经济参数有重要的关系。因此，必须设计出全面的方案以促进部落人口全面发展，特别是青少年的发展。

**关键词：**青少年、部落、膳食、营养状况、身体质量指数、部落、印度。