PRINT: ISSN 0972-0073 ONLINE: ISSN 2456-6802
Anthropologist, 9(4): 273-279 (2007)
DOI: 10.31901/24566802.2007/09.04.03

Biology of the Tribal Groups of Rajasthan, India: 6. A Comparative Study of the Nutritional Status

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KEYWORDS Health Status. Nutrition. Anthropometry. Tribals

ABSTARCT Cross-sectional investigation on 2928 samples consisting of 1503 males and 1425 females was carried out on the Scheduled Tribes, namely Minas, Bhils, Sahariyas, Garasias, Damors and Kathodis of Rajasthan. Samples were collected belonging to age group 8 to 18 and were classified into yearly intervals. Information regarding the nutritional status was based on 24 hours recall method. Weights and volumes of foods were taken for each individual. The total daily nutrient intake for the individual was calculated using the food composition tables for the Indian foods. Consumption of most of the healthy and protective foods is lacking in the present study populations. Cereals is the staple food which is also lacking along with pulses, animal proteins, fats and green leafy vegetables which results in lower intake of nutrients. It is seen that the present study tribal groups are below the recommended values for all the major nutrients indicating a high prevalence of malnourishment, with males showing somewhat better position than the females of the present study.

INTRODUCTION

Nutritional status grossly depends upon the feeding habits, ecology, vegetation of the area and the socioeconomic condition of the community. India, in recent years has become self-sufficient from the agricultural point of view, but the problem of malnutrition still continues undoubtedly and it is still considered to be one of the crucial issues. According to Calder and Jackson (2000) undernutrition is one of the major causes of morbidity and mortality in the developing world. Inadequate dietary intake and disease are immediate causes of malnutrition and they reinforce one another synergistically (Scrimshaw et al., 1968). Growth of the individual is also impaired owing to the combination of poor nutrition, malabsorption and the host response to infection, which can involve anorexia and altered metabolism of nutrients (Calder and Jackson, 2000). The immediate response to poor nutrition is slowing of growth rate, but after a certain time probably shorter for the young child and the adolescent than for a child of intermediate age, permanent effects on child size occur.

Malnourishment may increase income inequality, lower social returns to educational expenditure, impede economic growth and increase unemployment. Thus nutrition is a psychological need for a human being, physiological and biochemical necessity for a human body, and social and economic requirement for a state or government.

Epidemiological data show that the world's populations living under low socio-economic conditions and high rates of parasitic diseases are also those that have most of the world's malnutrition (Crompton and Nesheim, 1982). It is generally in developing countries with borderline nutrition that children are small; thus, it is quite rightly concluded that the slower growth and smaller size of these children is the result of poor nutrition.

Biologists and nutritionists have charted the effect of nutritional deficiencies on the human growth profile. Fetal malnutrition, especially when combined with poor nutrition during infancy and early childhood, may lead to substantial permanent stunting, even if nutrition improves at later ages. Short periods of undernutrition during adolescence merely delay the adolescent growth spurt. If undernutrition is prolonged, moderate growth will continue beyond the age at which the growth of well-fed adolescents ceases. Hence, average size at birth, the average age at which growth spurt peaks, the average age at which growth terminates, the mean height during adolescent ages, and the mean final height are all indicators of mean nutritional status. Gopalan (1972) has reported that 80% of pre-school children suffer from malnutrition dwarfism.

Nutrition plays a major role in human adaptation because it acts both as an independent stress (e.g. food scarcity) that may necessitate adjustment and as an important modifier of other stresses (e.g. disease severity). Because nutrition

is important to human functioning, behaviors and biological traits that lessen the impact of nutritional stress or improve the capacity of nutrition to buffer the effects of other stresses should be advantageous. Good nutrition promotes the production and activities of growth hormones, which influences the metabolism of proteins, carbohydrates, fats and mineral and promotes nitrogen retention. A lack of adequate nutrition hinders such natural pattern and causes stunted physical growth accompanied by physiological abnormalities or even retarded mental development, the basis for which lies in the fact that birth is not a mark of equal development.

Nutritional deprivation interferes with growth during periods when a high growth velocity would normally occur, especially in infancy. Fortunately, the organism may recover and catch-up (Prader et al., 1963; Martorell et al., 1994), depending on the extent and duration of the deficiency state, when adequate nutrition is reinstituted during a developmental period of high growth potential (Smart et al., 1983). Catch-up growth may thus serve as a diagnostic tool. Lag-down growth (Smith et al., 1976) may follow when food intake is reduced. A surplus of energy may be stored in body fat as well as in lean body mass (Frisancho et al., 1977; Van ES, 1977) accelerating, to a certain extent, tissue maturation and growth.

Tribals, who constitute 7.5 percent of India's population, are drawing the attention of planners and administrators and are given priority in developmental measures. They are one of the most economically and socially backward groups, which is reflected in their nutritional status particularly that of children Easwaran and Poorani (1991). Scheduled Tribes have been caught in 'deprivation trap' and its five interrelated clusters of disadvantages, i.e. physical weakness, isolation, poverty, vulnerability, and powerlessness (Chambers et al., 1987). The Scheduled tribes inhabit the areas which may be included in the 'poverty square' of India, measured according to four indicators-infant mortality, female literacy, number below poverty line and per capita net domestic product and is centered mainly in the states of Uttar Pradesh, Bihar, Orissa, Rajasthan, and Madhya Pradesh (Chambers et al., 1987). The present study is also endeavored to study the nutritional status of the tribal groups of Rajasthan and to assess their dietary intake in terms of recommended values by ICMR.

MATERIALS AND METHODS

The present study is based on a cross-sectional investigation on 2221 samples consisting of 1133 males and 1088 females belonging to adolescent (8^+ to 18^+) age groups. Scheduled Tribes, namely Minas, Bhils, Sahariyas, Garasias, Damors and Kathodis, residing in the districts Sawai Madhopur, Udaipur, Baran, Sirohi, Dungarpur, respectively of Rajasthan were studied for details about area and people see Bhasin and Jain (2007). Samples are collected from the place of residence and schools. For the purpose of analysis, the subjects were classified into yearly intervals. Those subjects who had completed 8 years of age but were less than 9 years even by one day were grouped under 8+ age group. Similar pattern was followed for other age groups as well (Table 1).

The collection of information regarding the nutritional status was based on questioning the individuals and sampled mothers about the diets of their children over the past 24 hours (24 hours

Table 1: Distribution of sample size in various age groups in six tribes of Rajasthan

Age (Yrs)	*Mina*		*Bhil*		*Sahariya*		*Garasia*		*Damor*		*Kathodi*	
	M	*F*	*M*	*F*	*M*	*F*	*M*	*F*	*M*	*F*	*M*	*F*
8+	21	26	24	20	21	24	13	13	12	12	12	12
9+	21	20	22	20	23	22	12	12	12	12	13	12
10+	21	20	21	23	22	25	14	13	12	11	12	12
11+	24	20	22	23	21	21	14	11	12	12	12	12
12+	25	20	23	23	21	21	14	12	12	12	13	11
13+	25	21	20	21	21	21	12	12	12	12	12	12
14+	21	20	22	21	24	22	12	11	12	12	11	11
15+	21	20	21	20	21	21	13	11	12	12	13	12
16+	21	19	22	20	20	23	13	11	12	11	12	12
17+	24	21	21	20	22	20	12	13	13	13	12	12
18+	22	21	22	20	22	17	12	12	12	12	11	11
Total	246	228	240	231	142	131	238	237	134	132	133	129

recall method). A suitable questionnaire for this rapid dietary inquiry was based on adequate background knowledge of local foods, cooking practices and food habits. Weights and volumes of foods were taken for each individual. The total daily nutrient intake for the individual was calculated using the food composition tables for the Indian foods (Gopalan, 1971). The calculated values of nutrients are then compared with the reference standards or Recommended Dietary Allowances (RDA). The reference values of RDAs (ICMR, 1996) were used to know the nutritional adequacy of a diet. RDAs are the basis to plan, formulate and provide adequate diets. Possible deficits in different food categories were calculated to know the dietary habits of a population. Intake of an individual below the RDA level will be considered at risk of inadequacy.

RESULTS AND DISCUSSION

The dietary intake analysis was carried out in terms of per consumption unit of the household substituting for members of household with equivalent consumption units defined by ICMR (Gopalan et al., 1985). Table 2 gives the consumption of various food categories per consumption unit.

The results indicate that the tribal groups primarily nosh on cereal-based diets with highest consumption of cereals is found in Garasias (42 g/day) with a deficit of only 7.0% from RDA. The intake of legumes is also less, in addition to the general deficit of animal foods, which is almost lacking in the tribal groups studied. The intake of animal food is lacking because of its higher price and the availability. The vegetables including green leafy vegetables are also not consumed in adequate amounts. Out of all the food categories, milk and milk products show the highest deficit when compared to RDA. Percent consumption for other food categories like green vegetables, fruits, milk etc. are almost uniformly less than the average recommended values in all the six tribes.

The adequacy of energy and nutrient intake in relation to average recommended levels could be observed from the distribution of households consuming more or less than the average recommended levels. Table 3 shows that the average energy intake (CU/day) in the family data is found to be the highest among Minas and its highest inadequacy among Bhils. Apart from energy levels, the intakes of proteins, iron and fat levels are also comparatively higher in Minas than the other five tribal groups. The poorest status of nutrient intake of fats and iron is seen in Kathodi and Garasia households, respectively. Fats and oils, sugars and jaggery are important

Table 2: Dietary Intake of the households per consumption unit among the tribal groups of Rajasthan

Food Group	*Mina*		*Bhil*		*Sahariya*		*Garasia*		*Damor*		*Kathodi*		*RDA*
	Mean	*Deficit %*	*Mean*	*Deficit %*	*Mean*	*Deficit %*	*Mean*	*Deficit %*	*Mean*	*Deficit %*	*Mean*	*Deficit %*	
Cereals	325.2	29.3	295.5	35.8	289.7	37.1	317	31.3	338.3	31	428	7	440
Pulses	18.61	53.5	12.6	68.5	14.1	64.8	19.7	50.7	16.4	59	30.9	22.8	45
Green Leafy Veg	17.3	-	-	-	-	-	20	50	-	-	30.4	33.1	40
Roots & Tubers	24.1	51.8	20.4	59.2	20.1	59.8	24.2	51.6	19.9	60.2	22	56	50
Other Veg.	30.5	49.2	17.6	70.7	29.7	50.5	26.2	56.3	21.4	64.4	22.5	62.5	60
Milk &Milk Pdts.	15.4	89.7	12.4	91.7	17.7	88.2	17	88.7	18.7	87.6	24	84	150
Eggs	-	-	-	-	-	-	13.1	56.3	-	-	8.9	-	-
Fruits	11.1	63	7.2	76	10	66.7	13.1	56.3	10	66.7	10.8	64	30
Sugar & Jaggery	9.3	69	8	73.4	11.1	63	10.9	63.7	9.1	69.7	8.3	72.4	30
Fats & Oils	6.3	-	6.9	-	4.8	-	7.75	-	6.5	-	11.9	-	40
Spices	6.2	-	5.2	-	6.7	-	5.7	-	5	-	4.2	-	-

Table 3: Means of food nutrients consumption per unit among six tribal groups of Rajasthan

Nutrients	*Mina (NF = 69) Mean*	*Bhils (NF = 68) Mean*	*Garasia (NF=35) Mean*	*Sahariya (NF=71) Mean*	*Damor (NF=35) Mean*	*Kathodi (NF=40) Mean*
Carbohydrate	254.83	161.4	170.01	165.95	180.86	158.29
Energy	2020.51	1434.12	1575.33	1473.32	1653.96	1479.88
Fat	16.76	16.63	13.24	13.03	13.04	11.39
Iron	21.93	16.77	15.19	16.92	18.44	18.91
Protein	46.62	40.18	38.33	38.57	36.63	34.54

sources of energy, but are consumed in small quantities. As fats and oils are much costlier than cereals, their intake is usually inadequate.

Food intake data are often used to assess nutrient adequacy. It is possible to derive the nutritional requirements by consuming a judicious combination of few foods. Intakes of various nutrients are presented in Table 4. Adequate protein is essential during growth when new tissue proteins are being synthesized. As shown in the Table 4, the protein intake level among males increase with the advancing age. Mina males show the highest intake of protein than the others, which in turn is followed by Sahariya and Bhil males. Among females, Garasias have comparatively better protein levels than other tribal group counterparts in preadolescent and adolescent age groups. The higher protein intake level at later ages is exhibited by Mina females.

Iron deficiency anemia is quite widespread in India, with the prevalence varying from 45% in male adults to 70% in women and children (WGFSI, 1982). The present study also indicates a high prevalence of iron deficiency, thus indicating a high incidence of anaemia. From Table 4 it can be observed that the iron intake level increases with advancing age in both males and females. Among males highest iron intake is observed among Minas and lowest among Garasias. Mina females also show the highest intake levels of iron as compared to the other tribal groups, whereas lowest status is observed among Kathodi and Damor females.

Fat is a concentrated source of energy and increases the energy density of the diet. In the present study tribal groups the fat intake levels do not show any consistency with advancing age as shown in the Table 4. Among males highest level of fat intake is shown by Mina males and lowest by Sahariyas. Among females also Minas are seen to be ahead of other tribal groups, whereas lowest level of fat intake is shown by Kathodi females.

The body needs energy for maintaining body temperature, metabolic activities and for supporting growth and physical work. The energy allowances recommended are designed to provide enough energy to promote satisfactory growth in infants and children and to maintain constant body weight and good health in adults. In the present study it is seen that the daily intake of energy is comparatively higher in males as compared to females. This trend continues from the preadolescent till the adolescent age groups. Compared to the recommended values, both males and females show lower levels of energy intake. In inter-population differences, Mina males and females are seen to have the highest energy intake levels at all age groups. The energy intake in this tribe is satisfactory and the deficit from RDA is not very significant among males. Bhils and Garasia males follow Minas in energy consumption levels; however Kathodi and Damor males are much lower than the recommended values. Among females, poor energy intake level is observed among Kathodi and Bhil females.

Thus it is seen that the present study tribal groups are below the recommended values for all the major nutrients. It is generally recognized that as a result of extreme poverty, intake of various constituents of food may be inadequate among the tribals as also reported by Gore et al., 1977. The study indicates a high prevalence of malnourishment, with Minas showing a comparatively better nutritional status than the other tribal groups. Females exhibit greater risk than the males though Mina females are also seen to be at a better position than others. This can be due to better dietary conditions and better economic status of the Minas than others.

It is generally observed that girls and women particularly in lower socioeconomic groups suffer relative neglect with respect to nutritional inputs and have a low priority in getting share of the family food (Prameela et al., 1995). It has been documented that girls are worse off in terms of intake as well as in heights, weights as compared to their male counterparts (Prameela et al., 1995; Devadas and Malanthan, 1989). Body weight is the sum of all aspects of body composition and is rough measure of total energy stores. Changes in weight therefore, usually parallels energy and protein balance. Thus lower weights can reflect the undernutrition of the tribal communities studied. Above observations also tend to conclude that though both males and females are much below recommended values, females are worse off than the boys indicating that girls received lower priority in family in terms of nutritional inputs (Devadas and Malanthan, 1989). Adolescence is a period of increased nutritional requirements. Rapid accretion of new tissue and other widespread developmental changes are accompanied by increased nutritional requirements, which are increasingly inadequate in the tribal groups studied.

From the data of the present survey it is clear

Table 4: Mean values of nutrient intakes among the tribal groups of Rajasthan

Age (yrs)	*Mina*		*Bhils*		*Garasia*		*Sahariya*		*Damor*		*Kathodi*	
	M	*F*	*M*	*F*	*M*	*F*	*M*	*F*	*M*	*F*	*M*	*F*
Protein												
8+	34.05	28.70	30.99	29.19	25.15	29.57	30.56	30.67	24.26	20.54	26.64	24.48
9+	36.62	20.58	30.43	31.40	29.56	30.60	33.06	33.21	24.28	22.56	27.46	28.42
10+	42.26	33.14	39.42	42.81	36.65	38.67	38.69	35.52	28.64	25.38	32.50	30.39
11+	45.70	36.16	37.59	42.10	41.09	41.09	38.55	43.13	29.19	30.55	32.03	32.93
12+	47.59	40.01	42.75	41.31	40.39	43.51	42.29	49.56	33.97	32.56	37.51	39.83
13+	50.35	41.68	48.65	46.12	47.74	47.64	47.41	52.36	37.29	38.34	40.81	40.32
14+	59.93	43.44	51.07	48.45	49.94	46.76	48.17	51.04	41.07	45.07	45.11	46.67
15+	63.41	48.14	50.63	48.96	51.95	48.69	51.30	53.35	49.98	48.32	50.41	50.19
16+	65.34	45.57	50.78	50.28	55.64	47.53	61.98	47.75	54.31	49.93	51.17	48.69
17+	67.87	50.89	50.02	48.15	55.98	44.59	64.73	49.28	53.32	47.54	56.50	47.09
18+	70.96	53.28	51.28	48.85	55.19	46.19	65.56	50.01	54.97	48.34	57.98	47.78
Fat												
8+	21.94	16.86	11.39	9.99	11.59	10.61	12.56	13.18	11.44	9.12	9.08	8.19
9+	19.04	17.33	12.89	13.59	11.80	13.41	14.00	14.87	11.68	11.17	10.33	9.01
10+	19.08	15.69	14.37	11.78	12.53	12.12	13.88	15.97	11.56	12.06	10.91	9.14
11+	18.57	17.26	15.23	13.95	12.81	12.81	13.65	14.10	12.78	13.58	10.24	10.74
12+	18.73	15.90	13.47	15.37	12.30	12.70	13.92	13.77	13.61	13.81	12.26	11.01
13+	18.94	14.57	14.86	13.66	13.62	12.63	13.70	15.23	12.64	13.23	12.44	11.45
14+	19.14	15.22	15.61	12.82	12.59	13.18	14.07	13.88	13.43	13.51	12.39	10.70
15+	19.18	16.99	20.32	14.42	13.04	12.65	15.51	14.95	14.10	14.17	13.92	11.37
16+	19.33	17.91	16.21	13.70	12.51	13.03	16.75	15.17	14.27	15.07	12.81	12.07
17+	19.52	18.22	14.98	16.16	12.73	13.46	15.38	14.53	14.46	14.76	14.67	12.92
18+	19.88	18.56	14.14	14.57	15.56	13.37	15.05	15.33	14.73	15.30	15.37	12.45
Iron												
8+	18.10	17.17	15.10	15.95	12.96	14.11	10.49	9.75	13.54	12.90	13.09	10.37
9+	19.93	17.39	15.93	17.34	13.72	14.89	11.02	11.37	13.71	13.90	12.40	10.34
10+	22.93	15.02	19.77	13.96	17.67	12.68	14.86	12.44	18.24	14.09	16.35	10.48
11+	24.82	14.69	17.93	16.67	21.15	13.15	17.41	12.33	19.94	14.19	16.74	11.51
12+	27.56	14.50	19.05	12.91	21.94	13.86	18.36	13.74	20.66	13.95	17.31	13.69
13+	30.99	16.99	20.48	18.48	28.73	18.01	16.70	15.09	23.94	15.63	21.69	14.02
14+	32.64	18.17	26.28	17.95	25.15	17.62	17.72	17.88	28.82	15.48	21.69	12.84
15+	33.30	19.20	26.94	19.19	29.83	17.63	18.15	18.04	29.16	16.94	27.86	14.17
16+	40.59	20.72	27.43	20.03	36.17	18.36	23.36	18.85	29.16	19.21	27.86	16.37
17+	40.56	21.28	30.38	19.84	34.75	19.35	25.82	18.21	29.36	16.50	29.51	18.63
18+	43.17	24.14	26.79	18.65	31.79	20.70	25.84	18.65	32.91	19.81	34.93	16.36
Energy												
8+	1671.72	564.49	1129.40	1125.58	1155.46	1107.32	1361.83	1214.40	1452.12	1257.54	1130.15	1007.35
9+	1700.04	1619.10	1265.17	1178.04	1284.24	1257.28	1612.31	1370.16	1560.23	1388.61	1218.55	1072.08
10+	1796.83	1673.89	1322.35	1262.35	1384.71	1384.39	1552.95	1508.03	1578.90	1480.61	1353.02	1152.05
11+	1885.58	1701.75	1400.17	1388.59	1454.01	1424.88	1594.65	1516.80	1651.73	1527.82	1396.37	1352.46
12+	2003.48	1750.80	1412.23	1440.80	1623.02	1492.61	1599.69	1562.92	1753.12	1587.69	1494.79	1523.30
13+	2112.46	1801.69	1573.91	1502.80	1734.70	1617.50	1807.21	1556.02	1819.25	1662.43	1565.84	1525.95
14+	2345.96	1876.53	1786.79	1533.74	1842.44	1655.72	1975.93	1791.93	1895.52	1723.71	1725.33	1599.20
15+	2381.31	1903.29	1795.52	1600.26	1782.25	1747.31	1941.24	1876.10	1930.22	1705.49	1722.85	1605.86
16+	2421.86	1906.91	1986.36	1622.08	2005.29	1728.42	2186.47	1930.49	1981.18	1814.89	1846.50	1650.19
17+	2496.00	1928.58	1916.18	1669.00	1954.39	1757.63	2265.82	1898.42	1993.20	1804.33	2003.65	1701.38
18+	2512.81	1971.91	1997.22	1997.22	2038.57	1779.84	2258.04	1892.35	2098.08	1830.26	1977.53	1791.30

that the populations studied are shorter and lighter than that of reference values (ICMR, 1989). It is also evident from the height-weight ratios that the incidence of Protein-Energy Malnutrition (PEM) is also high among them. High prevalence of undernutrition was observed in both adolescent boys and girls of the present study on the basis of BMI. The results of Chronic Energy Deficiency Grades (CEDG) also indicated a high prevalence of thinness. It has been reported that malnutrition during childhood further retards growth and delays the appearance of adolescent spurt (Datta Banik et al., 1973). Overall the tribal groups reflect a high degree of nutritional insult in adolescents. Rao et al., 1976, reported that nutritional constraints in the earlier age period resulted in stunted height and weight in later age group and that the 'catch-up' phenomenon of adolescent age groups may not be sufficient to equal the standards of Indian children as is observed in the tribal groups of Rajasthan also, which shows that the adolescents might have been subjected to malnutrition from their childhood.

The problems of malnutrition and other health hazards prevail in majority of tribal groups, which is interplay of social, cultural and economical factors. Malnutrition however leads to defective development and pathological states resulting primarily from diet deficiencies. Sometimes the diet is so inadequate in quality, that diet deficiency outweighs other factors as a cause of mal-nutrition. The problems of health, undernutrition, nutritional deficiency diseases and infectious diseases in the tribal areas studied are seen to be very common. Dietary habits also differ from population to population although two meals per day was the pattern found consistent in all the three tribal groups.

Eco-system plays an important role in shaping people's dietary habits. Depending on what grows in a given ecosystem and what is available, people adapt their dietary habits accordingly. The tribes are plagued by inadequate irrigation facilities, drought proneness, marketing network as well as high degree of indebtedness and none or poor cattle breed ownership. Many are still pursuing subsistence agriculture, having small size of landholdings and following traditional methods of cultivation. An overwhelming large segment is also engaged in agriculture/casual labour, and often they migrate to other areas for work. Most of the tribal groups live in *kuchcha* houses, in unsanitary, crowded condition without separate kitchen, cattleshed, power supply and disposing the refuse in the open/in the immediate surroundings. They also do not have access to or not accessing the educational, medical facilities available. Nearly all of them have a strong belief in traditional/folk medical care or faith healers. All these factors lead to their low development and as a result they are at disadvantage with regards to their biological growth and physical fitness.

The nutritional scenario of these tribal groups is not very encouraging from the standpoint of the present study conducted. In addition to the inadequacy of good quality nutrition, the tribal groups of Rajasthan have certainly been deprived of good health facilities, healthy life styles, even safe drinking water resulting in a number of health hazards. Negligence of health and nutritional care of children is yet another factor, which has been responsible for poor health and even deaths among children in such areas. Nutrition knowledge also contributes to better health status (Wardle et al., 2000), which is found lacking in the tribal groups of Rajasthan. Thus, in all these tribal populations' health and nutritional problems are severe and despite all efforts, a lot more needs to be done to improve the health status of these tribal communities.

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