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# Nutritional Assessment of Boys of the Spitian Tribe of the Himalayas

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**ABSTRACT** The present study has been conducted on boys belonging to Spitian tribe of the high altitudes of the Himalayas in order to evaluate their nutrient intakes. The 24 – hour recall data on nutrient intake was collected on 149 subjects during 1996-1998 from various areas of Spiti valley. The altitudes of different areas from where the data was collected range between 3500-4200 metres above mean-sea-level. The amounts of nutrients present in each food item (viz., carbohydrate, protein, fat, minerals, etc.) consumed by the subject were calculated. The diet of Spitians is low in calories as well as in fat than the RDA which perhaps reflects on a fact that the food intake is closely monitored so as it lasts for the whole year and especially during winter when the outside activity cannot commence. The deficit in caloric intake is to the tune of 12 to 21 per cent in this population, and this deficit is more during childhood than during late adolescence.

## INTRODUCTION

The growth and development of children is subject to the environmental conditions. Favorable environmental factors help the child to grow to his fullest whereas unfavorable factors try to depress it. Nutrition is by far the most important factor for the growth of children. Controlled studies on rats with monitored malnutrion has lead to the findings of permanent and long lasting effects on growth and body size (Widdowson and McCance 1963). It has often been seen that even in case of favorably growing populations, sudden calamities of the gravest type like those of famine, drought, earthquake, wars, etc., do affect the growth of their children. Nutrition of the child is dependent on the socio-economic conditions of the parents. Widespread malnutrition occurs in African, Asian and Latin American countries in spite of the fact that the total food availability for the world as a whole during 1961- 63 was 2300 calories per person which increased to 2720 calories during 1990-92 (WHO, 1997). Poverty and illiteracy have been amongst the major factors responsible for malnutrition, however, both of them can be handled with appropriate social action and the strong will of the governments (Singh, 2002).

Stunting in children is one of the outcomes of undernutrition especially which is operative during the early years of life. Studies by Martorell et al. (1979, 1990) on Mexican children indicate that the stunting which happened in the early childhood remained for life and the catch-up growth during later childhood and adolescence did not happen. The shady side of the effects of restricted nutrition during early years also affects the normal metabolic functions of the individuals which persist during later life as well (McCance and Widdowson, 1974; Widdowson and McCance, 1963). There is generally a very high correlation between the heights of an individual during childhood and the adulthood (Martorell et al., 1992). It reflects that the malnutrition during early years results in irreversible changes in the body of the child which becomes apparent later on. Undernutrion in its initial phases remains latent in its effects but shows itself later on with serious effects (Bogin, 1996; Golden, 1996; Ulijaszek, 1996; Widdowson, 1962; Wootton and Jackson, 1996). The clinical deficiency signs of malnutrition appear only when the effects have reached serious levels (Gopalan et al., 1989; Payne, 1992). The most prevalent nutritional deficiencies occurring in Indian children are Protein Energy Malnutrition (PEM), Vitamin A deficiency, iron deficiency anaemia and iodine deficiency which are named as “Big Four” and are the major concern of the health authorities in India (Gopalan et al., 1989).

Nutritional assessments of vulnerable groups are one of the national priorities so as to find out the frequency and levels of malnutrition. Infants and young children, girls, adolescents, lactating and expecting mothers are among the most important groups. Other are those which are relegated to the fringe of the national mainstream by virtue of their social backwardness, ignorance, illiteracy and lack of empowerment. Most of the tribal groups also fall

under this category. Taking up this challenge, the present study has been conducted on Spitian boys in order to evaluate their nutrient intakes. The Spiti tribe inhabits the Himalayas under the most trying circumstances. The high altitude, cold winds, limited area for cultivation and crop failures are some of the hardships they have to endure.

## MATERIAL AND METHODS

The present study on changes on the nutrient intakes during growing years has been conducted on Spitian boys, ranging in age from 5 to 20 years. The 24 – hour recall data was collected on 149 subjects during 1996-1998 from various areas of Spiti valley. The altitudes of different areas from where the data was collected range between 3500-4200 metres above mean-sea-level. The age of the child was calculated from the date of birth (which was taken from the school registers in case of school going children and from the parents of those children who did not attend the school) and from the date of examination. Yearly age groups were formed so as the mid-point coincided with the whole year figure, e.g., all subjects from 4.500 to 5.499 years were included in 5- year age group, those from 5.500 to 6.499 years in the 6- year age group and so on.

For the assessment of food intake, a 24 –hour recall method (Pike and Brown, 1970) was used. The subject was asked to recall all food items consumed during the last 24 hours. In order to make the estimations of the quantity of food to be accurate calibrated measures were used. In order to know the cooked versus uncooked proportions of foods, measured amounts of raw foods were given to 5 households. The cooked dishes were weighed and the cooked to uncooked ratios were calculated for each dish. From these ratios, the raw amounts of foods present in each recipe taken by the subjects were obtained. The amounts of nutrients present in each food item (viz., carbohydrate, protein, fat, minerals, etc.) consumed by the subject were calculated from the tables of 'the nutritive value of Indian foods' given by Gopalan et al. (1989).

Most of the Spitians are non-vegetarian, however, their meat intake is relatively meagre. Their staple diet is of barley, wheat and meat. Cauliflower, potatoes, peas and cabbages are also among their favorites. Though the crop yield is low but it is still somewhat higher as compared to that of the state yield (Oberoi et al., 1992). At the onset of winter they store the excess vegetables in the ground while digging pits near their houses and cover them with the tin sheets or with stones which remain frozen due to the snow. Thus they get the green vegetables in the off season. Dried meat and vegetables are also eaten in winter, which are dried in summer season. Meat of Yak is the most favoured dish, however the meat of sheep and goat is also consumed. Yak is sacrificed by enclosing the nostrils with rope.

Their habitual dishes are *Thukpa* a kind of soup having noodles, *Mumo* which is a wet boiled *samosa* filled with meat and vegetables and their ready to eat food is *Sattu* which is roasted barley flour. Salted butter tea is generally preferred to the ordinary tea. Drinking of local beer called *Chang* or *Lugri* is common in both the sexes. However, the local whisky called *Aara* is consumed by men folk only. Both the beer and whisky are extracted and distilled from barley and rice.

The food items available for consumption in Spiti are highly limited because the area remains under snow from mid October to July. Due to the severity of climate and geographical constraints Spiti has a single cropping season, i.e. monoculture pattern. Yields of crops were comparatively higher than the average state yields. The cultivation includes wheat, barley, potato, peas, cabbage, kidney beans, mustard etc. Yak, sheep and goat are the only farm animals. A cross between yak and cow is also preferred which is locally named as *Churi*. The commonly consumed food articles are *Sattu, Thukpa, Mumo,* etc.

## RESULTS

Average daily intake of calories, carbo-hydrate, protein and fat by Spitian males is presented in Table1. The average daily intake of energy by Spitian males is 1321.6 kcal at the age of 5 years which increases to a value 2370.4 kcal at the age of 20 years. Similarly average daily consumption of protein and fat is 44.1 gm and 14.5 gm, respectively at the age of 5 years, which reaches a value of 128.2 gm and 27.1 gm respectively at the age of 20 years.

Table 2 presents the values of minerals in the diets of Spitian boys. The total amounts of

**Table 1: Calorie, carbohydrate, protein and fat intake in Spitian boys**

| Age (yrs) | Number | Calories (kcal) | | Carbohydrate (gm) | | Protein (gm) | | Fat (gm) | |
|---|---|---|---|---|---|---|---|---|---|
| | | Mean | S.D | Mean | S.D | Mean | S.D | Mean | S.D |
| 5 | 8 | 1321.6 | 200.9 | 233.4 | 34.2 | 44.1 | 7.21 | 14.5 | 8.5 |
| 6 | 9 | 1382.6 | 240.1 | 270.6 | 65.9 | 43.1 | 11.6 | 11.4 | 6.2 |
| 7 | 10 | 1448.8 | 77.9 | 282.2 | 48.9 | 54.0 | 12.01 | 12.0 | 4.7 |
| 8 | 9 | 1509.9 | 147.4 | 259.2 | 63.4 | 54.4 | 14.1 | 13.9 | 7.2 |
| 9 | 9 | 1645.0 | 176.8 | 290.7 | 51.4 | 52.8 | 16.3 | 14.1 | 8.1 |
| 10 | 10 | 1710.3 | 79.1 | 305.8 | 105.1 | 81.7 | 28.4 | 24.7 | 5.0 |
| 11 | 8 | 1788.0 | 116.8 | 304.8 | 56.2 | 56.4 | 16.0 | 15.6 | 4.2 |
| 12 | 10 | 1909.3 | 41.2 | 361.8 | 54.0 | 70.3 | 12.0 | 13.2 | 3.3 |
| 13 | 8 | 2006.0 | 122.9 | 315.2 | 55.7 | 97.2 | 14.6 | 22.9 | 7.7 |
| 14 | 10 | 2153.4 | 143.2 | 361.3 | 52.0 | 97.7 | 48.2 | 20.0 | 8.1 |
| 15 | 10 | 2270.5 | 265.2 | 361.1 | 95.6 | 105.8 | 28.7 | 23.6 | 11.5 |
| 16 | 9 | 2306.0 | 206.6 | 369.6 | 99.6 | 117.0 | 38.4 | 23.9 | 8.0 |
| 17 | 10 | 2209.0 | 187.4 | 400.4 | 78.6 | 89.4 | 30.4 | 19.9 | 5.6 |
| 18 | 9 | 2307.1 | 136.4 | 424.4 | 72.3 | 100.1 | 37.5 | 26.6 | 12.7 |
| 19 | 10 | 2310.4 | 130.2 | 410.7 | 52.8 | 92.8 | 32.0 | 25.4 | 13.1 |
| 20 | 10 | 2370.4 | 200.9 | 428.3 | 50.2 | 128.2 | 38.4 | 27.1 | 12.6 |

**Table 2: Intake of calcium, iron, minerals and phosphorous in Spitian boys**

| Age (yrs) | Calcium (mg) | | Iron (mg) | | Minerals (gm) | | Phosphorous (mg) | |
|---|---|---|---|---|---|---|---|---|
| | Mean | S.D | Mean | S.D | Mean | S.D | Mean | S.D |
| 5 | 241.1 | 86.5 | 9.7 | 1.1 | 4.2 | 0.8 | 636.1 | 126.2 |
| 6 | 230.1 | 75.2 | 10.4 | 2.5 | 4.6 | 1.5 | 645.7 | 110.1 |
| 7 | 223.2 | 51.9 | 11.6 | 2.9 | 9.0 | 2.3 | 718.5 | 118.4 |
| 8 | 181.4 | 66.2 | 13.6 | 8.2 | 4.6 | 1.3 | 692.5 | 76.8 |
| 9 | 230.9 | 91.0 | 11.5 | 2.1 | 5.6 | 1.1 | 825.2 | 121.0 |
| 10 | 309.5 | 74.7 | 18.2 | 8.1 | 12.7 | 1.9 | 825.6 | 131.1 |
| 11 | 283.4 | 73.2 | 12.1 | 1.5 | 6.5 | 1.5 | 781.3 | 147.0 |
| 12 | 296.1 | 81.2 | 15.4 | 3.1 | 6.8 | 0.9 | 920.6 | 120.0 |
| 13 | 317.6 | 97.3 | 22.3 | 8.7 | 7.7 | 1.5 | 1040.5 | 76.8 |
| 14 | 303.6 | 95.2 | 21.1 | 12.0 | 6.3 | 1.9 | 958.9 | 151.6 |
| 15 | 470.4 | 137.6 | 26.7 | 11.5 | 7.3 | 1.2 | 1164.9 | 134.1 |
| 16 | 383.0 | 100.5 | 30.5 | 10.5 | 7.8 | 1.4 | 1115.4 | 108.9 |
| 17 | 358.7 | 99.8 | 20.5 | 11.0 | 7.3 | 3.2 | 1124.1 | 194.0 |
| 18 | 372.1 | 100.3 | 24.6 | 8.1 | 8.4 | 3.2 | 1117.5 | 330.7 |
| 19 | 328.7 | 110.9 | 29.6 | 16.8 | 7.7 | 2.1 | 1182.3 | 120.0 |
| 20 | 360.2 | 115.3 | 32.04 | 19.9 | 8.3 | 2.0 | 1207.6 | 206.6 |

minerals consumed by Spitian boys are 4.2 g at 5 years which rises to 8.3 g at 20 years of age. The calcium intake increases from a value of 241.3 mg at age 5 to 360.2 mg at 20 years of age. Iron intake at 5 and 20 years is 9.7 mg and 32.04 mg, respectively. Phosphorous intake almost doubles from a value of 636.1 mg at 5 years to 1207.6 mg at 20 years.

Spitian males obtained their maximum calories from wheat, barley and rice. Cereals and pulses jointly improve the quality of protein. Some of the pulses and legumes which find an important place in their food are rajmah, black gram and peas (green and dry), even green leafy vegetables are also taken. Fat is mainly taken in the form of cooking oil and from the animal products. Calcium and iron is obtained from the green leafy vegetables, pulses and onion.

Average dietary intake of nutrients by Spitian males has been calculated on the basis of food intake survey (24-hour recall). With the increase of age the nutrient intake also increases. The recommended dietary allowances for Indian children and adolescents (Gopalan et al., 1989) have been used as reference values in order to find out the status of Spitians whether they are under the stress of nutrition or not.

Spitians at all ages show comparatively lower intake of calories than that of the RDA (Table 3). Spitian males have on average 1353.9 kcal intake of energy at the age interval of 5-6 years which increases to 2271.7 kcal at the age group of 16-18 years. The caloric intake of Spitians vis-à-vis RDAs expressed in terms of percentage indicates that this differential is greater during childhood ages which keeps on decreasing with

**Table 3: Calorie, protein and fat intake in Spitian boys alongwith RDA**

| *Age interval* | *Calories (kcal)* | | | *Protein (gm)* | | | *Fat (gm)* | | |
|---|---|---|---|---|---|---|---|---|---|
| *(yrs)* | *Present Study* | *R.D.A.** | *Percentage deficient* | *Present Study* | *R.D.A.** | *Percentage above RDA* | *Present Study* | *R.D.A.** | *Percentage deficient* |
| 5-6 | 1353.9 | 1690 | 19.9% | 43.6 | 30 | 45.3% | 12.9 | 25 | 48.4% |
| 7-9 | 1531.5 | 1950 | 21.5% | 53.7 | 41 | 31.0% | 13.3 | 25 | 46.8% |
| 10-12 | 1803.6 | 2190 | 17.6% | 70.4 | 54 | 30.4% | 18.0 | 25 | 28.0% |
| 13-15 | 2153.1 | 2450 | 12.1% | 100.5 | 70 | 43.6% | 22.1 | 22 | 0.5% |
| 16-18 | 2271.7 | 2640 | 14.0% | 101.7 | 78 | 30.4% | 23.3 | 22 | 5.9% |

the increase in age. Protein intake by Spitian at the age group of 5-6 years is 43.6 gm which increased to 101.7 gm at the age bracket of 16-18 years. Thus the protein intake is relatively greater when compared with RDAs. This is because of an ideal combination of cereal and pulses. The surplus protein intake expressed in percentage indicates that the intake is much greater during childhood ages than that of the post adolescent ages. In Spitian males, food intake in general is deficient of fat up to the age of 15 years as compared to RDA. Thereafter, the consumption of fat increases and becomes almost equal or a little more than RDA.

## DISCUSSION

Food items consumed by Spitians had very small day to day variation. Cereal intake by Spitian males is greater in all the age groups as compared to the RDA. Cereals are the cheapest source of energy (which are provided also on subsidized rate by the Government). Spitians consume fewer pulses as compared to RDA. Pulses consumed at the age of 5 years are 32.91 percent less as compared to the RDA, however, this difference in general reduces after the pre-adolescence age. . About 62 percent of the total cropped area of Spiti valley has been under the cultivation of cereals (Oberoi et al., 1992) which might to a major extent meet the daily requirements of the cereals. Cereals when eaten with pulses increase the quality of protein. Consumption of green leafy vegetables, tubers and root is more as compared to RDA. Consumption of cabbage and potato is maximum due to its pit storage strategies as also because its yield is higher in Spiti valley. The intake of other vegetables, milk, fats, sugar and jaggery is less as compared with recommended dietary allowances. The average number of milch animals per household (which includes sheep, goat and *churi* etc.) is 1.31 (Oberoi et al., 1992). It is worth mentioning here that menu of Spitians does not change much during winter as compared to that of the summer. Dried cabbage and meat is consumed in winter, which is dried and stored during summer. These dried materials have larger percentage of protein than that of fresh ones. Thus Spitians get nourishment even during the off season (winter). However, since the study was conducted during the summer months therefore it would be a far reaching conclusion to comment on the nutritional status of Spitians during winter season.

In the present study, the diet is low in calories as well as in fat than the RDA which perhaps reflects on a fact that the food intake is closely monitored so as it lasts for the whole year and especially during winter when the outside activity cannot commence. The food intake is thus actually influenced by the availability of the food stocks with the family alongwith the socio-economic, cultural and demographic factors. Since there are a variety of nutrients where intake of one may be higher and of the other may be low and a general comment on the nutritional status would seem logical if it is stated in comparison with the intake of calories. The calorie intake comparisons are more meaningful since it gives the value of calories when all the ingredients of a food item are burnt. Thus the deficit in caloric intake to the tune of 12 to 21 per cent exists in this population. The greater deficit occurs at younger ages. Similar deficiencies in nutrient intakes have been reported for a moderate altitude population of the Gaddis of the Himalayas (Singh and Sidhu, 1980).

Large systematic variations in adult body size and morphology among different populations can be explained with the help of their nutritional status in the context of adaptations. Though the typical *Nilotic* and *Polar* physiques are adapted to thermoregulatory demands in different environments, yet this is possible on the availability of the fat in diets among the latter. It

is reasonable to mention here that the Spitian diet is deficient in calories and lipids. Lipid deficiency also compounds the deficiency of vitamins as well which might lead to multiple nutritional deficiencies. Lipids are energy rich nutrients and their availability in diet has an important effect on growth rates in children. In the Indian settings and also in the Spiti valley, the staple diet largely consists of a combination of cereals and pulses. This complementary intake of legumes and cereals guarantees adequate protein intake provided the intake of carbohydrates is met with. The periods of organ development and growth spurts are highly vulnerable to nutritional inadequacies, e.g. the last trimester of pregnancy, the period of adiposity rebound (around 5-7 years) and the adolescence are among the most delicate and sensitive periods from the growth and development point of view. Although during the whole of the growth period the needs of optimal nutrition must be met with yet the above mentioned special periods need extra care and better nutrition. It is during these periods that the maximum growth deficit can occur and the irreversible damages can happen.

Under most favourable environmental conditions, the adult height is usually accomplished by 16 years in girls and 18 years in boys. The adult height does not stabilize by the age of 18 years in Spitian boys . It may indicate a few more years of growth in height of Spitians. The slowing of the rate of growth and prolonging its duration so that it nearly reaches its predestined curve may be an adaptation to environmental insults.

Energy needs of the body depend on the body size of the individual. An estimation of daily energy needs can be made from the basal heat production at rest (BMR) which is required for the maintenance of vital functions of the body at physical and mental rest. Besides this, energy is required for physical activity which can be highly variable and also for growth and maintenance. In general, the height velocity of children is very high in the first year of life and the brain grows very rapidly (Tanner, 1978). The energy needs per kg of body weight of children during this period are very high. The deficit in nutrition during this period seems to have an enormous effect on the growth and development of children. Not only does the growth is affected but the mental, cognitive and psychological development is also impaired.

Taking stock of the nutritional profile of the Spitian children, it emerges that the diet is deficient in nutrients. Thus the children of this population are highly vulnerable and their growth gets affected. It is suggested that not only the food availability be increased by providing subsidy but greater awareness be created about nutrition and the harmful effects of its deficiencies so as to minimize the risks associated with it.

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