

Nutritional Status Of Tribal Versus Nontribal Children (5 - 10 Years)

By

G. Nithya

A THESIS SUBMITTED TO THE AVINASHILINGAM INSTITUTE FOR HOME SCIENCE AND
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IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF
MASTER OF SCIENCE IN FAMILY AND COMMUNITY SCIENCE

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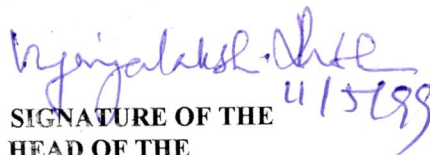
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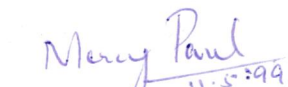
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CERTIFIED AS BONAFIDE RESEARCH WORK.


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Acknowledgement

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Introduction

INTRODUCTION

Two thirds of the World's children are in the developing countries and a quarter of them live in South Asia (Sudhir, 1993; Venkataram, 1993). In India alone, children under the age of 15 years constitute 38 percent of her total population of which 13 percent is accounted by the under fives (Mehta, 1997).

Children and their well being are the basic concern of every nation. Their health is not only an indicator of the socio-economic status and standard of living of the country but also it reflects the values and beliefs of the society. A healthy child is happiness to the parents, thrill of the society and hope of the nation (Maurya and Jaya, 1997).

Nutritional adequacy is one of the key determinants of the quality of human resources. Despite the rapid progress that has been made in the technology of food production and processing global malnutrition continue to be a major area of concern for public health. According to UNICEF and World Bank reports 63 percent of children in India are malnourished. Malnutrition in children stunts physical growth, impairs mental ability and ends up with poor education and poor productivity (Pathanaik, 1999).

Malnutrition is usually the result of a complex interplay of factors

involving diverse elements such as inadequate dietary intake and infection. In children malnutrition is synonymous with growth failure. Malnourished children are shorter and lighter than they should be for their age (UNICEF, 1998). Poor linear growth during childhood and failure to maximize genetic potential are major public health challenges. Poor growth is often associated with impaired cognitive development and behavioural abnormalities in children (Taylor, 1994). Many children suffer from multiple types of malnutrition i.e., nutritional stunting and wasting. It is estimated that 226 million children in India are stunted, shorter than what they ought to be for their age and about 183 million weigh less than they should be for their age (Nutrition Reviews, 1998).

Malnourished children unlike their well nourished peers, not only have life time disabilities and weakened immune systems, but also lack capacity for learning (UNICEF, 1998; Saibaba and Murthy, 1998). Children who have suffered malnutrition during their early life give less attention to education and social skills irrespective of their Intelligent Quotient (Singh, 1997). The problem of malnutrition in India encompasses a spectrum of deficiencies of one or more of the three micronutrients namely iron, vitamin A and iodine. Together they contribute to a great deal of morbidity and ill health, growth retardation, reduced levels of physical and developmental activity in children. The basic cause of these deficiencies is lack of adequate intake of these nutrients through the diets compounded by poor bioavailability. Other environmental factors such as parasitic infestation and chronic infections aggravate the deficiencies (Seshadri,

1997). Iron deficiency and its resultant anaemia is concurrently the most widespread micronutrient deficiency in the world. Children besides pregnant women are the most affected with an estimated global prevalence of 43 percent (0-4 years) and 37 percent (5-12 years) respectively. In India the prevalence rates of iron deficiency anaemia are higher in girls compared to boys beyond the age of 6 years. Estimates suggest that about 25 to 50 percent of girls become anaemic by the time they reach menarche (Dubey, 1995).

Anaemia is of particular significance in school because of its high prevalence and adverse functional consequences. In children anaemia impairs scholastic performance (Raman and Sharma, 1998). The performance of anaemic school children in tests of learning and selective cognitive function tests involving attention, concentration and memory were poorer than those children with normal haemoglobin levels. Such deficits in cognitive functions of anaemic children can lead to cumulative deficits in school performance which may extremely result in school drop outs (UNICEF, 1997).

Vitamin A deficiency is another major nutritional problem affecting young children. Reports of NNMB surveys have indicated that higher prevalence of vitamin A deficiency is seen in school age children irrespective of economic status (NNMB, 1997). Even mild vitamin A deficiency impairs the immune system, reducing children's resistance to infection (Bhaskaram, 1998). Approximately 250 million children in India have deficient vitamin A body stores and therefore they

have on an average 20 times greater risk of dying from severe infections (Kearney, et al, 1998).

Children deficient in iodine suffer from lack of concentration, impaired co-ordination and sluggishness which result in poor school performance. It has been estimated that on an average, school children living in iodine deficient areas have IQ levels which are approximately 13 points lesser than those children living in areas with sufficient iodine. (Pandev et al, 1999). Iodine deficiency also causes poor eye-hand co-ordination, muscular disorders, speech disorders, delayed motor development, partial paralysis, deaf mutism, dwarfism, stunting and neurological damage (Sohal et al, 1998).

Health and nutritional status of children of school age^{is} neglected by nutritionists as well as policy makers because of the reduced acceleration of growth observed during this age range. Many forget that these children are also at risk of micronutrient deficiencies owing to increased energy expenditure combined with decreased meal frequency, reduced maternal attention and parasitic infestation.

Micronutrient deficiencies are a major obstacle to socio-economic development. Since they have an immense impact on the health of the school children, their learning ability and productivity, solving micronutrient malnutrition may therefore be seen as a precondition for rapid and sustainable development.

Also improving the micronutrient status of school age children will improve the cost effectiveness of investments in education (FAO / ILSI, 1997).

Nutritional status of the population is a good yardstick of development of a nation. Also it is one of the critical indicators of health of children and assessment of nutritional status therefore naturally monitors the children's health. Results of surveys on tribal population reveal that the nutritional status of tribal children is a matter of concern. Although NNMB has data on the nutritional status of tribal pre-school children, no information is available pertaining to the nutritional status of tribal children of school age. Hence an attempt has been made to study the nutritional status of tribal children (cross sectional) and compare it with that of the non-tribal children of the same age and environment with the following objectives

- i to elicit information on the family background of selected tribal and non tribal school age children
- ii to assess their health and nutritional status and
- iii to assess their biochemical profile with reference to haemoglobin, serum protein, iron and iodine status

Review of Literature

II . REVIEW OF LITERATURE

The review of literature pertaining to the study on '**Nutritional status of tribal versus non tribal children (5 - 10 years)**' is presented under the following headings:

- A. Prevalence of nutritional deficiencies in children
- B. Consequences of nutritional deficiencies
- C. Nutritional considerations and
- D. Anthropometry - a tool to assess the nutritional status of children

A. PREVALENCE OF NUTRITIONAL DEFICIENCIES IN CHILDREN

According to UNICEF, India has the unfortunate distinction of having 75 million malnourished children below 5 years, and rate of malnutrition is more than double the average for sub Saharan Africa. Among the states, the situation in Rajasthan is the worst with as many as 91 percent malnourished children followed by Bihar 82 percent, Uttarpradesh 81 percent, Orissa 70 percent and Kerala 35 percent .

According to UNICEF's global, regional and country assessment of child malnutrition, about 36 percent of children under five in the developing world excluding china are under weight. More than one in six malnourished children are suffering from severe malnutrition interms of their weight for age. Rural malnutrition prevalence is consistently higher than urban, roughly one and a half times greater. There is little

difference between male and female prevalence except in the case of wasting. The prevalence of malnutrition is consistently higher during the second year of life, but in the case of stunting, there is a second, major peak in the fifth year (Carlsow and Wardlaw, 1990).

A significant proportion of the world's population suffers from or is at risk of deficiencies of vitamins and minerals, commonly referred to as micro nutrients. Adequate intake and availability of these dietary essential vitamins and minerals are closely related to the survival, the physical and mental development, the general good health and the overall well-being of all individuals (Lotfi etal, 1996).

Vitamin A deficiency primarily affects children. In developing countries, it is estimated that approximately 250 million children are at risk of whom at least 2.8 to 3 million are clinically deficient. Every year 2,50,000 to 5,00,000 lose their eyesight as a result of VAD, two thirds of these children likely to die. An estimated one million additional children die each year of infectious diseases because vitamin A deficiency impairs their resistance to infection (FAO / ILSI, 1997). In India, milder forms of vitamin A deficiency affecting conjunctive are observed in about 1 - 5 percent in 1 - 5 year old children. It is estimated that 30 - 40,000 children are at risk of developing nutritional blindness every year (Vijayaraghavan, 1995).

In India, iron deficiency anaemia affects more than half the total population. In a large scale study by the Indian Council of Medical Research, about 53 percent of children were found to be anaemic. A recent study undertaken in Chennai revealed a startlingly high incidence of iron deficiency anaemia among children aged 6-15 years. According to this 8 out of 10 children in Chennai have iron deficiency anaemia. The research covered a base of 1,000 children from the upper income group and the sex split comprised of 280 boys and 720 girls. Results from the study documented a high prevalence of anaemia at 88% with mild and moderate anaemia is the range of 55% and 33%. While the study clearly showed a high prevalence of iron deficiency anaemia, there was no difference in the prevalence among boys and girls. Hence, contrary to the belief anaemia is no longer an issue only for girls (Shivaji, 1998).

Iodine deficiency is probably the first-nutritional disease recognised by man kind. Iodine deficiency is the most common cause of preventable mental retardation. Today roughly 1.6 billion people live in areas where soil lack sufficient iodine. About 655 million people have goitre where as 43 million are affected by some degree of mental impairment of which 6 million are cretins. More than half of the affected individuals live in China and India (Lotfi et al, 1996). In India 150 million people are at risk of iodine deficiency and approximately, 40 million are goitrous (Ghosh,, 1997).

B. CONSEQUENCES OF NUTRITIONAL DEFICIENCIES

Malnutrition in children is potentially dangerous and vulnerable to infection. The risk of death from common childhood diseases is doubled for a mildly malnourished child, tripled for a moderately malnourished and may be as high as eight-times for a severely malnourished child (Sinha , 1998).

Malnutrition will not only cause death if severe, but also it may lead to retarded growth, impaired mental ability and child behaviour. Children who have suffered malnutrition through early life may give less attention to education and social skills irrespective of Intelligent Quotient (IQ), Nutritional status of children thus influence their educational achievement (Singh, 1997).

Besides PEM, there are other types of malnutrition due to specific micronutrient deficiencies. Vitamin A deficiency anaemia and iodine deficiency disorders are the most common forms of micronutrient malnutrition. Although the most severe problems of micronutrient malnutrition are found in developing countries, children in developed countries also suffer from various forms of these nutritional problems. Micronutrient malnutrition leads to high social and public costs, reduced work capacity in populations due to high rates of illness and disability and tragic loss of human potential (FAO/ILSI, 1997).

Vitamin A deficiency primarily affects children. It causes night blindness and eventually permanent blindness. Xerophthalmia and childhood blindness are not only the consequences of vitamin A deficiency. In severe forms it can impair the immune response which may have an effect on school attendance and consequently performance. It also contributes to retarded physical growth and impaired resistance to infections, resulting in high rates of sickness and death among children. Vitamin A deficiency also affects iron metabolism. It has been shown that responses to iron supplementation are limited in children with marginal vitamin A status and supplementation with iron is more effective when iron is given in conjunction with vitamin A (Stuijvanherg et al, 1999).

Anaemia in children is associated with retarded physical growth, reduced resistance to infections and slow development of learning abilities (FAO/ILSI, 1997). Anaemia in children is also associated with reduced intellectual and psychomotor development (Dubey 1995).

Iodine deficiency can lead to spectrum of disorders ranging from severe mental retardation to milder forms of motor and cognitive deficits. The interplay between the two most significant immediate causes of malnutrition - inadequate dietary intake and illness - tends to create a vicious circle; A malnourished child, whose resistance to illness is compromised, falls ill, and malnourishment worsens. Children who enter this malnutrition infection cycle can quickly fall into a potentially fatal spiral as one condition feeds off the other.

Malnutrition lowers the body's ability to resist infection by undermining the functioning of the main immune - response mechanisms. This leads to longer, more severe and more frequent episodes of illness. Infections cause loss of appetite, malabsorption and metabolic and behavioural changes. These, in turn, increase the body's requirements for nutrients, which further affects young children's eating patterns and how they are cared for (Bodhankar, 1998).

C. NUTRITIONAL CONSIDERATIONS

The age ranges from 7 to 12 years represents the school children which is also called as pre-adolescence. This period has been called as the latent time of growth. During this period growth slows down and body changes occur gradually. The slowed rate of growth results in gradual decline in the food requirement per unit body weight as compared to pre-school period. Since this period precedes the period of adolescence which is marked by very rapid growth, it is important that a good nutritional foundation is laid during this period (Srilakshmi,1995).

The Recommended Dietary Allowances for children aged 5-10 years are presented in Table.1.

Table 1. Recommended Dietary Allowances for children (5 - 10 years)

S.No.	Nutrients	Years			
		4-6	7-9	10 - 12	
				Boys	Girls
1	Energy (kcal)	1690	1950	2190	1970
2	Protein (g)	30	41	54	57
3	Calcium (mg)	400	400	600	600
4	Iron (mg)	18	26	34	19
5	Retinol (μg)	400	600	600	600
6	β Carotene (μg)	1600	2400	2400	2400
7	Thiamine (mg)	0.9	1.0	1.1	1.0
8	Riboflavin (mg)	1.0	1.2	1.3	1.2
9	Niacin (mg)	11	13	15	13
10	Ascorbic acid (mg)	40	40	40	40

* ICMR, 1996.

The recommended dietary intakes for this age group are influenced by their pattern of growth. Some of the features which influence their nutritional needs are

- a. differences in rate of growth between boys and girls
- b. differences in body composition of boys and girls
- c. growth and development of muscles, expansion of blood volume and increase in size of various body organs.

d. considerable mineralization of bones and formation of permanent teeth (Sri lakshmi,1997).

The yearly increase in height varies from 4 to 7.7cm in boys and 4.9 to 7.2cm in girls. The yearly increase in weight varies from 2.5 to 5.2 kg in girls between 5-13 years and 2.5 to 6.6 kg in boys between 5 to 14 years. Girls are found to be ahead of boys in skeletal maturity and subcutaneous fat thickness and in the maturity of permanent dentition all throughout. It would seem that the sex difference lies in the general maturity factor and also in various more detailed factors. Girls are usually ahead of boys in motor development and also in certain forms of aptitude tests (David, 1995).

Undernutrition has serious consequences for the children of age 5 to 10 years. Undernourished children are shorter and they weigh lesser than their well nourished peers. The rate of gain in weight is more pronounced in these group than the rate of gain in height. However, if the nutritional deficit is severe and continues long enough, linear growth may be retarded. Linear growth is delayed when energy intake is adequate but low in protein while weight is affected by low calorie intake (Pipes, 1994).

Nutritional status studies have shown that children from the low socio economic stratum are shorter and lighter than those who hail from affluent families. Undernutrition in these children also interferes with their intellectual abilities. The risk of infection is greater in these children (Kapil etal, 1977).

Children require more calcium than adults to meet their skeletal growth demands. More calcium is constantly deposited so as to add strength and rigidity to the bones. Similarly calcium is being deposited in the permanent teeth as shedding of the deciduous teeth and erupting of permanent teeth take place during this age range (Bloem et al, 1998).

By the time children reach the age of 8 to 10 years, their appetite is usually very good. Therefore Increase in blood volume keep pace with growth and thus lays a greater demand on the iron requirement. Iron needs for boys comprise growth needs, need for placement of basal loss and need for improved body stores of iron. Similarly in girls it comprises besides growth needs and replacement of basal losses , additional need for menarche and for future menstrual losses (Mehta 1997).

Poverty, ignorance, disturbed emotional status due to maladjustment in schools are some of the contributory factors of malnutrition in these children. Dietary surveys carried out in different parts of India show that diet consumed by this group is deficient in calories protein, vitamin A, riboflavin, folic acid and iron. More than 50 percent of the school children are anaemic. Children of this age group should be encouraged to relish fruits and vegetables, particularly green leafy vegetables . (Wardley et al., 1997).

Children aged between 5 to 10 years have relatively few dislikes for food except possibly for vegetables which are not taken in satisfactory amounts. Most children however, are in a hurry and thus do not take enough time for meals. By the

time children reach the age of 8 to 10 years, their appetite is usually very good. Therefore they should be encouraged to take varieties of foodstuffs to meet their nutritional requirements (Williams et al, 1998).

D. ANTHROPOMETRY - A TOOL TO ASSESS THE NUTRITIONAL STATUS OF CHILDREN

Assessment of nutritional status of community is one of the first steps in the formulation of any public health strategy to combat malnutrition. The principal aim of such an assessment is to determine the type, magnitude and distribution of malnutrition in different geographic areas, to identify the at-risk groups and to determine the contributory factors. Indicators like nutritional anthropometry, clinical examination for nutritional deficiency signs and biochemical estimation are available for the assessment of nutritional status of communities (Hanumantha Rao and Vijayaraghavan, 1998).

Nutritional status of children can be evaluated under three broad headings namely, clinical, biochemical and anthropometric. Although a variety of clinical features have been described in protein energy malnutrition and other micronutrient deficiency states, these description are not specific enough to warrant their routine use in nutritional status assessment.

Several biochemical and endocrinal parameters have been increasingly used for the assessment. The need for blood sampling and cumbersome assays make these an impractical tool for routine application. Consequently for practical purposes,

anthropometry is the most useful parameter for assessing the nutritional status of children (Sachdev, 1995).

The most commonly used simple body measurements which serve as good indicators of nutritional status are

- Weight for age
- Height for age
- Weight for Height

The use of anthropometric measurements specially height and weight depends on two factors namely accurate age assessment and appropriate standards for comparison. Accurate age assessment is essential because the body dimensions increase with age furthermore, the use of body measurements become useful only if the actual measurements obtained on an individual are compared with known standards. If the body measurements for age are comparable with those of well to do and healthy children, the child is considered to be nutritionally healthy (IGNOU,1997).

Weight for age is a commonly used indicator of body size and it reflects the level of food intake. The relative change of weight with age is more rapid and sensitive to changes in the growth pattern of an individual. Significant changes can be observed over periods of few days (Gopalan,1995).

Height for age is a very reliable measure that reflects the total increase in the size of the individual up to the moment it is determined. It is a measure of long duration malnutrition. Low height for age is indicative of stunting. Low weight for age on the other hand is called under weight. By relating the weight of a child to its height, an objective measure of the child's degree of thinness can be obtained. Weight for height therefore is a very good index for short duration malnutrition. A too low weight for height is wasting (Mukherjee, 1997).

Methodology

III. METHODOLOGY

The methodology pertaining to the study on "Nutritional status of tribal versus nontribal children (5 -10 years)" is presented under the following heads

- A. Selection of the area
- B. Selection of the sample
- C. Formulation of the tool
- D. Conduct of the study and
- E. Analysis of the data

A. Selection of the Area

Hindustan Photo Films (HPF) school, Neerkazi Mandu school wherein many tribal children belonging to the Toda community receive their basic education and Sri Venkateshwara Vidhyalaya of Udhagamandalam which caters to the non-tribal children were chosen because of the co-operativeness, willingness and keenness of the authorities in improving the nutritional status of their inmates and also due to the availability of sufficient number of children.

B. Selection of the sample

The school age is one of the crucial period of life as about 40 percent of physical growth and 80 percent of mental growth is believed to take place during this age.

School age is a time for acquisition of skills that permit independence in eating and development of likes and dislikes of foods. Individual variation in children

become more noticeable in the rate of growth, nutrient requirements, personality development and food intake. Development of good food habits and nutritional practices in early childhood establish the foundation for adult health (Chandra and Sehgal, 1994).

Hence two hundred school going children belonging to the tribal as well as non tribal communities of age ranging from 5 to 10 years were selected at random from the first to fifth standards of the above mentioned schools.

C. Formulation of the tool

A detailed Interview schedule was developed by the investigator in order to elicit information pertaining to the educational and economic status of the families, nutritional status and incidence of infectious diseases in children.

Questions pertaining to the educational and socio-economic status of the family were included in the first part of the questionnaire in order to get an insight pertaining to the relationship between economic and educational status of the parents and the nutritional status of their children.

The second part of the interview schedule was related to the nutritional status of the children. This was framed in order to obtain information related to the pattern of consumption of milk and milk products, fleshy foods, fruits and vegetables.

Last part of the questionnaire, consisted of information related to health problems and incidence of infectious diseases in the selected children.

D. Conduct of the study

The parents of the children were interviewed by the investigator and information pertaining to the educational and economic status of the families, pattern of consumption of milk and milk products, fleshy foods and fruits and vegetables, health problems and incidence of infectious diseases of the selected children was obtained.

The nutritional status of the children was assessed through

- a. Anthropometric measurements
- b. Clinical examination
- c. Dietary survey
- d. Biochemical profile

a. Anthropometric measurements

Anthropometry is considered to be the most sensitive parameter for assessing the nutritional status of children. Use of anthropometric measurements depends on accurate age as well as appropriate standards for comparison. The most commonly used indicators of nutritional status are body weight for age, standing height for age and weight for height.

1. Body weight

Body weight is the most widely used and simplest reproducible anthropometric measurement for the evaluation of nutritional status of the children and weight for age is a commonly used indicator of body size which reflects the level

of food intake. The body weights of the selected children were recorded with minimum clothing in bare foot using bathroom scale balance and was corrected to the nearest 0.5 kilograms.

2. Height

The height of an individual is influenced both by genetic and environmental factors. The maximum growth potential of an individual is decided by heredity (genetic) factors while the environmental factors, the most important being nutrition and morbidity determine the extent of exploitation of that genetic potential.

The heights of the children were measured by making the subject stand erect, looking straight on a level surface without shoes, with heels together and toes apart.

b. Clinical examination

This is the observation of outward signs of malnutrition. It involves looking for changes in the body which are indicative of a particular deficiency. The investigator carried out the clinical examination for all the children in order to find out the children who suffer from obvious signs and symptoms of nutritional deficiencies.

c. Dietary survey

Dietary survey involves the collection of information concerning food habits, food supply, preparation and distribution of foods. Dietary data on children

is obtained in order to get a more precise measurement of the average nutrient intake and to determine dietary inadequacies, if any.

Food weighing method is one of the most accurate methods available as accurate information on the consumption of foods can be obtained by this method. Food weighing survey was done on 10 percent of the tribal and non-tribal children respectively for a period of three consecutive days. Weights of the ingredients used for cooking as well as the actual weight of the cooked items were obtained. From the weight of the quantum of cooked items, raw equivalents were calculated and nutritive value computed.

d. Biochemical profile

Biochemical tests estimate the quantity of nutrients or their metabolites present in blood or the activity of an enzyme/hormone in which the nutrient is a cofactor.

Five ml. of the blood samples were obtained and used for the following estimations.

1. Haemoglobin by Cyanomethemoglobin method (Varly, 1988)
2. Total serum protein by Biuret method
3. Serum iron and
4. T₃, T₄, TSH by Elisa method.

E. Analysis of data

The average food and nutrient intake was computed and compared with the dietary and nutrient allowances recommended by ICMR for children. Percentage

analysis was done whenever the data did not lend for any other statistical appraisal. 't' test analysis was done for the serum protein, iron, T₃,T₄,and TSH profiles of the tribal against the non tribal children.

Results and Discussion

IV. RESULTS AND DISCUSSION

The results of the study on “**Nutritional status of tribal versus non tribal children(5 - 10 years)**” are discussed under the following headings.

I. Findings of the Survey

A. Family details

- i. Educational status of the parents
- ii. Economic status of the parents
- iii. Type of families

B. Personal details

- i. Age and sex of the subjects
- ii. Nutritional status of the subjects
 - a. Frequency of consumption of vitamin A and iron rich foods
 - b. Mean food intake of the subjects
 - c. Mean nutrient intake of the subjects
 - d. Mean height and weight for age of the subjects
 - e. Clinical picture of the subjects
 - f. Foods avoided / included and
 - g. Morbidity pattern

II . Biochemical profile of the subjects

- a. Mean haemoglobin level of the subjects
- b. Mean total protein profile of the subjects
- c. Mean serum iron content of the subject
- d. Mean T3, T4 and TSH profile of the subjects

I. Findings of the survey

A . Family details.

i. Educational status of the parents

The educational status of the parents of the tribal as well as non tribal children is presented in Table 2.

Table 2 *EDUCATIONAL STATUS OF THE PARENTS*

S.No	Educational Status	Father				Mother			
		Tribal		non Tribal		Tribal		non Tribal	
		no	%	no	%	no	%	no	%
1.	Illiterate	7	7	-	-	5	5	-	-
2.	Elementary school	25	25	-	-	9	9	-	-
3.	High School	65	65	35	35	82	82	46	46
4.	Higher Secondary	1	1	25	25	4	4	20	20
5.	College	2	2	40	40	-	-	34	34

Out of the 100 parents of the tribal children, seven percent of the head of the families and five percent of the mothers were illiterates. It is interesting to note that 42 % of the mothers of the tribal children had education upto high school while only 25 percent of their male counter parts had studied upto high school .

On the contrary, the parents of the non tribal children were educated and none had education below high school . It is worthy to note that 40 percent of the fathers and 34 percent of the mothers of the non tribal children had college education.

ii. Economic status of the parents

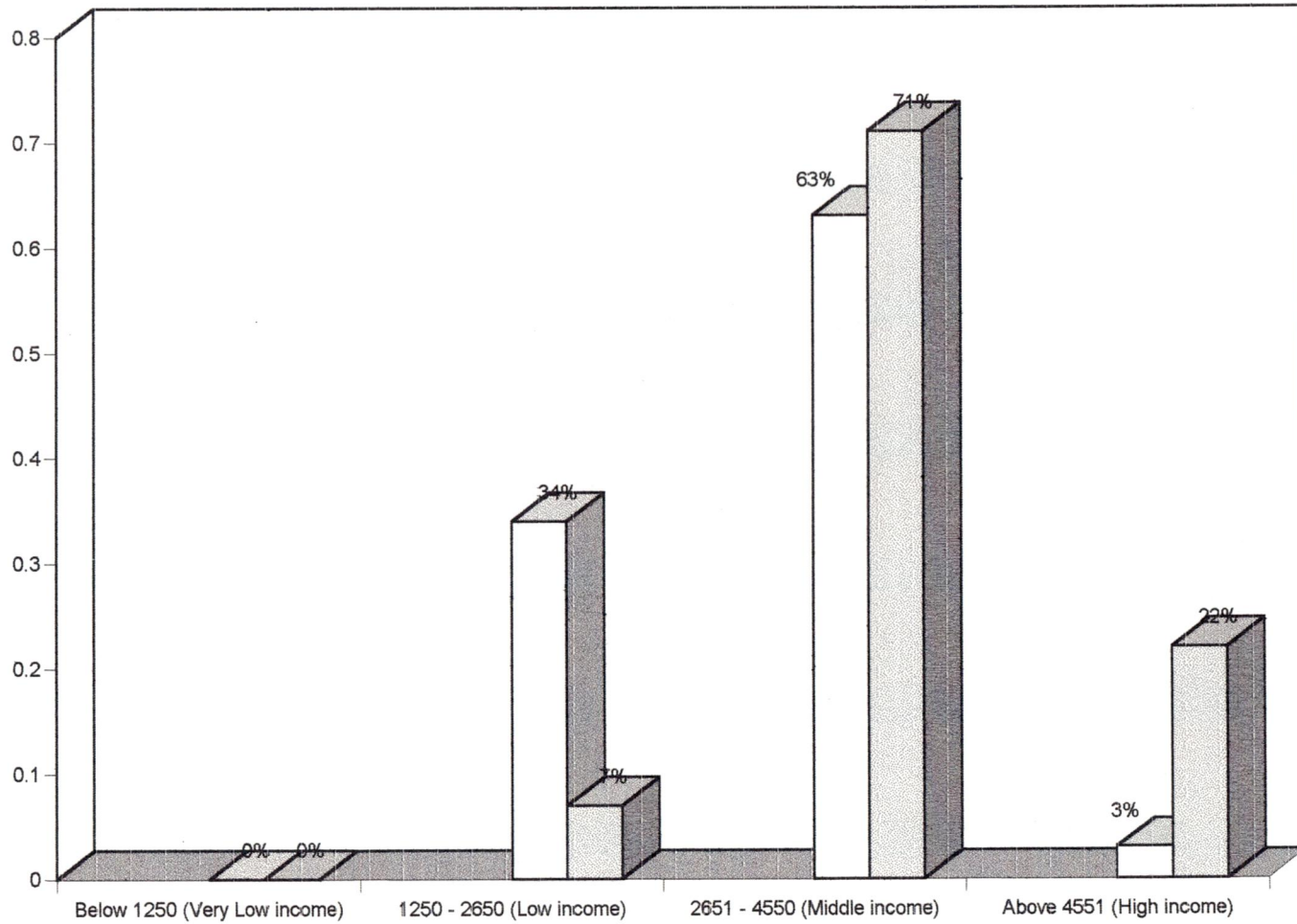
Economic status of the parents of the tribal and non tribal children is shown in Table 3 and Fig.1.

Table 3. ECONOMIC STATUS OF THE PARENTS

S. No.	* Economic Status (Rs./Months)	tribal	percent	nontribal	percent
1.	Below 1250 (Very low income)	--	--	--	--
2.	1250-2650 (Low income)	34	34	07	7
3.	2651 - 4550 (Middle income)	63	63	71	71
4.	Above 4551 (High income)	03	3	22	22

* HUDCO, 1994.

Fig.1. Economic Status of the Parents



Majority of the tribal (63 %) as well as nontribal (71 %) families belonged to the middle income category . None of the families interviewed had income lower than Rs. 1250 / month.

Type of the families

Though joint family system is most commonly preferred among the Toda tribal Community, 21 percent of the families had come out of the primitive hamlets. The remaining 79 percent were part of the joint family system. On the other hand all the non Tribal families were nuclear.

B. Personal Details :

i. Age and sex of subjects.

Details pertaining to the age and sex of the subjects are presented in the

Table 4.

Table 4. Age and sex of the subjects

S.No	Category	Age (yrs)	tribal children				non tribal children			
			Boys		Girls		Boys		Girls	
			no	per cent	no	per cent	no	per cent	no	per cent
1.	Children	5	5	10	6	12	3	6	5	10
		6	7	14	8	16	11	22	15	30
		7	5	10	15	30	12	24	8	16
		8	8	16	7	14	7	14	9	18
		9	16	32	5	10	7	14	7	14
		10	9	18	9	18	10	20	6	12

Out of the 200 children selected for the study , 50 percent were girls and the remaining 50 percent were boys. The sex distribution among the various age groups is shown in the table. Among the boys of the tribal Community, 32 percent were 9 year old followed by 18 percent from the 10 year category . On the other hand majority of the tribal girl children who participated in the study were from the 7 and 10 year old categories (30 % and 18 % respectively) . On the contrary , majority of the non tribal children were drawn from the five and six year old categories.

ii. Nutritional status of the subjects :

a. Frequency of consumption of vitamin A and iron rich foods

It is interesting to note that almost all the children from the Toda community had consumed green leafy vegetables though not in optimum quantities . Since most of these tribal families have kitchen garden in which they cultivate different seasonal green leafy vegetables their dietaries were found to have varieties of these items.

Non tribal families on the other hand mainly depends on the markets for leafy vegetables, cabbage was by and large part of their dietaries . However they had included , carrots knol - khol and beans much more than their tribal counter parts. Potato was by and large part of the dietaries of these families irrespective of the community .

With regard to the fleshy foods , meat and meat products were included in their dietaries of the non tribal families . While the tribal families consumed more of milk and milk products .

b. Mean Food intake of the subjects

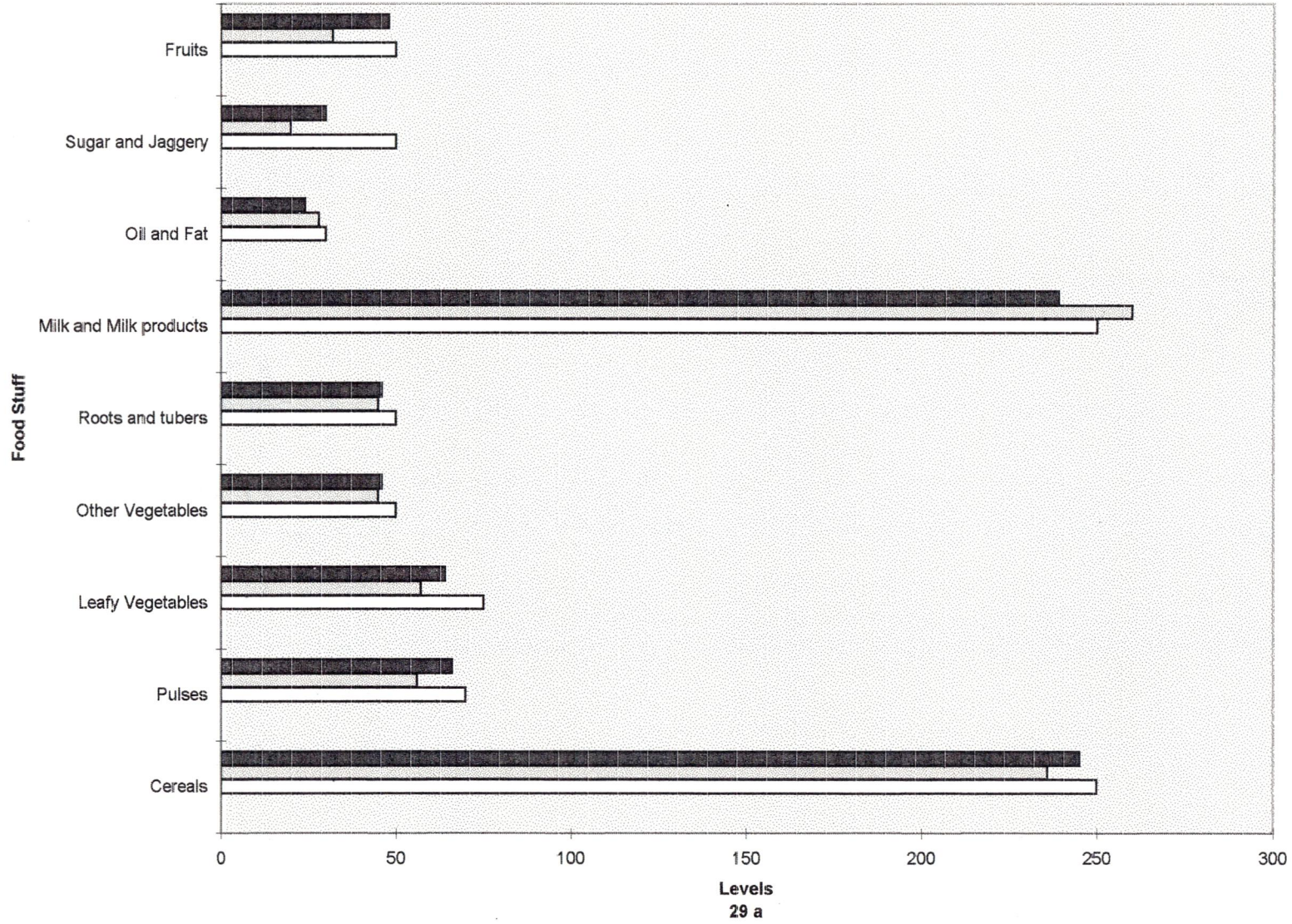
Mean food intakes of the subjects of the tribal and non tribal communities are shown in Table 5 and Fig.2.

Table 5. Mean food intake of the subjects

S.No	Food stuff	*ICMR 1984 (g)	tribal children		nontribal children	
			observed (g)	percentage of RDA	observed (g)	percentage of RDA
1	Cereals	250	236	94	245	98
2	Pulses	70	56	80	66	94
3	Leafy vegetables	75	57	76	64	85
4	Other vegetables	50	45	90	46	92
5	Roots and Tubers					
6	Milk and Milk products	250	260	104	239	96
7	Oil and fat	30	28	93	24	80
8	Sugar and jaggery	50	20	40	30	60
9.	Fruits	50	32	64	48	96

* 7 - 9 year .

Fig. 2. Mean food intake of the subjects



The scenario with regard to the intake of food by the children was not bad irrespective of their background. With the exception of sugar and jaggery, more than 75 percent of the RDA had been met by the dietaries of these children. On the whole the dietary intake of the non tribal children was surpassing the intake of their tribal counter parts. Extensive surveys carried out in different parts of India indicate that south Indian are predominantly cereal based. However, diets of high and middle income groups can be said to be satisfactory (Gopalan etal , 1996) . Since most of these children belonged to the middle income category, their diet components were almost on par with their RDA.

c. Mean nutrient intake of the subjects

Mean nutrient intakes of the children of both the tribal and non tribal communities are presented in Table 6.

Table 6. Mean nutrient intake of the subjects

S.No	Nutrients	* ICMR 1996	tribal children		non tribal children	
			observed	percentage of RDA	observed	percentage of RDA
1	Energy (Kcal)	1950	1960.00	101	2071.00	106
2	Protein (g)	41	47.5	116	51.61	126
3	Calcium (mg)	400	407.56	102	503.59	126
4	Iron (mg)	26	16.32	63	18.62	72
5	β Carotene (mg)	2400	2056.04	86	2256.04	94
6	Thiamine (mg)	1.0	1.12	112	1.28	128
7	Riboflavin (mg)	1.2	0.75	62	0.98	82
8	Niacin (mg)	13.0	12.67	97	13.40	103
9	Vitamin C (mg)	40	48.10	120	58.19	145

- 7-9 years.

By and large iron intake of the children irrespective of their community background were rather low. Cabbage was a common green leafy vegetable of the dietaries of these children . Iron intakes of the tribal and non tribal children were only 63 percent and 72 percent of the recommended dietary allowances for their age. Other iron rich food items were sparingly consumed and this might have been the reason for the low iron content of these diets.

d. Mean Height and weight for age of the children

From the four basic parameters such as age , sex , weight and height , three common indices have been desired they are height for age , weight for age and weight for height.

Growth pattern of school age Indian children are comparable to those of their American counterparts upto 14 years of age . Its therefore justifiable to use the international growth standard of the National Centre for Health Statistics (NCHS) for Indian children as well.

The NNMB data on rural population show that the average heights and weights of boys and girls are lower than those of their counter parts from well to do families in India as well as lower than NCHS standard (NNMB Report repeat surveys ((1988 - 1990) , 1991) .

i. Mean height for age of boys

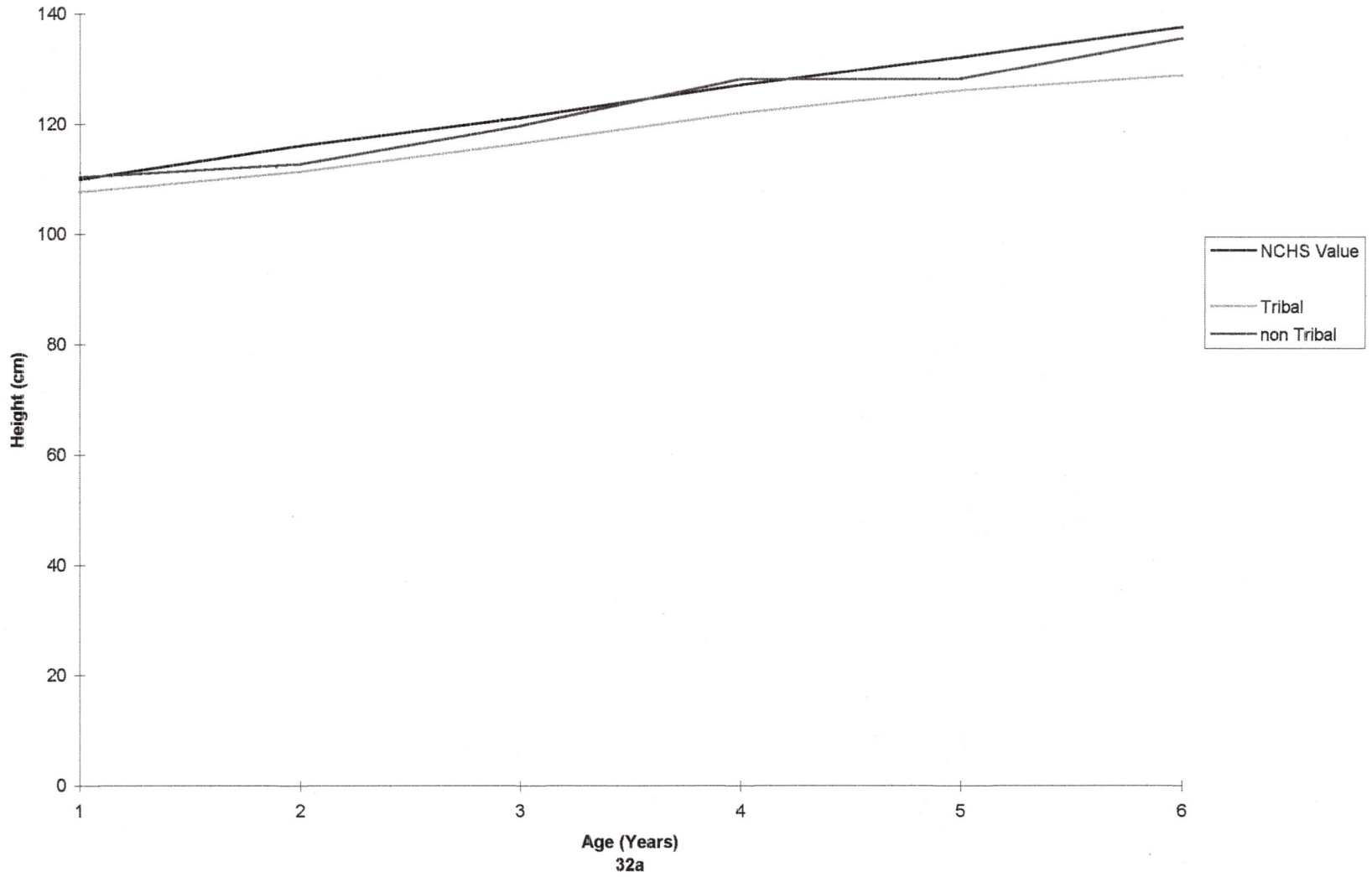
Details pertaining to the mean heights for age of boys are shown in Table 2 and Fig 3.

Table 7. Mean height for age of boys

S.No	Age (yrs)	NCHS values (cm)	Height (cm)			
			tribal children		non tribal children	
			observed	percentage of the NCHS values	observed	percentage of the NCHS values
1	5	110	107.60 ± 2.18	98	110.33 ± 2.49	100
2	6	116	111.28 ± 3.69	96	112.70 ± 4.29	97
3	7	121	116.4 ± 3.9	96	119.60 ± 8.80	99
4	8	127	121.87 ± 7.52	96	128.00 ± 5.19	101
5	9	132	126.0 ± 5.29	95	128.12 ± 8.38	97
6	10	137.5	128.77 ± 4.60	94	135.4 ± 7.85	98

When the heights of the boys of age 5 to 10 years were compared with the NCHS standards, it was found that the growth potential was almost on par with the standard

Fig. 3a. Mean Height for age of Boys



values . Not much of a difference was observed between boys of tribal and non tribal communities.

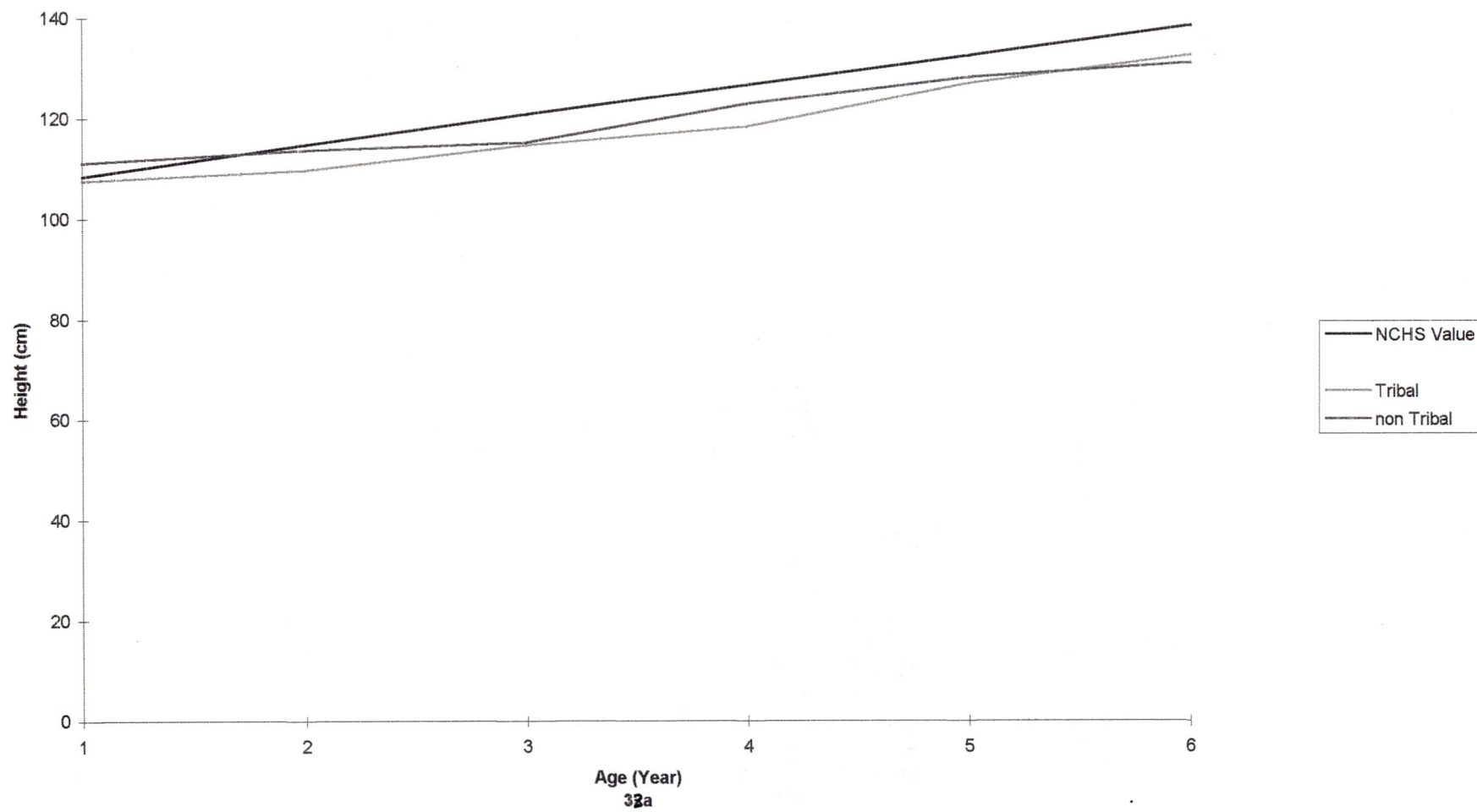
ii. Mean Height for age of girls

Details pertaining to the mean heights for age of girls are shown in Table 8 and Fig.3a.

Table 8 . Mean height for age of girls

S.No	Age (years)	NCHS values (cm)	Height (cm)			
			tribal children		non tribal children	
			observed	percentage of the NCHS values	observed	percentage of the NCHS values
1	5	108.4	107.50 ± 2.48	99	111.00 ± 2.52	102
2	6	114.6	109.6 ± 4.49	96	113.5 ± 4.4	99
3	7	120.6	114.53 ± 5.58	95	115.0 ± 6.2	95
4	8	126.4	118.28 ± 6.11	94	122.66 ± 4.08	97
5	9	132.2	126.8 ± 4.77	96	128.00 ± 4.46	97
6	10	138.3	132.37 ± 6.49	96	130.83 ± 9.40	95

Fig. 3b. Mean height for age of girls



Mean heights for age for girls of both tribal as well as non tribal were almost similar to their male counterparts. Sex difference was not found with regard to height . According to NNMB (1997) report , the nutritional status of rural girls has been found to be essentially similar to their male counter parts indicating that there is no gender bias in nutritional care . Better financial back ground and easy accessibility to good food might have been the reason for the optimum growth in these children .

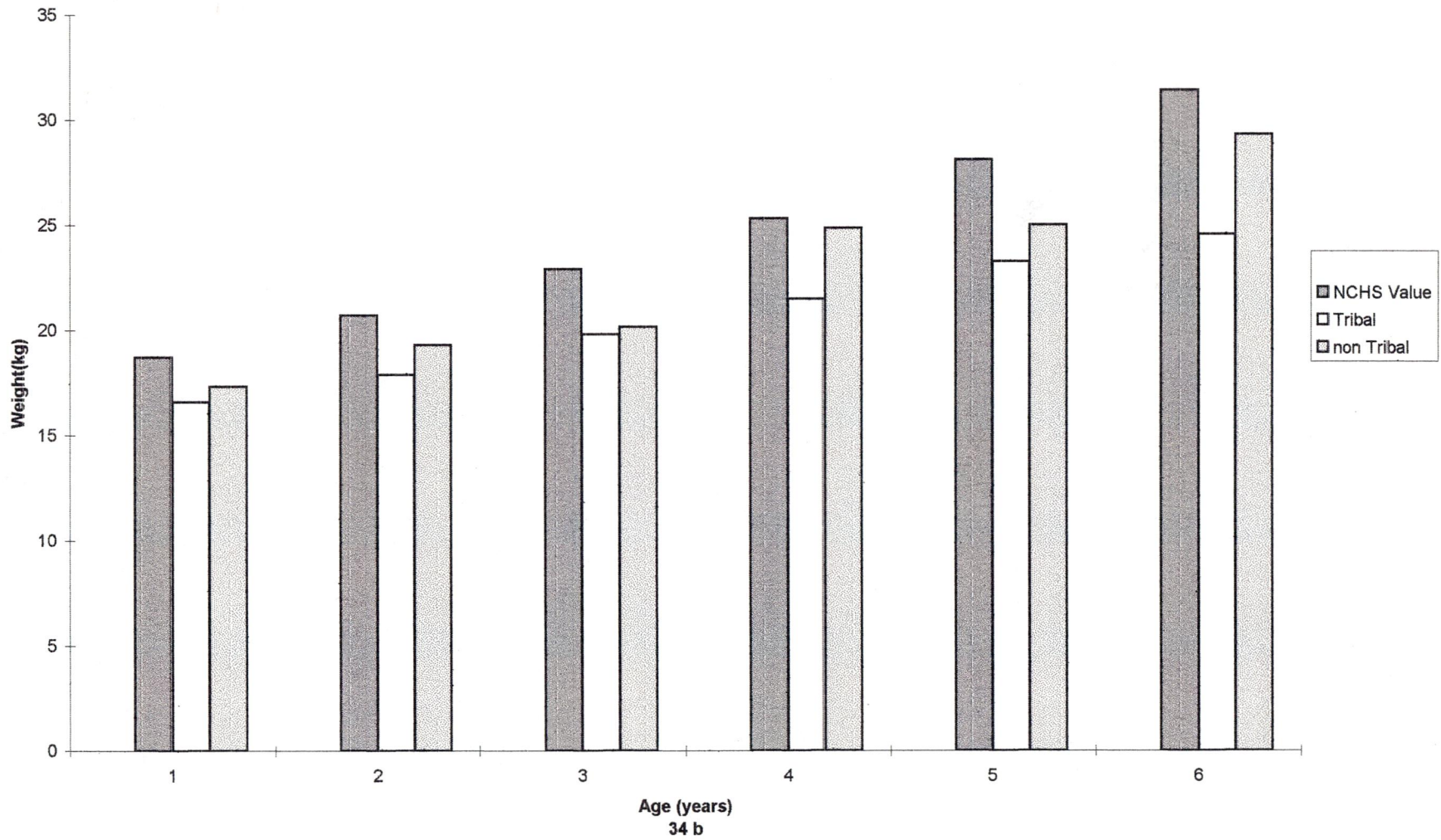
iii. Mean weight for age of boys

Details pertaining to the mean weights for age for boys are shown in Table 9 and Fig. 4.

Table 9. Mean weight for age of boys

S.No.	Age (year)	NCHS values (kg)	Weight (kg)			
			tribal children		non tribal children	
			observed	percentage of the NCHS values	observed	percentage of the NCHS values
1	5	18.7	16.60	89	17.33	93
			±2.43		±0.47	
2	6	20.7	17.87	86	19.30	94
			±2.38		±2.32	
3	7	22.9	19.80	86	20.16	88
			±2.48		±1.46	
4	8	25.3	21.50	85	24.85	98
			±1.79		±2.78	
5	9	28.1	23.25	83	25.00	89
			±2.87		±4.42	
6	10	31.4	24.55	78	29.30	93
			±2.40		±5.14	

Fig. 4b. Mean Weight for age of boys



Contents of this table reveal that the weights of the tribal boys were much lower than their non tribal counterparts. The weight deficits were found to be increasing with age indicating per nutritional status in the upper age range boys compared to the young ones. Maternal care with regard to food intake would have been optimum for the younger children and hence better weights. On whole weights of all the tribal boys irrespective of their age fell only within 90 percent of the NCHS standards. On the other hand, the weights of the boys of the non tribal community were almost on par with that of NCHS standards indicating good nutritional status.

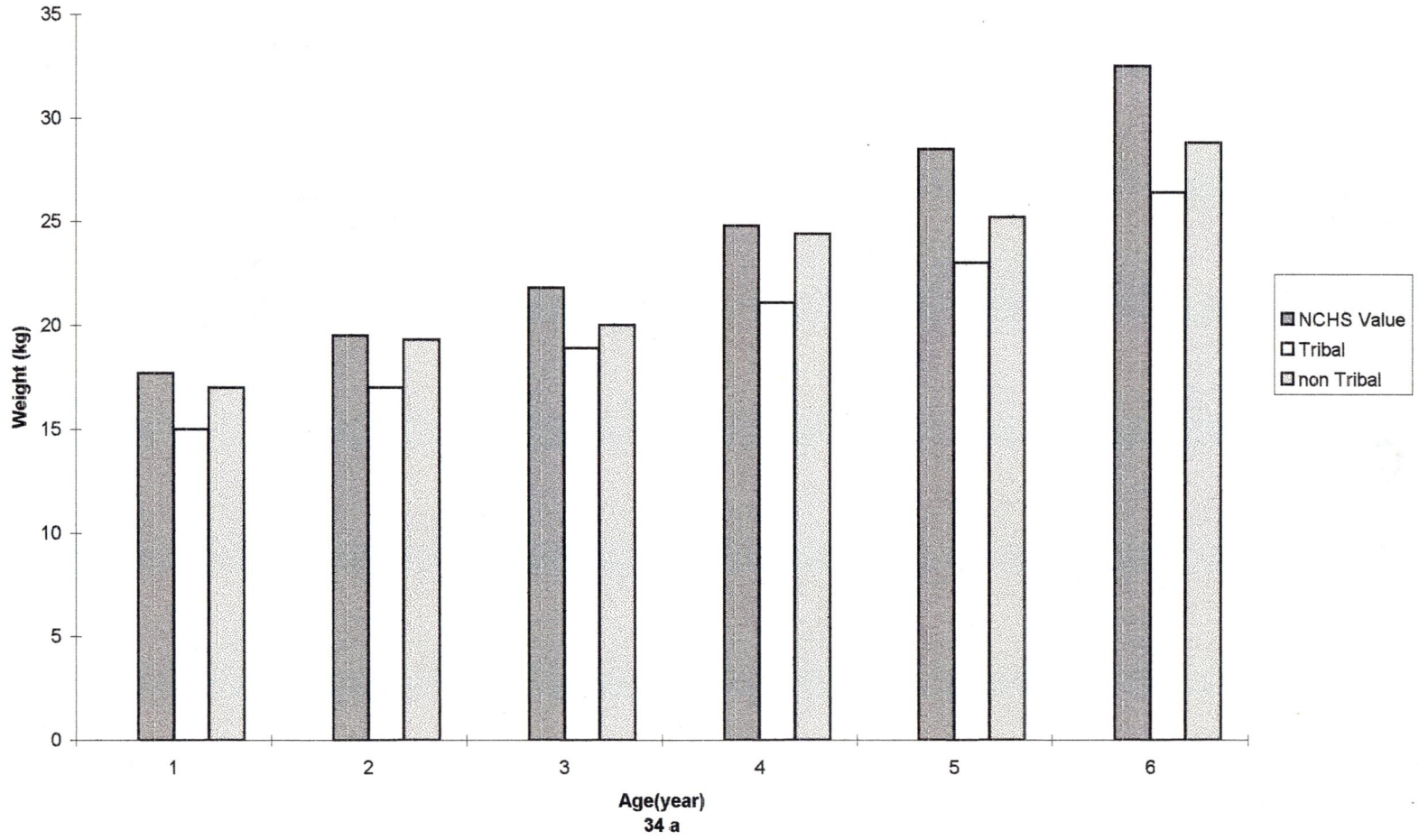
iv. Mean weight for age of girls

Details pertaining to the mean weights for age of girls are given in Table 10 and Fig.4a.

Table 10. Mean weight for age of girls

S.No	Age (year)	NCHS values (kg)	Weight (kg)			
			tribal children		non tribal children	
			observed	percentage of the NCHS values	observed	percentage of the NCHS values
1	5	17.7	15.00 ±1.46	85	17.00 ±1.26	96
2	6	19.5	17.00 ±1.35	87	19.30 ±2.26	99
3	7	21.8	18.90 ±2.06	87	20.00 ±1.65	92
4	8	24.8	21.14 ±2.16	85	24.44 ±3.83	89
5	9	28.5	23.00 ±2.89	81	25.28 ±2.24	89
6	10	32.5	26.44 ±2.11	81	28.83 ±5.55	89

Fig. 4a. Mean Weight for age of girls



When the weights of girls of the tribal community were compared with that of their non tribal community counter parts, it was observed that just like boys the tribal girls were comparatively poor in weight and none of them had weights above 90 percent of the NCHS values .

The nutritional status of children can be observed by anthropometric measurements . The recent NNMB survey (1998 to 1990) of rural children shows that only about 10 percent are normal with weights above 90 percent of the standard (NCHS) . The magnitude of malnutrition based on weight was similar among boys and girls (Reddy etal , 1993) .

e. Clinical picture of the subjects

Common deficiency symptoms observed among the tribal children were spongy and swollen gums , dental carries, and cheilosis . On the whole, 14 percent of the tribal children had dental carries, 8 percent Spongy gums and 1 percent cheilosis respectively.

Dental caries was observed in 30 percent of the non tribal children indicating high intake of sweets by these children as compared to the tribal children.

f. Morbidity pattern of the children

Common ailments encountered by these children were common cold , fever and diarrhoea. Irrespective of the community children had episodes of common cold, fever and diarrhoea although not all. Twenty five percent of the tribal children had frequent attacks of cold and fever while only seven percent of the non tribal children

had episodes of cold and fever. During the monsoon season almost all had suffered from diarrhoea atleast once during the current year.

g. Foods avoided / included during illness

By and large milk and milk products and oily and spicy foods are not given to these children of both tribal as well as non tribal communities during episodes of diarrhoea, measles, mumps and chickenpox. Majority of the tribals (80 Percent) believed that inclusion of such food items during illness will offend their goddesses and as a traditional customary practice, these items are avoided .

II. Biochemical profile

a. Mean haemoglobin levels of the subjects

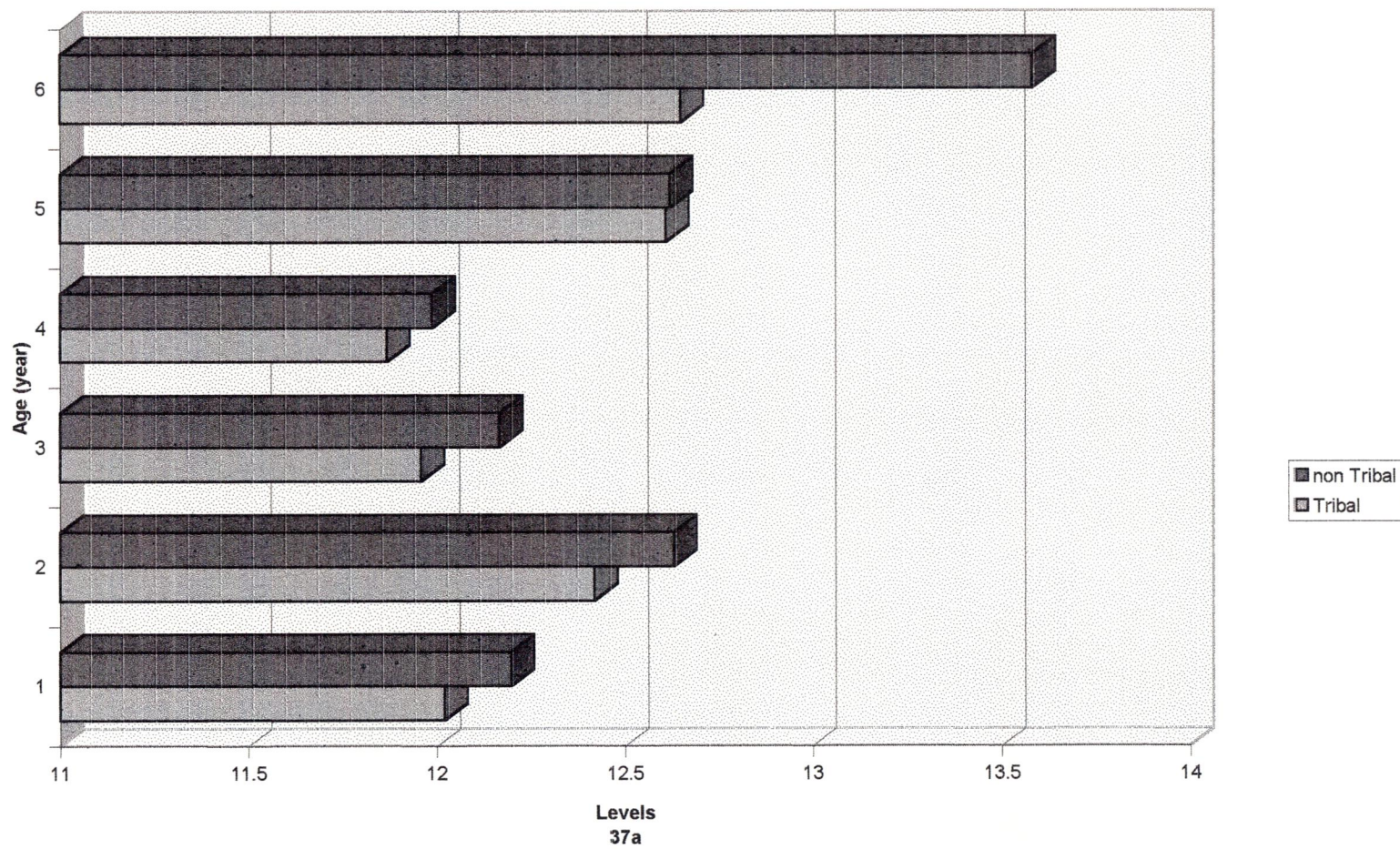
Mean Haemoglobin levels of the children are presented in Table 11 and Fig.5.

Table 11 Haemoglobin levels of the subjects

S.No .	Age (years)	* WHO cut-off value (g/dl)	Haemoglobin (g/dl)	
			tribal children	non tribal children
1	5		12.02 ±0.93	12.2 ±1.00
2	6		12.42 ±0.96	12.63 ±1.14
3	7		11.96 ±0.82	12.17 ±1.15
4	8	>12	11.87 ±0.66	11.99 ±0.85
5	9		12.61 ±1.13	12.62 ±1.04
6	10		12.65 ±1.51	13.58 ±1.23

* De Mayer, 1989.

Fig. 5. Haemoglobin levels of the subjects



On the whole mean haemoglobin picture both tribal and non tribal children was satisfactory and the levels were closer to the WHO cut-off value of <12 g/dl. However when individual values were examined, it was observed that 30 percent of the tribal and 24 percent of the non tribal children were mildly anaemic while the remaining had normal haemoglobin status. This might have been due to worm infestation in these children.

b. Mean total serum protein profile

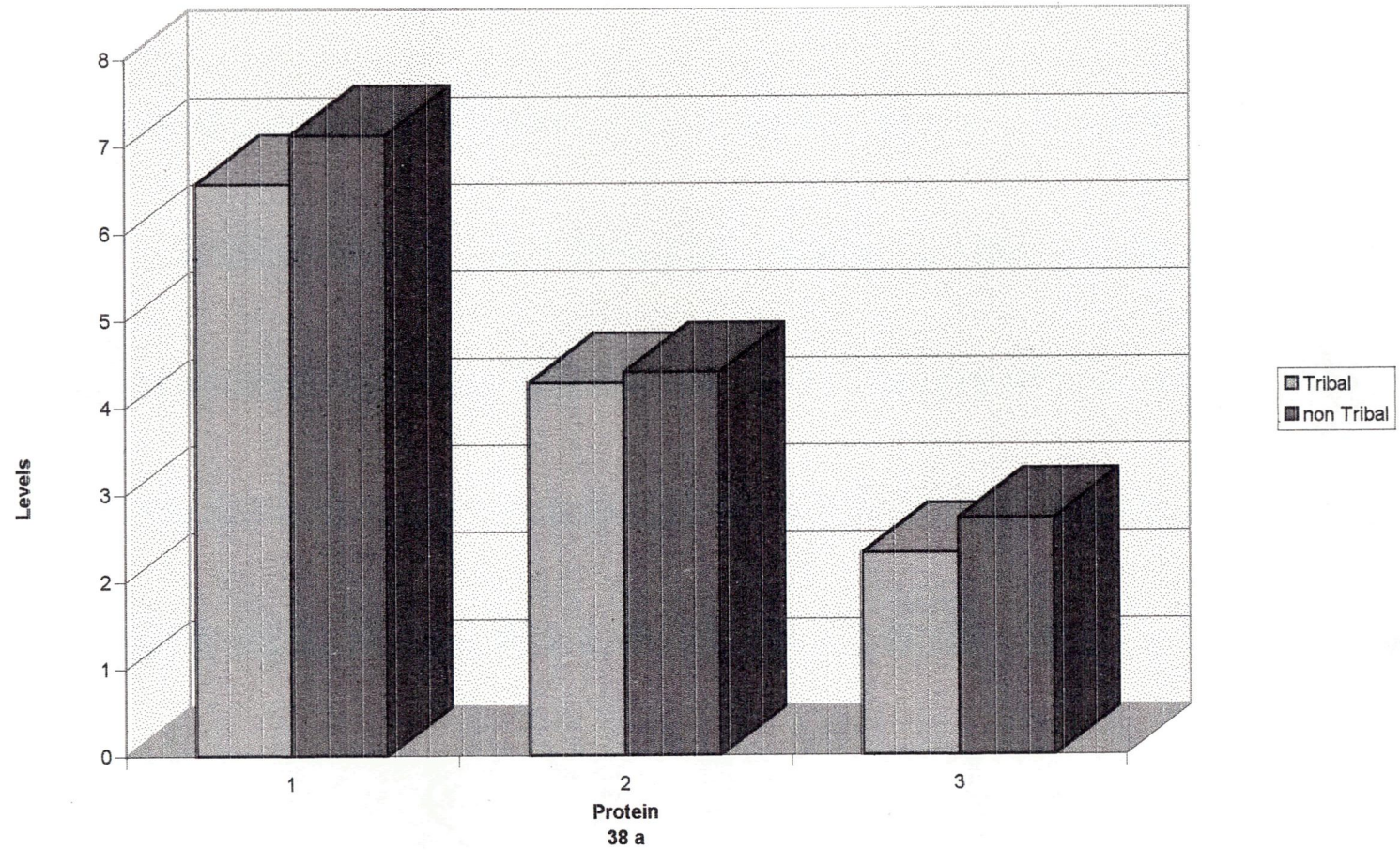
Information pertaining to the serum protein profile is presented in Table 12 and Fig .6.

Table 12. Mean total serum protein profile

S.No	Protein	Cut-off value (g/dl)	Serum protein (g/dl)		
			tribal children (A)(n-25)	non tribal children (B) (n-25)	comparison 't' value
1	Total Protein	5.3 - 8	6.57 ±0.64	7.13 ±0.62	15.50
2	Albumin	3.3 - 5.8	4.28 ±0.43	4.40 ±0.56	A Vs B 1.57
3	Globulin	2.0 - 2.2	2.32 ±0.60	2.72 ±0.43	5.90

With regard to the total protein profile, the observed values for the children were within the cut-off range indicating good nutritional status. None of the children had either fever or infection at the time of study. Globulin scenario normally speaks

Fig. 6. Mean Serun protein profile



ones health status as during infection globulin levels are elevated. Albumin level acts as an index of protein nutrition. The levels observed in these children prove that their protein nutritive is optimum.

c. Mean serum iron profile

Details pertaining to serum iron values are shown in Table 13.

Table 13. Mean serum iron profile

S.No	Children	Serum iron (mcg/dl)		comparison	't' value
		Cut-off value	observed		
1	tribal (n-10) (A)	35 - 140	101.01 ±16.06	A Vs B	0.149
2	non tribal (n-10) (B)		106.09 ±16.15		

Levels of serum iron reflect the balance between the absorbed iron, iron utilised for haemoglobin synthesis and iron released by red cell destruction and the size of the storage depot .

A constant and progressive fall in serum iron is indicative of negative iron balance. A serum iron value of <12 mcg/dl is considered diagnostic of iron deficiency in children (Dubey , 1995). Contents of the table reveal that the serum iron levels of the children, irrespective of their family back ground were far better than the lower

range of the cut-off values. Hence it may be concluded that these children had optimum iron nutritive at the time of the study.

d. Mean T₃, T₄ and TSH profile of the subjects

Information pertaining to T₃, T₄ and TSH profile is shown in Table 14 and

Fig.7.

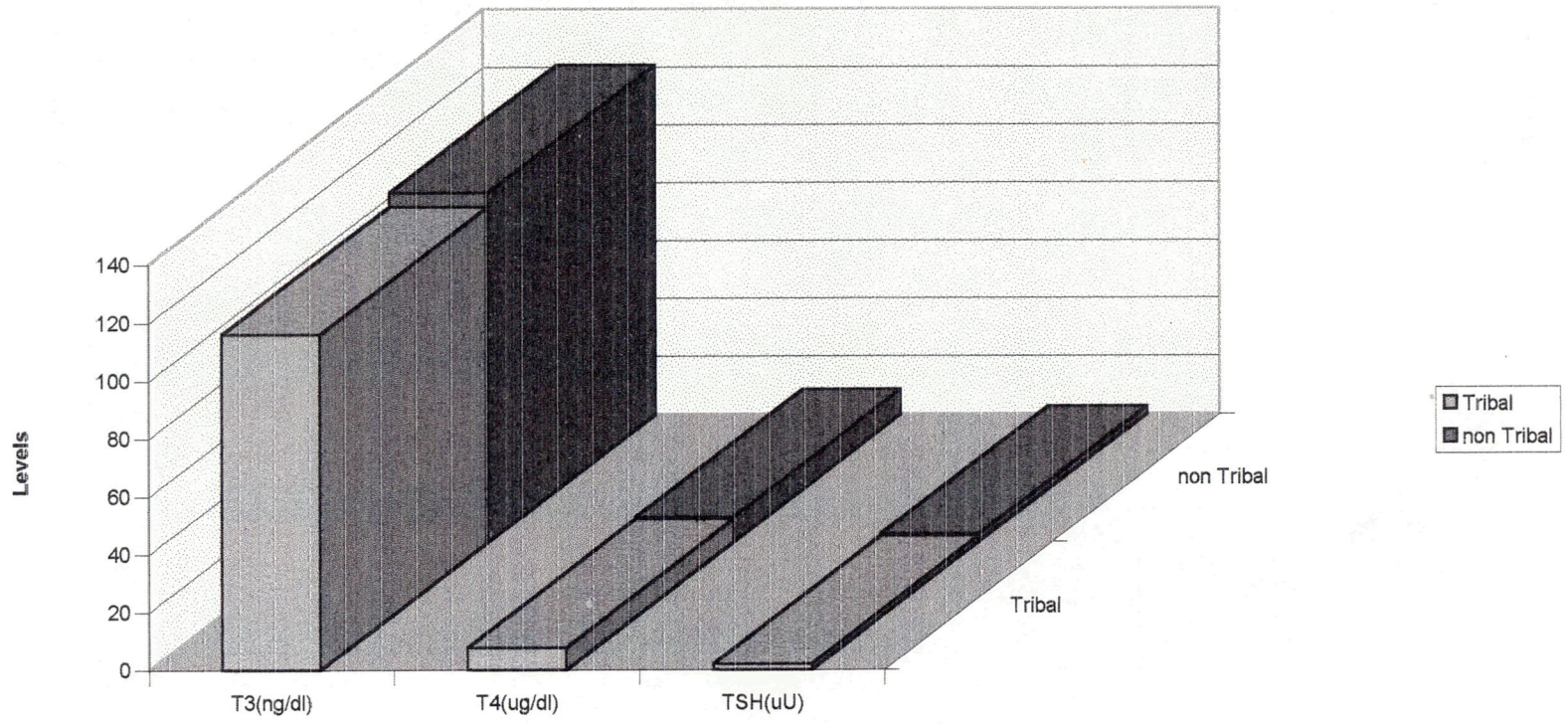
Table 14. Mean T₃, T₄ and TSH values

S.No		*Cut off value	tribal children (n-10)	non tribal children (n-10)
1	T ₃ (ng/dl)	86 - 187	115.90 ±13.51	120.71 ±13.56
2	T ₄ (ug/dl)	4.5 - 12.5	7.80 ±2.29	8.46 ±1.70
3	TSH (μu)	0.4 - 4.0	2.01 ±0.53	2.57 ±1.03

* Brahmam , 1998

Serum TSH estimation has been used to screen congenital hypothyroidism as well as epidemiological surveillance. TSH concentration are expected to be elevated in iodine deficiency. Serum levels of T₄ is an indirect measure of iodine nutritional status. In the presence of iodine deficiency, the thyroid produces less iodinated forms of the thyroid hormone and thus there is an increased production of T₃ than T₄.

Fig. 7. Mean T3, T4 and TSH



Contents of this table reveal that T₃, T₄ and TSH values of the children were within the cut-off values indicating optimum iodine status. Surveys have indicated that a wide range of normalcy for serum thyroxine levels which are influenced by iodine prophylaxis (Ramji , 1995).

It is imperative from the above result that these children irrespective of their communal back ground have a sound foundation in nutrition.

Summary and Conclusion

V. SUMMARY AND CONCLUSION

Children are the most precious human resource and hence their future generation deserves the best possible upbringing India's commitment to the cause of children is old and is clear from the unequivocal expression of this commitment through constitutional provision. Assessment of the nutritional status of the children is important as it is one of the important factors determining the quality and productivity of the children which in turn affects the national productivity.

Hence, with the objective of assessing the nutritional and health status of children of age 5-10 years, a comparative study of tribal children against non tribal children was framed and carried out. Two hundred children in the age group of 5-10 years with equal number of boys and girls were selected at random from the Toda community as well as non tribal community. These children were chosen from the elementary schools namely Hindustan Photo Films School, Neerkazi Mandu School and Sri Venkateswara Vidhyalaya situated at Udhagamandalam.

The study was conducted in two phases . During the first phase by the administration of pre-tested interview schedule, information on demographic profile, nutritional status and medical histories were obtained . During the second phase haematological and biochemical profile of the subjects were obtained .

Key findings of the study are as follows:

1. With the exception of seven percent of the fathers and five percent of the mothers respectively of the tribal children, all had studied up to or above elementary school level.
2. As against two percent of the tribal children's fathers, 40 percent of the fathers of non tribal children had college education.
3. Majority of the tribal as well as non tribal children's families (63% and 71%) belonged to the middle income category.
4. Seventy nine percent of the tribal families were joint families.
5. Though both tribal as well as non tribal families consumed seasonal vegetables, quantity wise non tribal families included more vegetable than their tribal counterparts.
6. While non tribal families included fleshy items in their dietaries by and large, tribal families opted for milk and milk products.
7. Dietary intakes of these children were satisfactory.
8. Mean iron intake of the tribal children was only 63 percent of the RDA while it was 72 percent with regard to the iron intake of non tribal children.
9. The mean height of the tribal as well as non tribal children irrespective of sex were almost on par with the NCHS standards for their age.
10. The tribal children of both sexes were underweight for their ages. However, no gender bias was observed.
11. Dental caries was observed both in the tribal as well as non tribal children to a certain extent.

12. Incidences of common cold, fever and diarrhoea were reported by these children.
13. By and large oily and spicy foods were avoided during chicken pox infection by all the families for fear of offending their goddesses.
14. Though mean haemoglobin values observed among the various age groups were optimum, 30 percent of the tribal children and 24 percent of the non tribal children were mildly anaemic.
15. Serum protein profile was within the normal range.
16. Serum iron picture was also within the normal range indicating optimum iron status.
17. T₃, T₄ and TSH profile of these children indicated that their iodine status was also optimum.

Thus it may be concluded that dietary improvements of the traditional diets along with an improvement in the socio economic status of the people have played a major role in the maintenance of almost optimum nutritional status except weight.

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Appendices

NUTRITIONAL STATUS OF TRIBAL SCHOOL CHILDREN

- 1. Name :
- 2. a. Age :
- b. Date of birth :
- 3. a. Sex :
- b. Birth order :
- 4. Weight (Kg) :
- 5. Height (Cm) :
- 6. Haemoglobin (g/%) :
- 7. Address :

- 8. a. Educational Status of the Father :
- " " Mother :

- b. Educational status of the child :
- . Attending Day care :
- . Staying back at home :
- . Attending school :

9. Type of family

Nuclear :

Joint :

10. Income particulars :

Members	Daily	Weekly	Monthly

11. Nutritional history

a. Whether the child is a vegetarian :

Non-vegetarian :

Ova vegetarian :

b. Amount of milk and milk products given to the child/day :

Below	Milk	Curd	Buttermilk
100ml			
150ml			
200ml			
250ml			
above 300ml			

c. Frequency of consumption of Non vegetarian foods by the child :

Type	daily	Weekly	fortnightly	Occasionally
Chicken				
Meat				
Beef				
Pork				
Fish				
Dry fish				
Egg				

12. Medical History

- 3 -

Is your child Healthy? : Yes/No

If no, does he suffer from any deficiency? :

Clinical signs :

Area of examination	Signs known to be of value in surveys
1. Hair	Lack of lusture, Dull hair, Sparsness Discoloured - reddish brown Easy pluckability
2. Face	Moon face
3. Eyes	Muddy coloured Bitot spots
4. Lips	Angular stomatitis Cheilosis
5. Tongue	Red and raw Magenta tongue
6. Gums	Spongy Bleeding gums Purplish Swollen gums
7. Glands- Thyriod	Visible and enlarged
8. Skin	Dry and scaly
9. Nails	Brittle and spoon shaped
10. Skeletal system	Beading of ribs Pigeon chest : protruding breast bone Knock knees or bow legs
11. Nervous System	Irritability

d. Frequency of consumption of fruits and vegetables by the child:

Type	Daily	Twice a week	Weekly	Fort nightly	Occasion-ally	Amount/day (g)
<u>Fruits</u>						
Dates						
Orange						
Mango						
Papaya						
Jack fruit						
<u>Vegetables</u>						
Carrot						
Yellow pump-kin						
<u>Roots & tubers</u>						
Sweet potato						
Potato						
<u>Green leafy vege-tables</u>						
Amaranthus						
Arai keerai						
Spinach						
Fenugreek leaves						
<u>Millets</u>						
<u>Others</u>						

e. 48 Hours Recall Survey:

Days	Breakfast	Lunch	Tea	Dinner
Day I				
Day II				

f. Dietary intake - Weighment survey

Meal pattern	Amounts used by the family previous day				Intake of an individual (child)	
	Name preparation	Ingredients used	Raw amount g/ml	Cooked quantity g/ml	Cooked quantity g/ml	Raw equivalents g/ml
(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)
Early morning Breakfast Mid-morning Lunch Tea & Snacks Dinner Others a. (Meals/snacks taken outside home) b. Supplements from any of the feeding programmes. if any, specify .						

g. Do you withhold any food from your children during any particular season/ sickness.

Yes / No :

If yes, Give the particulars:

Particulars	Foods avoided	Reasons
Season		
Sickness		

Morbidity pattern :

Year : 1998

Mention the frequency.

Cold :

Fever :

Influenza :

Diahhorea :

Chickenpox :

Measles :

Mumps :

Any other :

13. Do you give Boiled, filtered water to the child : Yes / No

14. Do you use foot ware regularly? : Yes / No

15. Do you deworm your child? : Yes / No

If yes, how often? :

ANANLYTICAL PROCEDURE OF BIOCHEMICAL INDICES
ESTIMATION OF HAEMOGLOBIN BY CYANAMETHEMOGLOBIN METHOD
(Varley)

Principle :

The haemoglobin is treated with a reagent containing potassium cyanide and potassium dihydrogen phosphate. The ferric cyanide forms methemoglobin which is converted to cyanamethemoglobin the cyanide.

Reagents :

Sodium bicarbonate 1 g
Potassium cyanide 0.05 g
Potassium ferricyanide 0.2 g
Distilled water 1 litre

The solution was preserved in dark bottle and preferably under cold storage. It's preparation and handling should be done with great care. This solution should not be used after it forms a precipitate at the bottom of the storage bottle.

Procedure :

1. Exactly 5.0 ml of Drapkin's diluent solution was measured into a dry test tube from a burette (or) a pipette with suction bulb.
2. Exactly 0.02 ml of blood was transferred from a standard haemoglobin pipette into a diluent solution usual care in filling and cleaning of haemoglobin was observed.

3. The pipette was rinsed three times with the diluent solution without allowing formation of air bubbles in the solution.
4. The blood and diluent were thorough mixed by rotating the tube.
5. 10 minutes time was allowed for the formation of cynomethaemoglobin.
6. 5 ml of diluent solution was used as blank.
7. Exactly 2.02 ml of above. This was used as the standard.
8. The readings were taken in a colorimeter at 540 m.

Calculation :

$$\frac{\text{Optical density of test}}{\text{Optical density of standard}} \times \text{Conc. X 6.25 standard}$$

ESTIMATION OF SERUM TOTAL PROTEIN

(BIURET METHOD)

Principle :

The calorimetric method for protein estimation makes use of the biuret reaction substances which contain two CONH₂ groups join together directly or through a single carbon or nitrogen atom give a purple colour which being different with proteins. The reaction takes its name from the complex biuret.

Reagents :

Stock reagent :

Dissolve 45 g of Rochelle salt (Sodium potassium tartarate) in about 400 ml of 0.2 N NaOH and add 15 gm Copper sulphate stirring continuously until the solution is complete. Add 5 gm of potassium iodide and make it up to a litre with 0.2 N NaOH.

Working reagent :

Dilute 200 ml of stock reagent to litre with 0.2 N NaOH.

Standard protein :

400 mg of BSA in 100 ml of saline

1 ml = 4 mg.

Procedure :

4 ml of water and 0.2 ml of serum is taken to which add 4.0 ml of reagent mix and keep it for 10 minutes read at 450 nm setting the blank to zero blank - 4 ml water and 4 ml reagent.

Calculation :

$$= \frac{T}{S} \times 4 \times \frac{100}{0.2 \times 1000}$$

$$= \frac{T}{S} \times 2 \text{ gm } \%$$

ESTIMATION OF SERUM IRON

(Dipyridyl Method, Varley 1988)

Principle

Ferrous iron gives a pink colour with dipyridyl. A solution of dipyridyl in acetic acid is added to serum followed by a reducing agent. Proteins are removed by heating in boiling water and then centrifuging (or) filtering.

Reagents

1. Dipyridyl 0.1% in acetic acid 3% v/v
2. Sodium sulphite 0.1 M. Dissolved 1.26g of anhydrous sulphite (or) 2.52g of $\text{Na}_2\text{SO}_3 \cdot 7\text{H}_2\text{O}$ in water and made up to 100 ml. Prepare freshly every few days.
3. Chloroform
4. Standard solution containing 100 mg iron per ml. Dissolved 0.498g of ferrous sulphate in water add one ml concentrated sulphuric acid and made up to a little.

Alternatively used a solution of ferrous ammonium sulphate $(\text{NH}_4)_2\text{SO}_4$,

$\text{FeSO}_4 \cdot 6\text{H}_2\text{O}$ containing 70.2 mg/100 ml.

Technique

Mixed equal volumes of serum, 0.1 M sodium sulphite and dipyridyl reagent in a glass stoppered tube which could be centrifuged. Heated in boiling water for 5 minutes. Cooled added 1 ml of chloroform, stoppered and shook vigorously for 30 seconds. Removed the stopper and centrifuged for five minutes at

300 rpm. Read at 500 millimicrons using the supernatant fluid. For the standard put through the working standard in the same way.

Calculation

$$\begin{array}{l} \text{Microgram of iron per} \\ \text{100 ml of serum} \end{array} = \frac{\text{Reading of unknown}}{\text{Reading standard}} \times 300$$

ESTIMATION OF THYROID HORMONES (T₃, T₄, & TSH)

(EIA method, merck kit)

EM ELISA is an Enzyme - immunoassay (EIA) for the quantitative determination of T₃, T₄ & TSH.

PRINCIPLE

Specific anti antibodies were coated on to micro titration wells. Test sera were applied along with Ab reagent containing T₃ releasing factors allowing the T₃ to bind to the wells - for T₃ only) The enzyme conjugate was added which competes with the released serum T₃/T₄/TSH for available binding sites on the solid phase. After 1-2 hours of incubation at room temperature, the wells were washed with water to remove any unbound T₃ or enzyme conjugate. On addition of the substrate, a colour developed in those wells in which enzyme conjugate was present indicating a lock of serum T₃, T₄ & TSH. The enzyme reaction was stopped by the addition of Hcl and the absorbance was measured at 45-nm.

MATERIALS PROVIDED WITH EACH KIT

- 1 micro titration plate
- 2 Reference standard set
- 3 Anti conjugate concentrate
- 4 Substrate solution (TMB)
- 5 Stop solution
- 6 Conjugate diluent (for T₃ only)
- 7 Antibody reagent (for T₃ only)

PROCEDURE ; For T₃ - 50 NI of sample/ standards and 50 NI of Antibody reagent were dispensed into each well and mixed thoroughly for 30 seconds. Incubated for 120 minutes at 20 - 25 C Discarded the well contents and washed 5 times with distilled water. Added 200 ml of TMB substrate solution to each well. Gently shaken for 5 seconds. Incubated in dark for 20 minutes. Added 50 ml of stop solution to each well and gently shaken for 30 seconds. Read the optical densities with a microplate reader using a 450 ml filter immediately.

T₄: The procedure was similar to that of T₃ except for one step, after the addition of sample and conjugate, incubation, was kept for 60 minutes instead of 120 minutes, using the reagent in T₄ kit

TSH: The experiment was carried out similar to that of T₄ except for one step that 100ml of sample was added instead of 50 ml, using reagents in TSH kit.

Mean height, weight and mid arm circumference of the subjects

S.No.	Tribal children				Non tribal children			
	Height (cm)	Weight (kg)	Mid arm circumference (cm)	hb. (g/dl)	Height (cm)	Weight (kg)	Mid arm circumference (cm)	hb. (g/dl)
1	108	19	18	13.1	107	23	17	11.2
2	110	13	15	13.4	110	23	16	13.1
3	112	17	14.5	12.8	109	16	16.5	12.9
4	107	17	16	11.4	110	19	16.9	13.0
5	106	14	16	12.1	111	20	17	12.7
6	112	13	14	11.9	113	24	17	11.2
7	126	15	15.4	13.6	110	21	16	11.2
8	107	20	15.3	11.4	116	21	17	12.3
9	113	16	14.3	10.5	110	16	16	11.6
10	110	14	14	10.9	116	19	16	12.4
11	100	15	14.9	12.1	115	25	19	14.0
12	107	18	17	12.4	109	17	14	13.1
13	114	17	16	12.3	107	19	16	13.4
14	105	15	18	10.9	109	19	17	10.5
15	110	19	16	11.3	118	20	17	15.2
16	124	21	16	14.3	119	18	17.2	14.8
17	114	20	17	13.1	108	19	17	13.2
18	113	15	15	12.9	105	19	14.5	12.3
19	124	24	17	12.8	109	20	15	11.4
20	114	20	16	13.7	112	19	17	11.9
21	114	22	16.2	11.8	102	19	17	13.1
22	107	19	16.3	13.4	111	17	18	13.4
23	113	17	14.3	12.5	107	17	17	12.9
24	120	20	15	12.7	112	21	17	13.9
25	113	17	15	10.8	108	17	15	13.3
26	115	20	14	11.4	107	19	16	12.9
27	106	15	17	12.5	111	19	18	11.2
28	118	20	17	11.4	104	16	14	11.4
29	117	21	17	10.9	121	20	16	10.9
30	116	19.5	18	12.7	115	19	16	13.1
31	113	18	17	11.1	111	17	15	12.8
32	114	21	17	12.7	109	18	16	12.0
33	109	19	17.5	13.2	109	17	16	11.4
34	131	20	19	13.0	113	19	19	13.2
35	121	19	17.1	13.1	116	20	17	12.1
36	111	16	18	12.0	116	19	16	11.2
37	105	15	14	13.1	116	22	18	10.1
38	118	16	19	10.7	116	19	16	10.3
39	113	20	14	10.9	121	22	16.5	12.1
40	124	22	20	11.5	113	19	16	11.2
41	119	21	19	11.1	114	19	16	10.4
42	110	19	19.1	12.3	107	19	16.5	11.4
43	121	20	17	12.0	125	22	17	12.3
44	120	20	17.9	12.5	119	22	17	13.2
45	118	23	19	11.5	120	21	16	11.9
46	114	17	17.3	11.6	111	19	17	13.0
47	99	15	18	11.6	118	20	17	13.6
48	123	22	20	11.1	115	22	16	12.2
49	120	19	16	12.8	109	18	16.4	13.2
50	114	20	16	12.5	115	22	18.5	12.0

Mean height, weight and mid arm circumference of the subjects

S.No	Tribal children				Non tribal children			
	Height (cm)	Weight (kg)	Mid arm circumference (cm)	hb.(g/dl)	Height (cm)	Weight (kg)	Mid arm circumference (cm)	hb.(g/dl)
51	133	25	20	13.0	112	19	17	14.3
52	122	19	20	12.3	111	18	15	12.1
53	123	20	18	11.1	121	22	17	13.7
54	122	26	20	10.8	134	25	18	11.3
55	122	21	21	11.9	123	23	16	10.5
56	126	21	18	11.3	133	29	19	11.0
57	119	21	18.3	11.1	133	28	17	13.0
58	124	22	21	12.5	121	22	18	10.5
59	105	20	19.9	11.6	126	22	17	12.3
60	105	20	17.8	11.9	122	29	21	13.2
61	125	23	19	12.0	132	25	18	12.0
62	120	20	18	11.1	121	23	18	11.2
63	122	21	18	11.1	124	24	23	12.0
64	120	19	18	11.9	121	19	16	12.3
65	124	22	19	12.0	122	22	19	12.3
66	129	23	19	12.1	128	31	19	12.8
67	137	29	19	12.5	118	29	16.5	13.1
68	130	21	18	11.0	130	25	18	13.9
69	122	19.5	18	11.2	118	19	16	12.5
70	123	23	14.5	13.0	119	20	17	12.3
71	124	24	18	10.5	123	24	17	12.8
72	123	24	20	12.3	143	34	20.5	11.9
73	126	23	21	11.5	130	24	18	13.1
74	123	22	19	10.9	137	24	18.5	12.0
75	137	30	19.4	11.1	121	20	17.1	11.4
76	125	26	19.3	12.0	126	28	18	10.5
77	126	23	20	10.5	118	20	17.3	13.1
78	126	25	19	10.9	133	25	18	14.2
79	130	20	21	11.4	122	22	18	14.8
80	127	21	19.3	10.9	126	25	19	13.3
81	115	20	20	12.1	127	25	18	13.0
82	133	23	19.4	11.8	136	30	19	12.2
83	129	24.5	20	13.1	131	26	18	12.9
84	138	26	19	13.8	126	24	17	11.8
85	131	25	18	12.3	138	30	20	12.0
86	122	25	21	14.9	129	25	19.9	13.2
87	130	24	22	11.3	142	34	21	14.3
88	128	23	25	11.8	132	25	17	14.1
89	127	20	20	11.9	132	25	18	13.1
90	123	21	19	10.5	131	28	19	12.5
91	127	26	21	10.6	136	28	18	10.8
92	135	26	20.5	10.9	151	43	21.9	15.0
93	130	25	20	11.5	122	25	17	14.9
94	142	30	22	12.3	122	24	17	15.1
95	128	26	23	15.1	127	29	18	14.0
96	133	28	21	14.4	139	30	19	13.8
97	143	29	21.4	14.9	150	39	20.5	12.9
98	130	26	12	13.9	133	33	22	15.4
99	125	23	21.7	13.0	124	23	19	13.9
100	126	27	23.1	12.1	125	25	18	12.4

Total Protein, Albumin and Globulin values of the subjects

	Total Protein (g/dL)	Albumin (g/dL)	Globulin (g/dL)
Tribal children			
1.	6,9	3,4	3,5
2.	6,2	4,1	2,1
3.	5,8	3,7	2,1
4.	6,1	4,5	1,6
5.	5,9	3,9	2,0
6.	6,7	4,9	1,8
7.	6,2	4,1	2,1
8.	5,7	4,3	1,4
9.	5,8	4,9	0,9
10.	7,1	5,1	3,0
11.	5,9	3,8	2,1
12.	7,7	4,2	3,5
13.	6,9	4,3	2,6
14.	6,6	4,0	2,6
15.	7,3	4,9	2,4
16.	6,1	3,9	2,2
17.	6,5	4,1	2,4
18.	5,9	3,9	2,0
19.	6,0	4,0	2,0
20.	6,3	4,1	2,2
21.	7,5	4,3	3,2
22.	7,0	4,4	2,6
23.	7,2	4,7	2,5
24.	8,0	4,8	3,2
25.	7,1	4,9	2,2
Non tribal children			
26.	8,3	5,4	2,9
27.	7,8	4,6	3,2
28.	7,1	4,4	2,7
29.	6,9	3,7	3,2
30.	7,4	4,1	3,3
31.	6,5	4,3	2,2
32.	7,1	4,9	2,2
33.	7,4	4,7	2,7
34.	7,7	4,9	2,8
35.	6,9	4,1	2,8
36.	6,7	4,4	2,3
37.	7,3	4,9	2,4
38.	8,1	5,7	2,4
39.	5,9	3,4	2,5
40.	6,5	3,2	3,3
41.	6,8	4,7	2,1
42.	7,4	4,3	3,1
43.	7,6	4,9	2,7
44.	6,1	4,2	1,9
45.	5,9	3,8	2,1
46.	7,4	4,2	3,2
47.	7,7	4,9	3,8
48.	7,8	4,2	3,6
49.	7,1	4,3	2,8
50.	6,9	3,9	3,0

T3 (Triiodothyronine), T4 (Thyroxine), TSH (Thyroid stimulating Hormone) and Iron values.

S.No.	T3 (ng/dl)	T4 (ug/dl)	TSH (μ u/ml)	IRON (mcg/dl)
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TRIBAL CHILDREN

1	110.01	8.3	1.49	106.6
2	132.00	7.1	2.05	110.0
3	120.00	9.4	2.04	120.0
4	108.15	8.2	1.33	87.0
5	143.03	9.4	4.5	120.0
6	128.15	7.3	1.44	111.3
7	140.00	11.5	4.00	67.0
8	114.00	6.5	3.00	90.0
9	109.80	10.8	3.01	114.0
10	102.00	6.01	2.93	104.0

NON TRIBAL CHILDREN

1	107.47	6.9	2.09	105
2	128.78	11.6	1.26	108
3	121.22	7.9	1.48	99
4	149.00	12.15	3.80	124
5	104.89	7.30	3.04	101
6	109.10	4.10	2.68	107.1
7	114.88	3.91	2.91	105
8	105.10	2.08	3.09	106
9	102.47	6.10	2.39	105
10	116.20	12.0	1.42	110