Man In India, **85** (1 & 2) : 49-60

USE OF NUTRITIONAL ANTHROPOMETRY AND CLINICAL EXAMINATION IN THE ASSESSMENT OF NUTRITIONAL STATUS OF CHILDREN

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The present study was undertaken to find out the use of nutritional anthropometry and clinical examination in the assessment of nutritional status of children (3-9 yrs). The study dealt with information regarding index child such as his sex, age, height and weight; his clinical examination and other related information like type and size of family and education of the parents. The results of the study had revealed diversified pattern which were evaluated categorically. The variability in the result suggested that as the index of anthropometry changes the percentage of children who are normal malnourished also changes. The clinical examination revealed that 56% children were apparently normal but many of them had weight/height below standard therefore the relation between clinical examination and nutritional anthropometry was assessed statistically using chi-square test. It was found that height for age and weight for height were not related with clinical examination but the weight for age values were significantly related with clinical examination. The finding concluded that clinical examination and weight can be used together to rapidly assess the nutritional status of children.

Introduction

Health has been defined as a state of complete physical, mental and social well being, and not merely absence of disease or infirmity, which is fundamental human right and that the attainment of the highest possible level of health is a most important world wide social goal whose realization requires the action of many other social and economic sectors in addition to the health sector (WHO, 1983). Nutrition, environment, geographical variation, socio-economic status, size and type of the family etc affect the health of the people. Among these, the 'optimal' nutrition is necessary for 'optimal' health, much attention has been directed towards definition and measurement of optimal state of health.

The epidemiological and etiological consideration of malnutrition and under nutrition has several common characteristic among which some are low

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weight of new born babies, small physical size of their inhabitants, elevated mortality rates particularly during infancy and childhood and as a consequence of this people have short life expectancy. The main reasons for these causalities include under nutrition as well as poor environmental health. These situations lead to decreased productivity and increased waste of human and economic capital including food. This perpetuates and often aggravates undernutrition, thus worsening nutrition and health and therefore, establishing a vicious cycle. This general picture associated with large concentration of still unproductive young people provides the background for underdevelopment (Goodhart and Shills,1973).

The underdevelopment need to be controlled and eradicated totally from the world for achieving fullest worth of all the resources for the attainment of health. Therefore, it is necessary to assess the magnitude of the problem of malnutrition. The assessment of nutritional status of children is an approach, which needs a careful vigil on the part of investigator and requires skill and indices for the correct interpretation of data.

The nutritional anthropometry is useful in field conditions since it is easy to carry out by any person who has expertised the technique and it is less time consuming. Nutritional anthropometry concerns with the measurement of the variation of the physical dimensions and the gross composition of the human body at different age levels and degrees of nutrition and give valuable information covering certain types of malnutrition in which body size and gross body composition are affected (Jelliffe, 1966). Clinical examination is the most applicable method in field for assessment of nutritional status because it is a less time consuming method and also cheaper from the point of view of resources and monetary requirements. Apart from this it gives clear-cut and on the spot information regarding deficiency of particular nutrients.

Among these methods, the use of clinical examination and nutritional anthropometry together may be a better index of nutritional status. But very few studies have been conducted in which nutritional anthropometry and clinical examination are used simultaneously to assess the nutritional status of children (Garcia M. and Kennedy E., 2004). Secondly studies are planned to find out the prevalence of clinical signs and not to find out the nutritional anthropometry and clinical examination, hence the present work was undertaken to find out the use of nutritional anthropometry and clinical examination in assessment of nutritional status with following objectives :

- To assess the nutritional status of children of 3-9 years of age.
- To find out the suitability of indices of anthropometry in the assessment of nutritional status.
- To find out the relationship between clinical examination and nutritional anthropometry in the assessment of nutritional status.

Materials and Methods

Selection of sample

The study was conducted on children hailing from different schools of Udaipur city, Rajasthan. A list of total schools of Udaipur city was prepared and was grouped as private, aided and government. The following schools were then selected randomly for the present study. (Table 1)

TABLE 1 — DISTRIBUTION OF CHILDREN BY SCHOOL AND SEX.

Sl.No.	Name of the School	Male	Female	Total
1	St.Paul's School	98	—	98
2	St Mary's School	9	104	113
3	St. Teresa School	54	74	128
4	Vardhman Jain School	21	43	64
5	Happy home School	56	7	63
6	Rajkiya Uchcha Prathmik Vidyalaya	35	20	55
7	Rajkiya Poorva Prathmik Vidyalaya	39	40	79
	Total	304	296	600

Since the literature available on this subject generally does not cover preschool and school age group, therefore, children from 3-9 years of age were selected for this study. One 'section' of each 'class' or about 10 percent of children belonging to 3-9 years of age were selected for this study. This constituted about 600 children of both the sexes (Table 2).

TABLE 2 — NUMBER OF CHILDREN STUDIED ACCORDING TO AGE AND SEX

Sl. No.	Age (years)	Male	Female	Total
1	3-4	8	10	18
2	4-5	35	50	85
3	5-6	67	63	130
4	6-7	112	81	193
5	7-8	54	69	123
6	8-9	28	23	51
	Total	304	296	600

Development of the tools and collection of data

A questionnaire was developed for collecting the data, which was broadly, grouped under three main aspects; General information of the child's family, anthropometric information regarding index child and clinical examination of the index child. The detailed information about the family of the index child i.e. his/her family composition, education of his/her parents, income of the family etc. were collected by questionnaire method. A proforma was developed and distributed to all children, which was collected by the investigator after it was filled by the parents. Information such as name, age, sex, class etc. were collected and the anthropometric measurements, height and weight were taken by the standardized techniques. In clinical examination, human body was divided into 14 parts and each part was examined for different clinical signs. These parts included general appearance of body such as normal, thin and sick built. Hair were assessed for different signs such a dyspigmentation, easy pluckability, flag signs etc. Face and eyes were seen for protein calorie malnutrition and Vitamin A deficiency respectively. Lips and tongue mainly suggested Vitamin B complex deficiency and anaemia. Similarly, teeth, gums, skin, nails and internal organs etc. were also observed for clinical examination.

Results

Around half of the children were male and similar numbers of female children were represented in the study. The food habits of the family were found as 73.6% vegetarian and 26.4% as non-vegetarian. Seventy seven percent children were from nuclear family where as 22.5% belonged to joint family (Table 3).

TABLE 3 — PERCENTAGE OF CHILDREN BELONGING TO JOINT AND NUCLEAR FAMILY

Sl. No.	Age (years)	Joint	Nuclear	Total
1	3-4	—	2.5	2.5
2	4-5	4.6	10.2	14.8
3	5-6	5.1	15.9	21.1
4	6-7	5.8	24.1	29.9
5	7-8	5.6	16.7	22.2
6	8-9	1.4	8.1	9.5
	Total	22.5	77.5	100.0

Size of the family

The size of the family was determined by counting the number of members of the family, which ranged from 2 to 14. In joint families the number ranged from 5 to 14 and in nuclear families it ranged from 2 to 11. In nuclear families, mostly the families consisted of 3 to 7 members whereas in joint families 6 to 10 member families were more common. Five and 7 member families were most common in nuclear and joint families respectively (Table 4).

TABLE 4 — PERCENTAGE DISTRIBUTION OF FAMILIES BY THE SIZE AND TYPE OF FAMILY

Sl. No.	Number of family members	Joint	Nuclear	Total
1	*2-4	—	30.3	30.3
2	5-7	11.3	43.7	55.2
3	8-10	8.6	3.3	11.8
4	11 & above	2.6	0.2	2.8
	Total	22.5	77.5	100.0

* One parent family

Education of parents

The education of parents was divided into 8 main heads. Only 1.4% parents were highly educated (Ph.D.), while 20.8% parents were illiterate in which percentage of illiterate mothers was higher in comparison to fathers. Similarly more fathers were on the upper side of education whereas more mothers were on the lower side of the education (Table 5).

TABLE 5 — PERCENTAGE DISTRIBUTIONS OF PARENTS BY THEIR LEVEL OF EDUCATION

Sl. No.	Education	Fathers	Mothers	% Literacy
1	Illiterate	12.2	29.4	20.8
2	Primary	2.3	10.4	6.1
3	Middle	6.6	10.6	8.6
4	Hr. Secondary	25.4	21.1	23.3
5	Diploma	1.6	—	1.0
6	Graduate	28.5	17.4	23.0
7	Postgraduate	21.4	10.6	16.0
8	Ph.D	1.9	0.5	1.4
	Total	100.0	100.0	100.0

Prevalence of Malnutrition

Weight for age : Gomez's Classification of weight for age showed that only 2.5% children were severely malnourished where as 17.6% children were normal. Remaining children had mild and moderate form of malnutrition. The male as well as female children had approximately equal presentation for normal and malnourishment (Table 6).

TABLE 6 — PERCENTAGE PREVALENCE OF MALNUTRITION IN CHILDREN ACCORDING TO WEIGHT/AGE* PERCENTAGE

Sl. No.	Weight/age	Male	Female	Total
1	≥90%	9.1	8.5	17.6
2	89-75%	22.4	24.0	46.3
3	74-61 %	17.5	16.0	33.5
4	≤60%	1.5	1.0	2.5
	Total	50.5	49.5	100.0

* Gomez Classification

Height for Age : Height as percentage of standard revealed that 86.8% children were normal and the remaining 13.2% children had heights less than 90% of the standard. The male and female ratio was approximately same for normal and malnourished children (Table 7).

TABLE 7 — PERCENTAGE PREVALENCE OF MALNUTRITION IN CHILDREN BASED ON HEIGHT AS PERCENTAGE OF STANDARD

Sl. No.	Height/age	Male	Female	Total
1	≤90%	6.5	6.7	13.2
2	≥90%	44.0	42.8	86.8
	Total	50.5	49.5	100.0

Composite anthropometry

The composite anthropometry revealed that the percentage of the children suffering from chronic, current and severe form of malnutrition were very few, whereas highest percentage of children were suffering from current moderate form of malnutrition. A marked difference was seen in percentage of normal and malnourished children by different composite anthropometrics. The male and female ratio was approximately equal (Table 8).

TABLE 8 — PERCENTAGE PREVALENCE OF MALNUTRITION IN CHILDREN ACCORDING TO HEIGHT/AGE AND WEIGHT/HEIGHT VALUES

		Weight/height						
		<90%		80-90%		>90%		
Sl. No.	Height/age	Male	Female	Male	Female	Male	Female	Total
1	<90%	1.5	1.4	3.3	3.3	1.5	2.2	13.2
2	≥90%	5.5	5.1	23.7	20.7	15.1	16.7	86.2
	Total	7.0	6.5	27.0	24.0	16.6	18.9	

Growth retardation

The pattern of growth retardation in male and female children according to their age was calculated on the basis of percent height and percent weight. The mean weight percentage values revealed that all the children irrespective of their sex were suffering from mild form of malnutrition. The height percentage values revealed that all the children were normal irrespective of their sex and age. The percentage weight was below 80 in the children of both the sexes aging 3-4 years (Table 9).

TABLE 9 — MEAN HEIGHT, WEIGHT VALUES AS PERCENTAGES OF STANDARD VALUES BY AGE AND SEX

Sl. No.	Age (years)	Percent height		Percent weight	
		Male	Female	Male	Female
1	3-4	92.6	92.1	78.3	79.8
2	4-5	94.5	95.0	81.3	84.9
3	5-6	93.9	92.6	84.0	81.0
4	6-7	96.8	95.4	84.6	83.3
5	7-8	98.5	95.3	82.0	81.3
6	8-9	96.0	95.6	79.8	80.1

Clinical examination

Based on the presence of clinical signs the children were categorized as listed in Table 10. Around 56% children did not have any clinical sign while remaining had one or the other ailment. The upper respiratory infection was more common in male children in comparison to female. Worm infestation was also more common in male children. The picture of anaemia revealed that more male children were suffering from anaemia than female children. The prevalence of Vitamin B complex deficiency was equal in male and female children whereas Vitamin A deficiency was more common in male children. Acute obesity was seen in male children only. Only one female child had grade III anaemia with PEM, one female child was richatic. One female child was albino with photophobia and angular conjunctivitis and one female child had protein energy malnutrition with Rheumatic heart disease (Table 10).

TABLE 10 — NUMBER OF CHILDREN SUFFERING FROM DIFFERENT AILMENTS AT THE TIME OF STUDY

Sl. No.	Ailments	Male	Female	Total
1	Apparently normal	165	171	336
2	PEM with Anaemia+	16	8	24
3	PEM with Anaemia++	10	13	23
4	PEM with Anaemia+++	—	1	1
5	Anaemia+	67	45	112
6	Anaemia++	52	25	77
7	Anaemia+++	—	1	1
8	Obese	4	—	4
9	Vitamin A deficiency	12	7	19
10	Vitamin B complex	4	4	8
11	Vitamin D deficiency	2	6	8
12	Angular conjunctivitis	12	14	26
13	Mucopurulent conjunctivitis	—	1	1
14	Albino with photophobia	—	1	1
15	URI	11	1	12
16	Worm infestation	3	—	3
17	Cervical lymphadenopathy	1	1	2
18	PEM with RHD	1	—	1
	Total	50.5	49.5	100.0

Clinical examination in relation to nutritional anthropometry

The dependence of the two methods on each other was assessed using chi-square, test. This test was applied between a) clinical examination and height for age, b) clinical examination and weight for age. The analysis of weight for age revealed that as the weight decreases the number of clinical signs increase. Therefore, it is concluded that weight and clinical signs were dependant on each other. The analysis for height for age revealed that for assessment of nutritional status the result given by clinical examination did not match height for age values (Table 11 and 12).

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4	PEM with Anaemia+++	—	1	1
5	Anaemia+	67	45	112
6	Anaemia++	52	25	77
7	Anaemia+++	—	1	1
8	Obese	4	—	4
9	Vitamin A deficiency	12	7	19
10	Vitamin B complex	4	4	8
11	Vitamin D deficiency	2	6	8
12	Angular conjunctivitis	12	14	26
13	Mucopurulent conjunctivitis	—	1	1
14	Albino with photophobia	—	1	1
15	URI	11	1	12
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TABLE 11 — CHI-SQUARE TEST OF 2 x 2 CONTINGENCY TABLE BETWEEN CLINICAL EXAMINATION AND WEIGHT/AGE VALUES

Anthropometry (Weight/age)	Clinical examination		Total
	Apparently normal	Apparently not normal	
Normal	73	33	106
Malnourished	263	231	494
Total	336	264	600

Chi-square tabulated at 5% level of significance = 5.99
Chi-square calculated = 8.64
Therefore, the two methods are dependent.

TABLE 12 — CHI-SQUARE TEST OF 2X2 CONTINGENCY TABLE BETWEEN CLINICAL EXAMINATION AND HEIGHT/AGE VALUES

Anthropometry (Height/age)	Clinical examination		Total
	Apparently normal	Apparently not normal	
Normal	39	40	79
Malnourished	297	224	521
Total	336	264	600

Chi-square tabulated at 5% level of significance = 5.99
Chi-square calculated = 1.62
Therefore, the two methods are independent of each other.

Therefore, it is concluded that if weight is taken along with clinical examination it minimizes the work and above all give on the spot information regarding health and nutritional well being of the child.

Discussion

The prevalence of malnutrition was assessed taking into consideration various anthropometric indices like height for age, weight for age, weight/height. The weight for age index revealed that mostly children suffered from mild form of

malnutrition (46%), where the severe form of malnutrition was seen in very few cases (30%). The height for age index showed that only 13% children were malnourished. When height and weight/height values were taken into consideration, it was found that most of the children were suffering from current moderate form of malnutrition. Therefore, it can be concluded that as the index of assessment of nutritional status changes the state of prevalence of malnutrition also differs. The same type of disharmony in results was reported by Trivedi *et al*, (1971); Bhandari *et al*., (1972); Gadre, (1973); NIN study, (1976); Gupta *et al*., (1979); Choudhary and Visweswara Rao, (1983); Ramankutty *et al*., (1981); Dewey, (1983); Rao *et al*., (1990) etc.

The sketch of growth deficit revealed that all the children had normal heights whatever results other anthropometric values suggested. The mean weight percentage in 3-4 years age were low for both the sexes which suggests that this age group is a vulnerable one and also, is a transitional period in the life of child, hence proper care and nutrition must be provided for better growth. Children of other age groups were having 75-89% weight of the standard weight.

The clinical examination of children revealed that those who were apparently normal also had normal height but weight wise these children were suffering from mild form of malnutrition. The children who were apparently not normal they also had normal mean height whereas weight wise these children were suffering from mild form of malnutrition.

The clinical examination also showed that Vitamin A deficiency was most prevalent. Vitamin B complex was less common but Vitamin D deficiency was least prevalent. A large percentage of children suffered from grade I and grade II anaemia and PEM. Further, the clinical examination revealed that 56% children were apparently normal.

Therefore, it was felt necessary to find out the correlation between nutritional anthropometry and clinical examination in assessment of nutritional status. The chi-square test was applied between clinical signs and height for age and weight for age (Rao, K. V., 1995).

The results revealed that height for age index was not related or associated with clinical examination, but the weight for age values were significantly related with clinical examination (Table 11 and 12). This may be due to the reason that weight is more sensitive and fluctuates on little stress. The prevalence of PEM is best indicated by weight deficiency in all age groups and by growth failure in children. The growth of a child is normally assessed by changes in his weight over a period of time (Jelliffe, 1966).

Therefore, if weight is taken along with clinical examination it minimizes the work and above all give on the spot information regarding health and nutritional well being of the child. Nabarro and Mc Nab (1980) have recommended the combination of clinical examination and anthropometric assessment as a valuable approach to the identification of the acutely malnourished children.

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