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Prevalence of malnutrition among the Chiru children of Manipur, India

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Abstract
The present study describes the nutritional status of 4 to 12 year-old Chiru children of Manipur, India evaluated with the help of anthropometric measurements. The Chiru is one of the 33 Scheduled tribes of Manipur. The study is based on height and weight of 322 children among whom 172 were boys and 150 girls. It also aims to throw light on different conventional methods of nutritional assessment based on height and weight and their varied results. The Chiru children are shorter in height and lighter in body weight as compared to the NCHS (National Centre for Health Statistics) and ICMR data on Indian children in all the age groups. According to Waterlow's classification of height for age, about 51% of the Chiru boys and girls are below -2SD score, whereas according to Gomez's classification of weight for age shows that 31.37%, 49.69% and 15.53% fall under mild, moderate and severe malnourished, respectively categories. Waterlow's classification of weight for height depicts 70.50% of the children as normal.

Keywords: malnutrition; height; body-weight; Chiru

Introduction

It is well known that nutritional status is a major determinant of the health and well-being among children and there is no doubt regarding the importance of the studies of nutritional status on children according to spatial and temporal dimension (NFHS-2, 2002). In developing country like India, children and adults are vulnerable to malnutrition because of low dietary intakes, infectious diseases, lack of appropriate care, and inequitable distribution of food within the household. Children belonging to scheduled castes, scheduled tribes, or other backward classes have relatively high levels of under nutrition according to all three measures.

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Children from tribal communities have the poorest nutritional status on almost every measure, and the high prevalence of wasting in these noticed groups (28%) is of particular concern (Balgir, 2004).Tribal communities in general and primitive tribal groups in particular are highly disease prone. Also they do not have required access to basic health facilities. They are most exploited, neglected, and highly vulnerable to diseases with high degree of malnutrition, morbidity and mortality Their misery is compounded by poverty, illiteracy, ignorance of causes of diseases, hostile environment, poor sanitation, lack of safe drinking water and blind beliefs, etc. (Balgir, 2004).

The nutritional status of individuals is commonly evaluated through the use of anthropometry. Anthropometric measurements are used as outcome indicators that reflect the end result of all the factors that affect nutritional status (Reddy, 2006). Under nutrition in children, encompassing stunting, wasting and underweight, a low body mass index in adolescents and adults, are some of the major consequences of energy and nutrient deficits (James, 1998). Inadequate nutrition is a problem throughout India, but the situation is considerably better in some states than in others. Under-nutrition is most pronounced in Madhya Pradesh, Bihar, and Jharkhand. Nutritional problems are also substantially higher than average in Meghalaya and (for stunting) in Uttar Pradesh. Nutritional problems are least evident in Mizoram, Sikkim, Manipur, and Kerala, and low levels of under nutrition are also notable in Goa and Punjab. Nutritional problems are pronounced in every state in India. The proportion of children under age five years who are underweight ranges from 20% in Sikkim and Mizoram to 60% in Madhya Pradesh. In addition to Madhya Pradesh, more than 50% young children are underweight in Jharkhand and Bihar. Other states where more than 40% of children are underweight are Meghalaya, Chhattisgarh, Gujarat, Uttar Pradesh, and Odisha. In Meghalaya, Madhya Pradesh, and Jharkhand, one in every four children is severely underweight. Although the prevalence of underweight is relatively low in Mizoram, Sikkim, and Manipur, even in these states more than one-third of children are stunted. Wasting is most common in Madhya Pradesh (35%), Jharkhand (32%), and Meghalaya (31%). Even in these states, however, levels of under nutrition are unacceptably high (NFHS-3, 2006).

The present study was designed to understand the nutritional status among Chiru, one of the vulnerable groups of Manipur, India. Various national and state health surveys have left this tribe as far as nutritional status is concerned. So, this study will be first of its kind among this tribe based on randomly selected cross-section of 322 children aged 4 through 12 years in the state of Manipur, India.

Luxmi, Y., & Sachdeva, M. P. (2012). Prevalence of malnutrition among the Chiru children of Manipur, India *International Journal of Human Sciences* [Online]. (9)2, 405-416.

Materials and methods

The State and the tribe

Manipur State is situated along the north eastern border of India between longitudes 93.20"E and 94.47"E and latitudes 23.50"N and 25.41"N. It is surrounded by the states of Nagaland in the north, Assam in the west, Mizoram in the south, and the Union of Myanmar in the east. Having an area of roughly 22,372 sq. km, with a valley in centre and surrounding hills, is an economically backward state with a per capita income (at 2003-04 prices) of 14766 rupees compared to 20989 rupees for the Indian average. The valley is chiefly populated by the Meiteis and the hills by the Naga and Kuki tribes. The majority of the Meiteis are Hindus and tribes are christians show many mongoloid characteristics (Gaur and Singh, 1994). Chiru villages are mainly scattered in the foothill areas. They have only 5622 persons in Manipur according to 2001 census. The term Chiru means simple hill people. They speak dialect called old Kuki language; it is closely related to central "Chin language" (Greirson, 1908-09). They follow Christian religion and have a patrilineal society. Rice is the staple diet of the Chirus.

The sample

The sample for the present study was drawn from 6 Chiru villages viz., Bungte Chiru, Uran, Waithou, Nungsai, Sadhu and Kangchup chiru Village, all of the villages are including under the Senapati District. Study consisted samples of 322 children of whom 172 were boys and 150 were girls aged between 4 through 12years.

Age Estimation

As many of Chiru children as many did not know their date of birth, ascertainment of age was not easy but not very difficult too. Though they do not maintain birth records, they are very conscious of an individual's age, which is, as per their tradition, determined by the number of New Year and Christmas that an individual has passed through since birth. Their ages were confirmed with the help of aged members of the households and villages, along with the church member and village chief. For conversion of the traditional age into biological (Gregorian) age, it was essential to inquire if the child was born before or after a New Year event and the time gap from the New Year in month and days if possible to recollect. Conversion into decimal age was not done because of uncertainty of exact date of birth in a number of cases. Assignment of the children into appropriate age group is the first and foremost important step to be taken up in any age dependent investigation, like growth and nutritional status. In the present study, the children belonging to 4 to 5 years of age, e.g., those who have completed 4 years and more but not attained 5, have been grouped together as 4+ years and so on.

Luxmi, Y., & Sachdeva, M. P. (2012). Prevalence of malnutrition among the Chiru children of Manipur, India *International Journal of Human Sciences* [Online]. (9)2, 405-416.

Anthropometric measurements

Anthropometric measurements of weight and height of boys and girls were taken as per the IBP recommendation. The same investigator collected all the measurements to avoid the inter observer error, and for maintaining uniformity and accuracy in techniques. Anthropometer was used to measure height of the boys and girls. The reading was taken to the nearest 0.1mm, and weighing machine was used to weigh of the boys and girls wearing minimum clothing and it was recorded to the nearest 0.5 kg.

Analysis

The parameters included in the study were height, and weight. For analytical purpose, classifications of Waterlow's height for age and weight for height, Gomez's weight for age were used for children (aged 4 to 12 years) using NCHS reference data. Ht/Age and Wt/Ht were expressed as SD scores (z-scores) using the reference data of the National Centre for Health Statistics (NCHS) (Hamill et al., 1979). The cut-off points for mild, moderate and severe malnutrition for the z-scores of these indices were -1.1 to -2.0 SD, -2.1 to -3.0 SD, and -3.1 to -4.0 SD, respectively.

Results

Table 1: Comparative figures of 50th percentile values of Height (cm) of NCHS, ICMR and Chiru boys and girls

Sl. No.	Age	NCHS		ICMR		Present study	
		Boys	Girls	Boys	Girls	Boys	Girls
1	4	106.6	105.0	104.7	104.2	98.4	95.1
2	5	113.1	111.6	113.5	112.2	99.7	99.2
3	6	119.0	117.6	118.9	117.7	106.2	99.9
4	7	124.4	123.5	123.3	122.6	110.3	110.4
5	8	129.6	129.3	127.9	127.2	113.9	111.1
6	9	134.8	135.2	133.6	133.1	122.0	115.3
7	10	140.3	141.5	138.5	145.0	124.2	119.6
8	11	146.4	148.2	143.4	150.9	128.3	122.9
9	12	153.0	154.6	148.9	153.4	134.3	128.9

Table 1 shows the Mean height of Chiru children 4 to 12 years of age compared with 50th percentile values of National Centre for Health Statistics (NCHS) and Indian Council for Medical Research (ICMR). It appears that American children are taller than the Indian children in all the age groups except at 10 and 11 year groups, during which the 50th percentile values of Indian girls are slightly higher than those of NCHS girls. The Chiru children are, however, shorter even when compared to ICMR data. Median height (i.e., 50th percentile) of NCHS boys ranges from 106.60 cm at 4 years of age to 153.00cm at 12 years. Comparative height for the Indian boys of 4years is 104.70cm and that of the Chiru boys is 98.4 cm. At the age of 12 years the height of the Indian

Luxmi, Y., & Sachdeva, M. P. (2012). Prevalence of malnutrition among the Chiru children of Manipur, India *International Journal of Human Sciences* [Online]. (9)2, 405-416.

boys increases up to 148.90 cm and the Chiru boys up to 134.30cm. Comparative height among the NCHS girls ranges from 105.00cm at 4 year to 154.60cm at 12 years. Indian girls show the picture as 104.19cm at 4 year and 153.40cm at 12 years. For the Chiru girls it ranges from 95.10cm at 4 years to 128.90cm at 12 years.

Table 2 exhibits the 50th percentile values of the weight of these children. Almost the same picture is observed in case of weight too. The Indian children are lighter than those of NCHS and the Chiru children represent the lightest of the three groups in all the age groups. The weight of 4 years old NCHS boys is 17.7kg while that of the girls is 16.8kg. The weights for Indian children of this age group are 16.7 kg for boys and 16.0 kg for girls. The respective median weights of the Chiru boys and girls of the same age group are 13.8 and 12.5 kg, respectively. At the age of 12 year the weight of NCHS is 42.3kg for boys and 43.8kg for girls, and the weight of Indian children are 37.0kg for boys and 38.7 kg for girls whereas the weight of Chiru at the age of 12 year are 29.7kg and 27.1kg for boys and girls respectively.

It is noteworthy that both in NCHS and ICMR data the girls of 10 and 12year group overtake their counterpart boys in both height and weight. This is an indication of early maturation of the girls than the boys. Generally, the boys are heavier than the girls. But by virtue of earlier onset of maturation of the girls, they appear to overtake the boys in size and weight during a certain period of growth. But the present study shows contrasting results as compared to NCHS and ICMR data.

Table 2: Comparative figures of 50th percentile values of Weight (kg) of NCHS, Indian (ICMR) and Chiru boys and girls

Sl. No	Age	NCHS		ICMR		Present study	
		Boys	Girls	Boys	Girls	Boys	Girls
1	4	17.7	16.81	16.7	16	13.8	12.5
2	5	19.7	18.56	18.7	17.7	14.3	13.6
3	6	21.7	20.61	20.7	19.5	15.8	16.5
4	7	24.0	23.26	22.9	21.8	19.6	18.3
5	8	26.6	26.58	25.3	24.8	22.7	20.0
6	9	29.7	30.45	28.1	28.5	24.2	21.7
7	10	33.3	34.72	31.4	32.5	26.2	23.5
8	11	37.5	39.23	32.2	33.7	26.4	26.0
9	12	42.3	43.84	37	38.7	29.7	27.1

Table 3 shows the anthropometric indices of malnutrition by sex for the entire sample. Using the Wt/Age classification of Gomez et al. (1956) about 96% of the children showed some degree of malnutrition. The majority (49.69%) were only moderately malnourished. There were more normal boys than girls, and the percentage of moderately and mildly malnourished boys was also higher

Luxmi, Y., & Sachdeva, M. P. (2012). Prevalence of malnutrition among the Chiru children of Manipur, India *International Journal of Human Sciences* [Online]. (9)2, 405-416.

than girls whereas severely malnourished was seen higher in girls (24.00%) as compared to boys (8.14%). About 92% of the children displayed different degrees of stunting (1 SD or more below the reference median), as defined by Waterlow et al. (1977). Of these, about 39.75%, 31.99% and 20.50% are suffered as mild moderate and severe stunting, respectively. The frequency of boys with normal Ht/Age (1 SD or less than the reference median) was little greater than that of girls (7.33%). The majority of children (about 70%) showed no signs of wasting; only 1.24% suffered from severe wasting, and the remainder (about 23%) had moderate and (4.97%) mild wasting. Girls were slightly better off in this regard but girls had greater severe wasting (2.00%) than boys (0.58%). According to the criteria used, apart from a few exceptions most of the results revealed that both boys and girls had quite similar frequencies of malnutrition.

Table 3: Prevalence (%) of malnutrition by sex in Chiru children

Anthropometric Index	Boys		Girls		Sexes Combined	
Weight for Age*	N	%	N	%	N	%
>90 %	8	4.65	3	2.00	11	3.42
75-90%	58	33.72	43	28.67	101	31.37
60-75%	92	53.49	68	45.33	160	49.68
<60 %	14	8.14	36	24.00	50	15.53
Total	172	100.00	150	100	322	100
Ht/age (Stunting)**						
> -1SD score	14	8.14	11	7.33	25	7.76
-1SD to -2SD	78	45.35	50	33.33	128	39.75
-2SD to -3SD score	51	29.65	52	34.67	103	31.99
<-3SD score	29	16.86	37	24.67	66	20.50
Total	172	100.00	150	100.00	322	100.00
Wt/Ht (Wasting)**						
> -1SD score	119	69.19	108	72.00	227	70.50
-1SD to -2SD	47	27.33	28	18.67	75	23.29
-2SD to -3SD score	5	2.91	11	7.33	16	4.97
<-3SD score	1	0.58	3	2.00	4	1.24
Total	172	100.00	150	100.00	322	100.00

*Gomez et al. (1956); **Waterlow et al. (1977)

The incidence of stunting is substantially higher than wasting in the sample in both sexes. The prevalence of stunting is higher in the age of 5years in boys whereas in girls stunting showed higher at the age of 6 years. This indicates that impaired nutrition during infancy and early childhood, lead to a deficit in attained stature (Fig.1). There is an increase in the prevalence of stunted boys and girls at the age of 10 and 11 years but in case of girls it is observed at the age of 10, 11 and 12 years. Therefore girls showed higher prevalence of stunting with increasing age. The maximum frequency

Luxmi, Y., & Sachdeva, M. P. (2012). Prevalence of malnutrition among the Chiru children of Manipur, India *International Journal of Human Sciences* [Online]. (9)2, 405-416.

of wasting in children with z-scores -2SD or more below the NCHS median was observed at 5 years of age in both boys and girls. Acute malnutrition or wasting is shown higher (2%) in girls than boys (0.58%) at 5 years of age. The increase in weight seems to have taken place at the expense of stature.

Table 4: Mean and Standard deviation (SD) of z-scores by age and sex for anthropometric indicators of nutritional status in Chiru children

Age (Years)	N		Wt/Age				Ht/Age				Wt/Ht			
			M		F		M		F		M		F	
	M	F	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
4	15	16	-1.75	±0.41	-1.91	±0.50	-1.44	±0.44	-1.62	±0.58	-1.06	±0.75	-1.41*	±0.76
5	24	21	-1.82	±0.62	-1.92	±0.11	-2.66	±0.93	-1.62*	±1.00	-0.80	±0.97	-1.82	±1.14
6	23	16	-1.39	±0.41	-2.58*	±1.00	-1.78	±0.77	-2.65*	±0.62	-0.62	±0.94	0.50	±0.98
7	20	10	-1.30	±0.48	-1.10	±0.32	-2.27	±1.04	-1.60*	±0.53	-0.22	±0.80	-0.20	±0.70
8	16	16	-1.08	±0.35	-1.10	±0.45	-2.24	±0.98	-2.37	±1.16	0.32	±1.37	0.29*	±1.33
9	16	16	-0.89	±0.44	-1.14*	±0.35	-1.50	±0.77	-2.24	±0.86	0.01	±1.39	0.42*	±1.24
10	16	16	-0.94	±0.49	-4.40*	±1.02	-2.11	±1.18	-2.37	±0.89	0.85	±1.51	0.65*	±1.19
11	21	22	-1.33	±0.38	-4.48*	±1.00	-2.17	±0.48	-2.50*	±0.76	-0.02	±0.74	0.13*	±1.14
12	21	17	-1.57	±0.21	-2.94*	±0.51	-1.76	±1.01	-4.11*	±0.70	-0.58	±1.06	-0.48*	±0.99

M = male; F=female; * = statistically significant ($P \leq 0.05$) difference between sexes

Table 4 exhibits the descriptive statistics of the z-scores of wt/Age, Ht/Age and Wt/Ht by age and sex. The majority of the children have z-scores between -2 and -1 SD below the reference median for Wt/Age in boys. Girls have higher z-scores than boys. Mean z-scores of Ht/Age fall between -1 and -3SD of the reference median. However, 12 years of girls have z-score < -3SD below the NCHS median indicating severe stunting. The mean values of z-scores for Wt/Ht of Chiru children fall between > 0 and -2SD of the reference median, indicating that, on an average of Chiru children were normal with respect to Wt/Ht.

The mean z-score for Wt/Age, Ht/Age and Wt/Ht were statistically significant in more or less in all age groups between the sexes. In the age group of 4 years, it is found in Wt/Ht; at ages 5, 6,7 and also in 11 and 12 years the significant difference is observed in Ht/Age, at age 8 the difference is found at Wt/Ht and in age 9, 10, 11 and 12 the statistically significant differences is observed in both Wt/Age and Wt/Ht. Interestingly, in all the cases, the differences is due to Stunting or Wasting in case of girls compared to boys (table 4, figure 1). In general, the sex differences in mean z-scores for Wt/Age, Ht/Age and Wt/Ht were statistically not significant, except in some age groups, indicating that girls were more affected than boys. This is an indicative of preferences of boys in the family. Boys have enjoyed of getting proper diet compared to girls.

Luxmi, Y., & Sachdeva, M. P. (2012). Prevalence of malnutrition among the Chiru children of Manipur, India *International Journal of Human Sciences* [Online]. (9)2, 405-416.

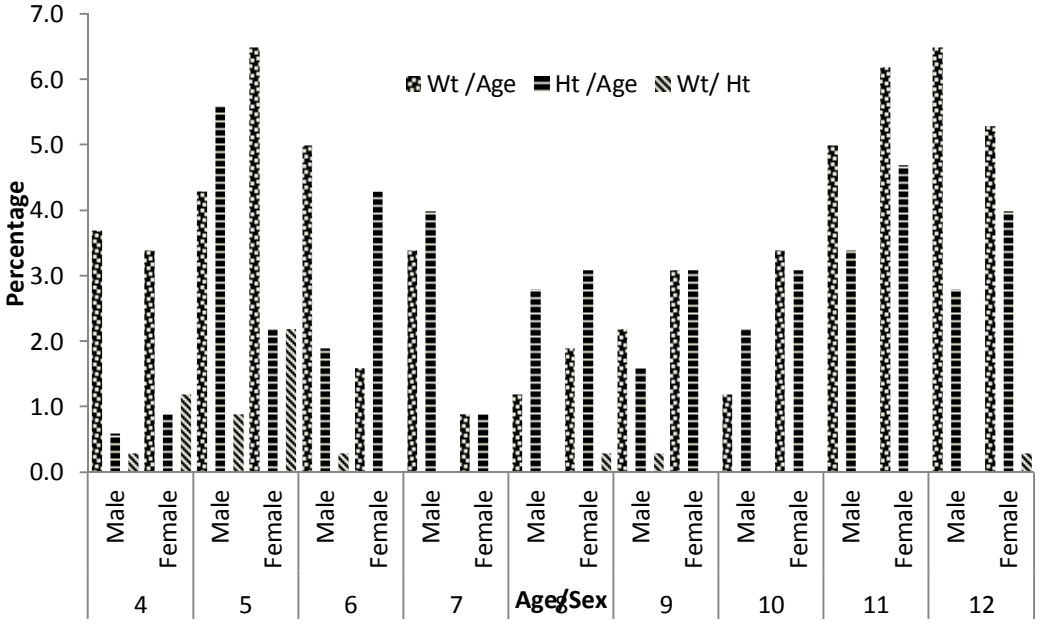

Figure 1: Percentage distribution of Chiru Children with Z-scores -2 SD or more below the reference median for Wt/Age, Ht/Age, Wt/Ht by Age and Sexes.

Table 5 presents a 4×4 breakdown of z-score for Ht/Age vs Wt/Ht. In relatively undernourished populations, the cross tabulation of St/age against Wt/Ht is recommended using z scores (Waterlow et al., 1977). Such tabulation presents better picture since many children may fall in both under Wt/Ht (wasted) and under Ht/Age (Stunted) categories. Wt/Ht is an index of current nutrition (Waterlow et al., 1977; World Health Organization., 1986).

St/Age is an indicator of past nutrition (Waterlow et al., 1977) and has been suggested as a measure of overall social deprivation (WHO, 1986). It is evident from Table 5 that for the present state of nutrition, 93.79% of the children were normal and 4.97% and 1.24% had mild to moderate wasting. On the other hand, only47.52% children were normal, 31.68% had mild stunting and the remainder 16.15% and 4.66% had moderate to severe stunting in Ht/age. Combining the two indicators, it is clear that only about 43% of the children were normal while the remainder suffered from either wasting or stunting.

Luxmi, Y., & Sachdeva, M. P. (2012). Prevalence of malnutrition among the Chiru children of Manipur, India *International Journal of Human Sciences* [Online]. (9)2, 405-416.

Table 5: Cross tabulation of z-scores of Wt/Ht (Wasting) and Ht/Age (stunting) in Chiru children aged 4-12 years

		Stunting (Ht/Age)				
	Grade		0	1	2	3	Total
		Z-Score as %	>-2.00	-2.00 to -2.99	-3.00 to -3.99	< -4.00	
Wasting (Wt/Ht)	0	>-2.00	43.17	30.44	15.53	4.66	93.79
	1	-2.00 to -2.99	3.11	1.24	0.68	0.00	4.97
	2	-3.00 to -3.99	1.24	0.00	0.00	0.00	1.24
	3	< -4.00	0.00	0.00	000	0.00	0.00
		Total	47.52	31.68	16.15	4.66	100.00

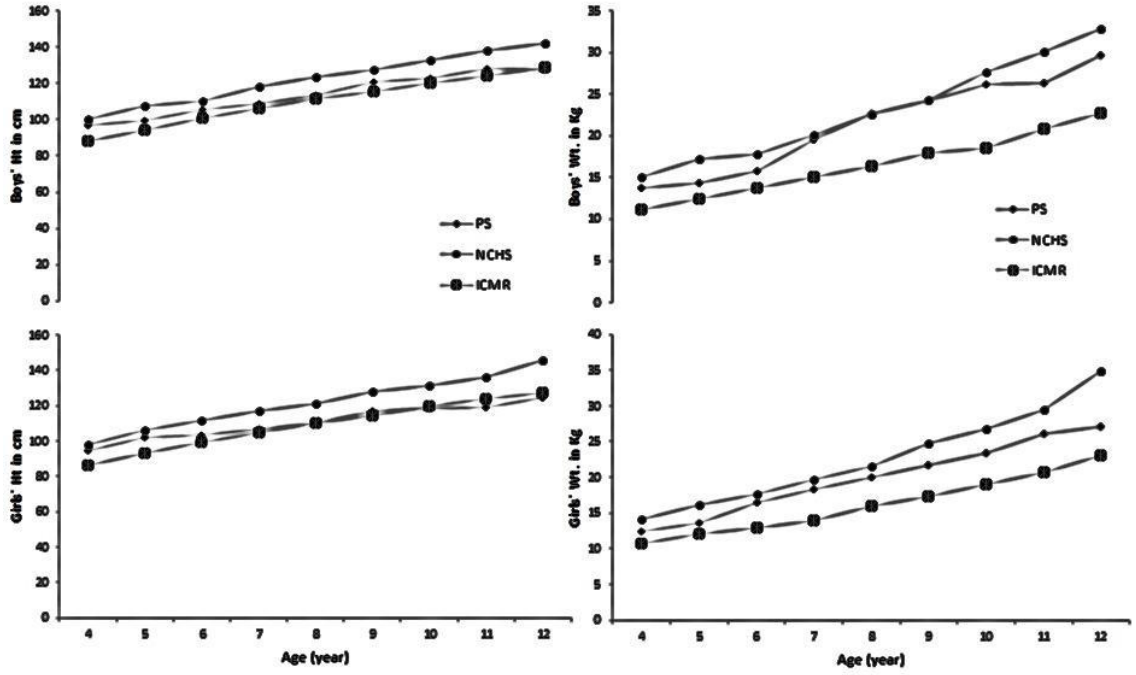

Figure 2: Height and weight of Chiru children relative to NCHS and ICMR reference data.

Figure 2 shows relative pictures of Chiru with 10th percentile reference data of NCHS and ICMR. The majority of the children in terms of weight and height lie between the NCHS 10th percentile and ICMR 10th percentile reference data. However, in the case of 7 to 9 years boys weights are somewhat similar to NCHS reference. And also in the case of height of both sexes show similar to ICMR reference data in the age groups 7 and 8 years in boys and 7, 8 and 9 years among girls respectively.

Discussion

The present study shows that the Chiru children of 4 to 12 years are shorter (stature) and lighter (weight) than those NCHS and ICMR. The nutritional status of the Chiru children is quite disappointing with about 93% of them being malnourished of different grades according to

Waterlow's classification height for age (stunting). The picture is more disappointing when the assessment on body weight (Gomez's classification) is taken into account; about 96% of them belonged to different grades of malnutrition while only 4% were normal. But if we look at Waterlow's classification of weight for height (wasting), the Chiru children's condition is not so disappointing; it displays 70.50% as normal.

According to weight for height method of assessment, 70.50% of the Chiru children are normal, that is the greatest value of normal children of all the classifications. Without further question on the reliability, validity, or suitability of these different classifications of nutritional assessment, it may be recalled that the Chiru children are shorter in height and lighter in weight than the NCHS and Indian children. Different methods for assessment of nutritional status give different results. Nutritional status, therefore, cannot be hastily stated without referring to the method upon which the report is based. What appears to be a matter of concern in nutritional research is the selection of a classification (method) that will be best suited with the situation. For instance, Gomez's classification of nutritional status, which is based on weight for age, yields greater frequency of malnourished children than Waterlow's classification of height for age in the present study. It is commonly believed that in many Indian populations, girls are at a greater nutritional disadvantage than boys (Miller, 1981). This is sometimes reflected in anthropometric dimensions which fall short of reference standards more often in females (Rao et al., 1976). A similar study conducted among Meitei children of Thanga of Manipur (Gaur and Singh., 1994) depicted that 90% of the children were some degree of malnutrition. About 72 % of children showed different degrees of stunting. And another study is among the Meitei scheduled caste children of Sekmai of Manipur had shown that 43.37% were malnourished according to Waterlow's classifications and 68.7% were malnourished when the assessment on body weight of Gomez's classification. (Singh & Singh., 2006)

In this regard, it may be said that body weight is a more appropriate indicator of nutritional status than height. Loss of body weight due to malnutrition, starvation, illness, etc. could be easily noticed in both the temporary and long-term basis. Height, on the other hand, is not easily fluctuating. Inability to achieve the minimum expected height may be the result of long-term malnourishment, illness, and so on. Weight is therefore more preferable to height in nutritional assessments.

Conclusion

From the above results and discussion, we can conclude that, all these are indicative of certain prevailing and past conditions and the present status which may affect the future condition either as a risk or normal. The extent of malnutrition expressed by the above indices is predictive of the

future risk situations such as the disease or morbid condition, poor health and poor nutritional conditions at the population level.

Chiru's diet seems to be inadequate; it may be because of lack of availability of specific food or may be lack of knowledge of about essential nutritious food. Malnutrition may also be associated with factors such as morbidity, maternal employment patterns, child care-giving arrangements and education level etc. Hence, there is a need to create awareness among Chiru about nutrition and health.

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