Research Paper

Anthropometric assessment of growth and nutritional status of school going boys of Himachal Pradesh

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ABSTRACT *The study intends to conduct an anthropometric assessment to evaluate the nutritional status of the school going boys of Himachal Pradesh between 9 – 11 years of age. Height for age, weight for age and BMI for age was evaluated as per WHO standard to evaluate the prevalence of stunting, under nutrition and thinness and Z- scores values were calculated. An increasing pattern was observed for height, weight and BMI with age in all the age groups. None of the subjects were classified as severely stunted or under nutrition. The prevalence of moderate stunting and under nutrition was much lower than the mild category Malnutrition in terms of stunting and wasting was lower as compared to other reports from other Indian states. Prevalence of stunting was less than that of wasting which reflected an acute state malnutrition.*

INTRODUCTION

School-going boys represent the most important segment of our society and their nutritional standards and growth patterns are the representative of health status of a community. Physical growth of children is reflected mainly by simple anthropometric measurements like height and weight.

The incidence of child under nutrition in the developing countries is alarmingly high, which is considered to be the primary cause of ill health and premature mortality among children in these countries (Nandy et al. 2005). A study in past by James(1998) had revealed that India alone accounts for about 40% under-nourished children in the World. Some recent studies by Som et al. (2006) showed that under nutrition among children is prevalent in almost all the states in India. A more recent study by Mondal and Sen (2010) revealed that child under nutrition (thinness) is a major underlying problem in Indian rural children.

Nutritional studies in India conducted among infants and preschool children are comparatively more than those conducted among school children and adolescents. However, previous studies conducted among adolescents in India showed higher prevalence of under nutrition (Anand et al.1999, , Medhi GK et al. 2006, Thakur et al. 2006,Marwaha et al. 2011).

Nutritional studies have also revealed that variation in life style, food habits and traditional socio-cultural activities may lead to high incidence of under nutrition among children (Balgir et al.2002 and Rao et al. 2006). Hence extreme diversification of climatic and socio cultural norms is sure to influence the nutritional status of the children in different areas of India.

Himachal Pradesh has its unique geographically isolated life style from the majority of states of India and more over the Hill state has undergone a major economic transition in the last decade. It has been well reflected in other studies that economic transition and in equality in health status is a major determinant of nutritional status of the community particularly affecting the children and adolescents (Kanjilal et al.2010). Nutritional studies conducted in Himachal Pradesh are scanty as compared to other area - parts of India. A study was conducted on the nutritional status of girls (Talwar, 2010), but no recent reports on the nutritional status of boys are available.

Under this backdrop, a cross – sectional study was conducted to evaluate the nutritional standard of the school going boys of Himachal Pradesh within the age group of 9 – 11 years. Attempts have been made to report the height, weight and BMI of these children and to compare them with other Indian studies and national standards. The prevalence of under nutrition in terms of stunting and wasting was also evaluated as well.

METHODOLOGY

Subjects

A total of 172 school-going boys between 9 – 11years were studied from 4 different schools of Sundernagar area of Mandi district of Himachal Pradesh. The design of the study and extent of involvement of boys were explained to them in presence of parents and teacher and consents were obtained from the parents. Boys suffering from any chronic disease during the time of examination were excluded from the study group.

Determination of Age, Height and Weight

Age was expressed in years and months from the date of birth obtained from the register of the school based on the birth certificate presented at the time of admission. Height was measured with an anthropometric rod with shoes removed and head aligning in the Frankfurt plane. Readings were taken to the nearest of 1 cm. Weight was measured in kg by using a weighing scale with minimum clothing and without shoes. Readings were taken to the nearest of 500 grams.

Assessment of Nutritional Status

Classification of nutritional status was made according to public health criteria recommended by a World Health Organization expert committee.(WHO 1995).. For analytic purposes, the subjects were divided in 4 groups: 1) normal 2) low height-for-age or stunted 3) low weight-for-height or wasted 4) low height-for-age and low weight-for-height (stunted and wasted). For further comparison z scores were calculated for height - for – age and weight for age values. The percentile for BMI is based on the charts developed by National Center for Health Statistics (NCHS) in collaboration with CDC (2000). The criteria used for the classification of the nutritional status are presented in table 1.

In addition, Weight for age criteria was used to assess the under – nutrition of the subjects using NCHS charts. Z scores were calculated for stunting (height – for age) and under nutrition (weight – for age). The WHO criteria was used to classify mild,

moderate and severe category of malnutrition using a cut of value of z scores of -1 to -2 for mild, > -2 to -3 for moderate and > -3 for severe category.

RESULTS

Anthropometric profiles of the children are presented in table 2. An increasing pattern was observed for all the parameters; viz, height, weight and BMI with age. The total increment of height from 9 to 11 years was 7.1 cm while the total weight gain was 5.4 kg.

Table 3 depicts the prevalence of stunting with the corresponding z scores. The prevalence of mild stunting was 34.5 % in 9years, 16.2% in 10 years and 32% in 11 years. No moderate stunting was observed in the age group of 9 years and prevalence rate of moderate stunting was much lower as compared to mild stunting; only 7 and 5 % of the boys were moderately stunted in the age groups of 10 and 11 years respectively.

Overall mean z scores in three age groups were -0.38 in 9 years, -0.56 in 10 years and -0.70 in 11 years, thus showing an increasing trend with age. Z scores for moderate stunting were also increasing with age; -2.17 for 10 years and -2.47 for 11 years. However no such age related pattern was observed in z scores for mild stunting.

Prevalence of under nutrition was obtained from weight – for - age values are summarized in table 4. Prevalence of mild under nutrition varied between 20 – 47 % with no age related pattern, highest among 10 years (47%) and lowest in 9 years (20%). and 36 % in 11 years. The mean z scores for mild under- nutrition varies accordingly between -1.41 to -1.55. Prevalence of moderate under nutrition was lower than mild category. The prevalence rates were 13.8 in 9 years followed by 13.3 % among 11 years and 7.4 % in 10 years age group. Mean z scores for moderate under nutrition were lowest for 10 years (-2.33) and highest for 11 years (-2.09) with no age specific trend. The overall mean z-score varied between -0.77 to -0.88.None of the subjects were classified as severely stunted or under nutrition.

Nutritional status of the subjects is summarized in table 5. Moderate stunting with height for age percentile below -2SD is considered as stunting criteria in this table. The prevalence of wasting was much more (20-37%) in the different age groups. Total under nourishment was maximum (51.5%) among the subjects of 10 years. 4%of the subjects in the 10 years of age group appeared to be both stunted and wasted.

DISCUSSION

The growth pattern of the Himachali boys as obtained in the present study is comparable with the ICMR standard, 2009. However the standards appeared lower than the NCHS (Hamill et al.1979) population particularly in the age group of 10 and 11 years. This has been presented in table 6a and 6b.

Comparison of height of children with other Indian studies

The mean height of boys obtained in present study is higher than the standards reported by Thakur et al. 2000 among South Gujarat urban children (mean height 133.7 cm for 10 years and 135.4 cm for 11 years). The present values are also higher as compared the children of tea garden workers Assam and school going children of Allahabad district. Values of height as reported for Assam children was 125.6 cm to 132.1 for 9 – 11 years (Medhi et al.2006) .While the heights of Allahabad children were obtained to be 128.5cm in 9 – 10 years(Handa et al. 2008). Again much lower heights as compared to the present study were reported among the school going children of Dharwad district with a mean height of 124 cm in 10 years and 132.2 cm in 11 years (Hunshal et al.2010) . Lower values for heights as compared to this study were also reported for north Bengal children.

The mean heights of boys reported in these studied children were 122 cm for 9 years, 125 cm for 10 years and 130 cm for 11 years (Manna et al.2011).

However, the height standard of the Himachali boys as obtained in the present study is almost similar to the Indian school children belonging to upper socioeconomic status as reported from 4 major states of India (Marwaha et al.2011), and the Urban Tripuri Tribal Boys of Tripura (Sil et al. 2012). In the former study the heights reported for 9,10and 11 years boys were 133.3, 138.6 and 144.3cm respectively. For Urban Tripuri tribal boys the heights reported were 132 cm for 9 years, 138.6 cm for 10 years and 140.8 for 11 yrs.

Comparison of weight of children with other Indian studies

The mean values of weight of boys obtained in present study is higher than the South Gujarat urban children reported by Thakur et al. 2000 (mean weight 25 kg for 10 years and 25.9 kg for 11 years). The boys in present study are also heavier as compared to the children of tea garden workers Assam and school going children of Allahabad district. Values of weight as reported by Medhi et al.(2006) for Assam children were 27.1 kg to 32.5 kg for 9 – 11 years while the weights of Allahabad children were obtained to be 24.2 kg in 9 - 10years (Handa et al. 2008). Again much lower weights as compared to the present study was reported among the school going children of Dharwad district with a mean weight of 23.5 kg in 10 years and 26.04 kg in 11 years (Hunshal et al.20010), and among the children of north Bengal. The mean weights of boys reported by Manna et al.(2011) in north Bengali children were as 22.5 kg for 9 years, 22.7 for 10 years and 25.7 kg for 11 years.

Likewise height, the weight standard of the Himachali boys as obtained in the present study is almost similar to the Indian school children belonging to upper socioeconomic status as reported from 4 major states of India (Marwaha et al.2011) and the Urban Tripuri Tribal Boys of Tripura (Sil et al. 2012) . In these studies the weights reported for 9,10and 11 years boys were 29.5 kg, 33.0 kg and 36.9 kg respectively for Indian School Children and for Urban Tripuri tribal boys the weights were reported to be 27.1 kg for 9 years, 31.9 kg for 10 years and 32.7 kg for 11 yrs.

Comparison of the prevalence of stunting of children with other Indian studies

In present study the overall prevalence of stunting was found to be 7% in the age group of 9 to 11 years boys, which indicate a better nutritional status of Himachali boys as compared to children of tea garden worker Assam(Medhi et al.2006) where 46.7% boys of 9 years, 57.1% boys of 10 years and 46.1% boys of 11 years were found to be stunted. The prevalence of moderate and severe stunting was reported to be 9.73% and 4.17% respectively among Santal Children of Puruliya district of the West Bengal among the age group 5 to 12years (Chowdhury et al.2008). Again our results showed better nutrition level in comparison to school going children of Allahabad district where out of total 17.3% children of 7 to 10 years were found to be stunted (Handa et al. 2008).Among the Jenukuruba Tribal children of Mysore district. Karnataka the prevalence of moderate stunting was 63.6% and 80% in age group 9 and 10 years respectively (Jai Prabhakar and Gangadhar,2009), while in our study the prevalence of moderate stunting was quite low. A study among school children in north Bengal revealed that 3.10% of 9 years, 15.5% of 10 years and 15.6 % boys of 11 years were stunted (Marwaha et al. 2011).However the less prevalence of stunting was reported amongUrban Tripuri Tribal boys of Tripura as compared to boys of Himachal Pradesh. Among these boys in overall 4.4% were found to be stunted in age group 9 to 11 years and individually 8.7% boys of 9 years and 4.8 % boys of 10 years were found to be stunted in all three age groups (Sil et al.2012).

Comparison of the prevalence of under nutrition of children with other Indian studies

In the present study overall 41.9% boys were found to be mildly undernourished and 11% were moderately undernourished in all the three age groups from 9 to 11 years. The prevalence of moderate under nutrition reported in present study is quite low in comparison with other previous studies. It was reported that in the age group 5 to 12years overall 33.7% Santal children of Puruliya distt of West Bengal were underweight and 7.9 % were found to be severely underweight (Chowdhury et al.2008) . In the age group 9 to10 years about 30 % school going children of Allahabad distt. Were found to be underweight (Handa et al,2008). A very high prevalence of mild and moderate under nutrition was reported among Jenukuruba Tribal children in Mysore (Jai Prabhakar andGangadhar, 2009) in comparison with our studies. The prevalence was found to be 63.6% mild and 27.3% moderate in 9 years boys and 60% mild and 40% moderate in 10 years boys. Also a high prevalence of moderate underweight children (47% in 9 years, 33.4% in 10 years and 45.6% in 11 years) were reported among North Bengal school children (Manna et al.2011).

Comparison of the prevalence of wasting of children with other Indian studies

In present study overall 29.1% boys in age group 9 to 11 years were found to be wasted(low weight for height).while compared with other previous studies the children of tea garden worker Assam found to be highly wasted with prevalence rate 53.3% in 9 years, 51.4% in10 years and 53.3% in11 years (Medhi et al.2006). About 29.4 % Santal children in age group 5 to 12 years of Puruliya district of West Bengal were reported to be wasted by Chowdhury et al.(2008). However among the school going children of Allahabad district only 3% children were found to be wasted in age group 7 to 10 years (Handa et al.2008).

In comparison with our studies the prevalence of wasted children was low in Jenukuruba Tribal children in Mysore district Karnataka 9.1% mild and moderate in 9 years (Jai Prabhakar andGangadhar, 2009). Also among children of Urban Tripuri Tribal boys Tripura 13% were wasted in 9 years, 14.3% in 10 years and 16.7% wasted in 11 years (Sil et al.2012).

Conclusion

In the present study the prevalence of wasting appeared to be more than that of stunting. The prevalence of thinness exceeded that of stunting by a factor of 3.6 in 10 years and 3.0 in 11 years. Therefore it can be concluded that the Himachli boys surveyed under present investigation might be suffering from acute malnutrition. For one of the cause of increased thinness may be due to the fact that at this age group the children may not be at direct parental care and may have indulge on their own daily habits which may not be sufficiently healthy enough to provide proper nutrition.

Table:1 Criteria for classification of nutritional status

Classification	Criteria
Normal	≥ - 2SD of height-for- age & ≥ 5th percentile – to ≤ 85th percentile of BMI –for- age
Low height for age (stunted)	< 2SD of height-for- age
Low weight for height (wasted)	< 5th percentile of BMI-for- age
Stunted and Wasted	< 2SD of height-for- age and < 5th percentile of BMI-for- age

Table 2: Physical characteristic of the subjects. Values are Mean ±SD.

Age gr (years)	N	Height (cm)	Weight (kg)	Body Mass Index (kg . m²)
9	29	133.8 ±6.4	27.0 ± 5.8	15.0 ± 2.8
10	68	136.8 ± 5.8	28.8 ± 5.5	15.3 ± 2.2
11	75	140.9 ± 6.1	32.4 ±6.9	16.4 ± 2.6

Table 3: Prevalence of stunting among the subjects.

Age in years (N)	Mild (Z score -1 to – 2 SD)			Moderate (Z score >-2 to -3)			Overall Mean Z score
	N	%	Mean Z score	N	%	Mean Z score	
9 (29)	10	34.5	-1.45	-	-	-	- 0.38
10 (68)	11	16.2	-1.54	7	10.3	-2.17	- 0.56
11 (75)	24	32	-1.29	5	6.7	-2.47	- 0.70

Table 4: Prevalence of under-nutrition among the subjects.

Age in years (N)	Mild (Z score -1 to – 2 SD)			Moderate (Z score >-2 to -3)			Overall Mean Z score
	N	%	Mean Z score	N	%	Mean Z score	
9 (29)	13	20.1	-1.41	4	13.8	-2.19	-0.79
10 (68)	32	47.1	-1.55	5	7.4	-2.33	-0.88
11 (75)	27	36	-1.45	10	13.3	-2.09	-0.77

Table 5: Nutritional status of the subjects.

Nutritional Status	Age group (years)							
	9 years (29)		10 yrs (68)		11 yrs (75)		Pooled (172)	
	N	%	N	%	N	%	N	%
Stunted (Ht – for – Age = - 2SD)	-	-	7	10.3	5	6.7	12	7
Wasting (BMI < 5th percentile)	10	34.5	25	36.8	15	20	50	29.1
Stunted and wasted both	-	-	3	4.4	-	-	3	1.8
Under nourished pooled	10	34.5	35	51.5	20	26.7	65	37.8

Table 6a: Comparison of the Height of Himachali Boys with ICMR and NCHS standards

Age group	Himachli Boys	ICMR	NCHS
9	133.8	132.2	133.7
10	136.8	137.5	138.8
11	140.9	140.0	143.7

Table 6b: Comparison of the Weight of Himachali Boys with ICMR and NCHS standards

Age group	Himachli Boys	ICMR	NCHS
9	27.0	28.1	28.7
10	28.8	31.4	32.1
11	32.4	32.2	36.1

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