Anthrop. Közl. 37. 135–148. (1995)

PHYSICAL GROWTH AND NUTRITIONAL STATUS OF RURAL SCHEDULED CASTE CHILDREN OF KHARAR TEHSIL, ROPAR DISTRICT, PANJAB

Rajan Gaur, Seema Dhingra and Meenu Lakhanpal

Department of Anthropology, Panjab University, Chandigarh, India

Abstract: *Physical growth and nutritional status of a sample of 436 (217 boys and 219 girls) rural school-going Punjabi scheduled caste children, aged 6 to 12 years, was investigated with the help of selected anthropometric measurements. In stature, the children ranged between 10th and 20th percentiles of NCHS reference data, with some variations. By and large, mean weight of sample children was either between 3rd and 10th percentiles or below 3rd percentile of NCHS reference standard. The growth performance of sample children in stature and weight was very poor as compared to well-to-do Indians and Americans. A 24-hour diet recall revealed that the children mainly consumed cereals, pulses, roots and tubers, with wheat as the staple food. The consumption of fruits, eggs and meat was extremely low. The percentage of malnourished children (having z-scores of -2 SD or more below the NCHS median) vas 27.0%, 45.9%, and 31.8%, according to stature-for-age, weight-for-age, and weight-for-stature, respectively. The percentage of children with various degrees of wasting was relatively more than that of stunting. The percentage of malnourished boys was more than that of girls.*

Key words: *Anthropometry; Stature; Weight; Malnutrition; Stunting; Wasting. Panjab children.*

Introduction

Growth retardation and mulnutrition are major public health problems in the developing countries. In south-east alone, the estimated number of children suffering from protein-energy malnutrition (PEM) exceeds 100 million (Gopalan 1988, Gaur and Singh 1944). In India, child malnutrition prevails on a large scale among the underpriveleged and poorer sections of our population. Country-wide survey covering 18000 children revealed that 90% of the children had heights and weights below the 10th percentile value of American children (Vijayaraghavan 1976). Malnutrition and impaired growth are closely related. A majority of the malnourished children fail to achieve their full genetic potential in bodily dimensions and may develop stunting and wasting, besides other deficiency disorders. As a consequence, the quality of human resource of a country is adversely affected. Studies on growth and development in a community provide useful information about the nutritional profile of a community (Vijayaraghavan et al. 1971). In fact, status of growth of children is considered as an index of the health and well-being of a community. Therefore, regular monitoring of child growth and nutritional profile, particularly of the vulnerable sections of the society, is now one of the major concerns for the public health policy makers and planners of our country.

The present paper deals with physical growth and nutritional profile of 6 to 12 year old rural scheduled caste children of a part of Kharar Tehsil of Ropar District of Panjab. Panjab is one of the most prosperous states of India with one of the highest per capita incomes. Naturally, the growth and nutritional status of Punjabi children would be expected to be, by and large, better than that of children from other parts of India. This may be true to some extent in the urban context among the upper and middle socio- economic groups (Singh et al. 1987). However, there remain sections of punjabi population, particularly belonging to lower

socio-economic stratum, which are marked by poor growth among children (Singh et al. 1987). There are not many reports on the growth and nutritional status of scheduled caste children, who belong to the underprivileged section of our society. The present investigation is an attempt to provide information on the growth status and nutritional profile of rural Punjabi scheduled caste school-going children.

Materials and Methods

The present study is based on a cross-sectional sample of 436 (217 boys and 219 girls) rural school-going scheduled caste children with low socio-economic backgrounds and ranging in age from 6 to 12 years. The data were collected during September- October, 1991 from the Government Primary and High Schools at Chuni Kalan and Govt. Primary School at Chuni Khurd villages of the Kharar Tehsil of Ropar District of Panjab. The present sample includes children not only from these two villages but also from neighbouring villages of Majat, Todar Majra, Rasulpur, Bassian and Sarkapra, who study in the above schools. Kharar Tehsil is one of the three Tehsil of Ropar District and has an area of about 731.7 sq.km. of which 707.7 sq.km. is rural area. The rural people of this area mostly live in 'Kuchcha' dwellings and do not have access to the modern facilities of a town. The majority (61.2%) of the parents of sample children were uneducated. The percentage of illiteracy was more among mothers (75.7%) than fathers (46.9%). A large proportion of fathers of the sample children engaged in labour (74.5%), some worked as skilled workers (17.6%) and only a few (7.9%) as professionals. The percentage of working mothers was meager (3.5%). On the whole, children in this sample belonged to poor socio-economic backgrounds and 86.7% had per capita income of less than 200 rupees per month, against the state average of rupees 812.45, per capita per month and national average of Rupees 519.99 per capita per month, at current prices for the year 1991–92 (RBI, 1993–94.).

The subjects were randomly selected. However, children suffering or having suffered in the near past, from some major illness were not included in the study. Information about age of the subjects was recorded from the school registers and verified from subjects or their parents in case of doubt. The decimal ages were calculated following Tanner and Whitehouse (1966) and the children from 6 to 12 years were grouped into seven age groups of one year each. Age group 6 included subjects with decimal ages from 5.50 to 6.49 years.

Ten anthropometric measurements, namely stature, weight, sitting-height, biepicondylar breadths of humerus and femur, head, chest, upper-arm, and calf circumferences, and triceps skinfold, were taken using standard instruments following Weiner and Lourie (1981). Besides anthropometry, some general information about the family, such as parents occupation, educational level and income, were also recorded. To have a rough estimate of the food habits, a 24-hours dietary recall method suggested by Weiner and Lourie (1969) was employed with appropriate modifications. The younger children had some difficulty to correctly recall the amounts of foods eaten. Therefore, only the rough estimates of the types and frequencies of the various food stuffs eaten were calculated.

The nutritional status was evaluated with the help of anthropometric method. According to Johnston (1981), it is a very useful and quick method of assessment of nutritional status, particularly under field conditions. Stature and weight are two basic measurements for the assessment of nutritional status (WHO 1986). Following the recommendations of World Health Organisation (WHO 1983), the derived indices used here for assessing the nutritional

status are: weight-for-age (Wt/Age), stature-for-age (St/Age), and weight-for-stature (Wt/St). The reference standards used for calculating these indices were those developed by National Center for Health Statistics (NCHS), USA (Hamill et al. 1979), following the recommendations of World Health Organisation (WHO 1981). Using NCHS reference data, the nutritional status of each individual was calculated as z-scores or SD-scores, following Waterlow et al. (1977). The cut-off point for malnourished children was taken as -2 SD scores below the reference median, as recommended by World Health Organisation (WHO 1983). The z-scores were preferred to the percentages of the reference median, following the recommendations of Waterlow et al. (1977) and WHO (1983). Where a large number of children fall below the lower centiles, their weight-for-height and height-for-age should be expressed as multiples of the standard deviation of the reference population rather than as percentages of the median (Waterlow et al. 1977, p. 494). The usual cut-off points for mild, moderate and severe stunting (low stature-for-age) are: less than 95%, 90%, and 85%, respectively, of the reference median which approximately correspond to z-scores of -1 SD, -2 SD, and -3 SD, below the reference median. Similary, wasting (low weight-for-stature) is usually defined as mild, moderate and severe with cut-off points of less than 90%, 80% and 70% of the reference median, respectively, which roughly correspond with z-scores of -1 SD, -2 SD, and -3 SD below the reference median.

Results

Food habits

The 24-hour recall of types of foods consumed by the children revealed that the staple food of the children was wheat. The children were used to three meals a day, viz. breakfast, lunch and dinner. The diet was found to be simple and based mainly on cereals, pulses, roots, tubers and green vegetables. The percentage frequency distribution of main food items consumed at different meal times by the sample children is given in Table 1.

Table 1. Percentage frequency distribution of consumption of various food stuffs at different meal times in rural scheduled caste children

Food Stuffs	Breakfast %	Lunch %	Dinner %
Green leafy and other vegetables	4.4	8.5	8.5
Pulses and legumes	10.3	28.0	30.3
Roots and tubers	33.5	38.8	33.5
Fruits	0.0	17.7	4.4
Milk and milk products	17.7	9.6	50.0
Fats and edible oils	49.8	74.1	71.6
Rice	0.7	2.5	29.8
Wheat cereals	94.0	97.7	94.3
Beverages (Tea)	72.7	74.8	29.1
Meat	0.5	0.9	0.5
Other, things (salt, pickles, etc.)	39.7	16.2	12.1

Table 2. Means and standard deviations of various anthropometric measurements of rural scheduled caste children of Kharar Tehsil by age and sex

Measurement	Sex	Age group (years)						
		6 (N=29, 30)# $\bar{x} \pm SD$	7 (N= 28, 30) $\bar{x} \pm SD$	8 (N = 34, 30) $\bar{x} \pm SD$	9 (N = 33, 31) $\bar{x} \pm SD$	10 (N = 31, 30) $\bar{x} \pm SD$	11 (N = 29, 33) $\bar{x} \pm SD$	12 (N = 33, 35) $\bar{x} \pm SD$
Weight (kg)	M	15.93±1.34	17.95±1.60*	18.74±1.84	21.84±2.40	25.00±3.16*	29.12±3.19*	30.72±3.78
	F	15.73±1.91	16.84±1.59	17.93±1.68	21.82±1.96	23.45±2.80	27.11±3.57	29.98±3.92
Stature (cm)	M	111.5±4.23	116.9±4.41	118.3±4.49	126.9±3.58*	131.8±4.47	139.8±4.34*	141.4±4.96
	F	110.8±4.26	115.0±3.73	118.1±2.90	123.8±3.68	130.0±4.47	136.5±4.49	142.9±5.37
Sitting (cm) height	M	58.5±2.57	60.7±1.89	61.4±2.39	63.6±2.65	66.7±2.55	71.2±2.49*	71.5±3.30
	F	58.6±1.24	59.9±1.99	61.8±2.55	63.5±2.32	65.2±3.10	68.1±2.35	71.0±3.59
Biepicond. (cm) humerus	M	4.38±0.21*	4.51±0.17*	4.59±0.27*	4.84±0.27	5.15±0.28*	5.52±0.36*	5.63±0.29*
	F	4.24±0.11	4.37±0.19	4.44±0.25	4.88±0.20	4.98±0.27	5.24±0.33	5.35±0.29
Biepicond (cm) femur	M	6.42±0.23*	6.77±0.14*	6.81±0.38*	7.23±0.27*	7.52±0.36*	7.73±0.36	7.75±0.05*
	F	6.22±0.1	6.44±018	6.53±0.28	6.90±0.21	7.03±0.27	7.21±0.24	7.24±0.47
Head circ. (cm)	M	49.55±2.02	49.60±2.86	50.36±1.35	51.36±1.25*	52.00±1.89	53.80±1.94*	54.78±2.29*
	F	49.43±0.86	49.50±1.41	49.71±1.54	50.40±1.20	50.55±1.51	51.70±1.68	52.33±1.82
Chest (cm) circ.	M	54.60±2.22*	55.01±3.28	55.60±1.99	58.30±2.50	61.12±3.64*	64.50±3.65	65.10±3.75*
	F	52.51±2.39	54.82±2.66	55.83±3.56	57.60±1.91	60.82±3.23	69.90±3.90	67.10±4.08
Upper-arm (cm) circ.	M	14.35±0.73	14.75±0.71	15.04±0.89	15.82±0.80	16.90±1.43	18.00±1.35*	18.20±1.56
	F	14.42±0.73	14.86±0.76	15.26±0.98	15.40±0.78	16.40±0.80	17.13±0.76	17.80±0.94
Calf circ. (cm)	M	19.70±0.87	20.75±0.95	20.90±1.30	22.10±1.17	23.51±1.63*	24.40±1.72*	24.60±1.51
	F	19.40±0.93	20.39±0.84	20.44±1.87	21.95±1.05	22.65±1.38	23.50±1.38	24.34±1.77
Triceps (mm) skinfold	M	3.64±0.48	3.48±0.36*	4.16±0.53	4.74±0.60	4.60±0.78*	5.15±0.81	6.84±0.89
	F	3.57±0.45	4.16±0.53	3.89±0.78	4.62±0.63	5.21±0.67	5.36±0.51	5.94±1.13

* Significant difference between the sexes (P = 0.05); # Number of individuals given first are of males

During breakfast, most children usually consumed the food cooked the previous night. Wheat 'chapatis' were eaten at all meal times by more than 90% of the sample children. Rice was not commonly consumed. Potatoes and sweet potatoes were the commonly consumed roots and tubers. The commonly eaten pulses and legumes included, green chickpea, dried peas, bengal grams, green grams ('Moong'), black grams (Mah') and beans, etc. Among the vegetables, brinjal, cabbage, cauliflower, and mustard leaves were more frequently eaten. Milk, though formed a part of the diet of many children, it was taken in small quantities, probably due to economic reasons. Tea was the only beverage taken, most frequently during breakfast and sometimes during lunch and dinner. Fruits, eggs and meat were the least frequently consumed items. On the whole, protein rich foods were less commonly eatin, probably due to its high cost.

Growth status

Table 2 gives the descriptive statistics of the various anthropometric measurements of the sample children according to age and sex. As can be seen in this table, except the triceps skinfold, the children show a gradual increasing trend in most anthropometric parameters. In weight as well as stature, the boys show higher mean values at almost all ages with statistically significant differences (p=.05) at 7, 10 and 11 years in weight, and 9 and 11 years in stature. The bone diameters of the Chuni Kalan Children also gradually increased with age and the boys were ahead of the girls at all ages, except at 9 years in biepicondylar diameter of humerus. In head and calf circumferences, the boys showed superior growth at all ages. In chest circumference, the boys were ahead of the girls up to 11 years after which the girls overtook the boys. The girls showed higher mean values of upper-arm circumference up to 8 years and the boys overtook them, thereafter. Triceps skin fold showed a fluctuating pattern in boys as well as girls. The girls were ahead of the boys in their mean triceps fat fold at 7, 10 and 11 years.

Table 3. Mean and standard diviations of z-scores by age and sex for anthropometric indicators of nutritional status in rural scheduled caste children.

Age group (Years)	N	St / Age		Wt / Age		Wt / St.	
		$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD
6	M 29	– 1.30	1.20	– 2.23	0.62	– 1.93	0.77
	F 30	– 1.23	0.99	– 1.92	0.87	– 1.82	0.89
7	M 28	– 1.36	0.84	– 1.95	0.85	– 1.67	0.97
	F 30	– 1.26	0.98	– 1.78	0.65	– 1.77	0.73
8	M 34	– 2.18	0.57	– 1.88	0.77	– 1.53	0.74
	F 30	– 2.10	0.39	– 1.62	0.46	– 1.70	0.64
9	M 33	– 1.43	0.69	– 1.85	0.59	– 1.62	1.12
	F 31	– 1.57	0.66	– 1.91	0.40	– 1.39	0.78
10	M 31	– 1.51	0.65	– 1.13	0.72	– 1.31	1.15
	F 30	– 1.86	0.46	– 1.45	0.96	– 1.25	1.21
11	M 29	– 0.90	0.54	– 1.32	0.55	– 1.16	0.81
	F 33	– 1.53	0.71	– 1.75	0.51	– 1.43	0.57
12	M 33	– 1.44	0.90	– 1.65	0.65	–	–
	F 35	– 1.49	0.83	– 1.79	0.58	–	–
6–12	M 217	– 1.45	0.79	– 1.72	0.38	– 1.54	0.27
	F 219	– 1.58	0.94	– 1.76	0.17	– 1.56	0.23

M = Male; F = Female

Table 4. Incidence (%) of malnutrition among rural scheduled caste children by age and sex

Anthropo-metric index	Age group (years)																				Ages comb.		Age & sex comb.
	6			7			8			9			10			11			12					
	M	F	C	M	F	C	M	F	C	M	F	C	M	F	C	M	F	C	M	F	C	M	F	
Stature / Age																								
> -1 SD	34.5	56.7	45.6	35.7	46.6	41.2	8.8	13.3	11.1	36.4	12.9	24.6	45.1	20.0	32.6	51.7	33.3	42.5	24.3	22.9	47.2	33.2	29.2	31.2
–1 to –1.9 SD	37.9	30.0	33.9	42.9	26.7	34.8	20.6	53.3	36.9	48.5	61.3	54.9	35.5	56.7	46.1	44.8	36.4	40.6	48.5	42.9	69.3	39.6	43.8	41.8
–2 to –2.9 SD	13.8	13.3	13.6	14.3	26.7	20.5	64.7	33.4	49.1	15.2	25.8	20.5	19.4	20.0	19.7	3.5	30.3	16.9	24.2	31.4	27.8	23.0	26.0	24.5
–3 and less	13.8	–	6.9	7.1	–	3.5	5.9	–	2.9	–	–	–	–	3.3	1.6	–	–	–	3.0	2.8	2.9	42.0	0.9	2.5
Weight / Age																								
> -1 SD	3.5	20.0	27.7	3.6	6.7	5.2	2.9	3.3	3.1	6.1	–	3.0	19.3	3.3	11.3	20.7	15.2	17.9	18.2	11.5	14.9	10.6	8.7	9.6
–1 to –1.9 SD	27.6	36.7	32.2	35.7	46.7	41.2	26.5	26.7	26.6	42.4	64.5	53.5	48.4	50.0	49.2	62.1	48.5	55.3	54.5	51.4	52.9	42.4	66.6	44.5
–2 to –2.9 SD	55.1	36.7	45.9	57.1	46.6	51.8	61.8	70.0	65.9	51.5	35.5	39.5	32.3	46.7	39.5	17.2	36.3	26.8	27.3	37.1	32.2	43.3	43.8	43.6
–3 and less	13.8	6.6	10.2	3.6	–	1.8	8.8	–	4.4	–	–	–	–	–	–	–	–	–	–	–	–	3.7	0.9	2.3
Weight / Stature																								
> -1 SD	6.9	30.7	18.8	27.5	20.0	23.8	14.7	20.0	17.4	15.1	35.4	25.3	35.5	20.0	27.8	41.4	24.2	32.8	–	–	–	22.3	25.5	23.9
–1 to –1.9 SD	37.9	40.0	38.9	35.7	40.0	37.8	55.9	50.0	52.9	48.5	41.9	45.2	35.5	43.4	39.4	41.4	57.6	49.5	–	–	–	42.9	45.7	44.3
–2 to –2.9 SD	44.8	26.7	35.8	35.7	33.3	34.5	26.5	30.0	28.3	30.3	22.6	26.4	25.8	33.3	29.6	17.2	18.2	35.4	–	–	–	29.9	27.2	28.5
–3 and less	10.4	–	5.2	7.1	6.7	6.9	2.9	–	1.4	6.1	–	3.1	3.2	3.3	3.2	–	–	–	–	–	–	4.9	1.6	3.3

M = Male; F = Female; C = Sexes combined

Nutritional status

The nutritional status of Chuni Kalan children was evaluated with help of weight deficit-for-age, stature deficit-for-age and weight deficit-for-stature, expressed as z-scores below the reference median. Table 3 gives the age and sex-specific mean z- scores according to the above three anthropometric indices. The majority of the children had mean z-scores between -1 and -2 SD below the reference median for Wt/Age, St/Age and Wt/St. However, at 8 years in St/Age, boys as well as girls, and at 6 years in Wt/Age the boys had z-scores more than -2 SD below the reference median.

Table 4 gives the percentage distribution of children in different z-score categories, according to various indicators of malnutrition, by age and sex. As can be seen it the table, a majority of the children have z-scores -1 SD or more below the reference median, by St/Age, Wt/Age and Wt/St, indicating some sort of malnutrition. The frequency of children classified as normal (with z-scores of -1 SD or less) was the maximum by St/Age (31.2%) and minimum by Wt/Age (9.6%). The percentage of children classified as malnourished (those with z-scores of -2 SD or more) was 27%, 49.5%, and 31.8% as assessed by St/Age, Wt/Age and Wt/St. The percentage of stunted children (27%) was less than those with wasting (31.8%). The percentages of malnourished boys according to St/Age, Wt/Age and Wt/St were 27,2%, 47.0% and 34.8%, respectively. According to St/Age, Wt/Age and Wt/St, the percentages of malnourished girls were 26.9%, 44.7% and 28.8%, respectively. Thus, more boys were affected by malnutrition according to all the anthropometric indicators. It can be seen in Table 4 that the percentage of severely malnourished girls (those with z-score of -3 SD or more below reference median) was clearly less than that of boys.

Discussion

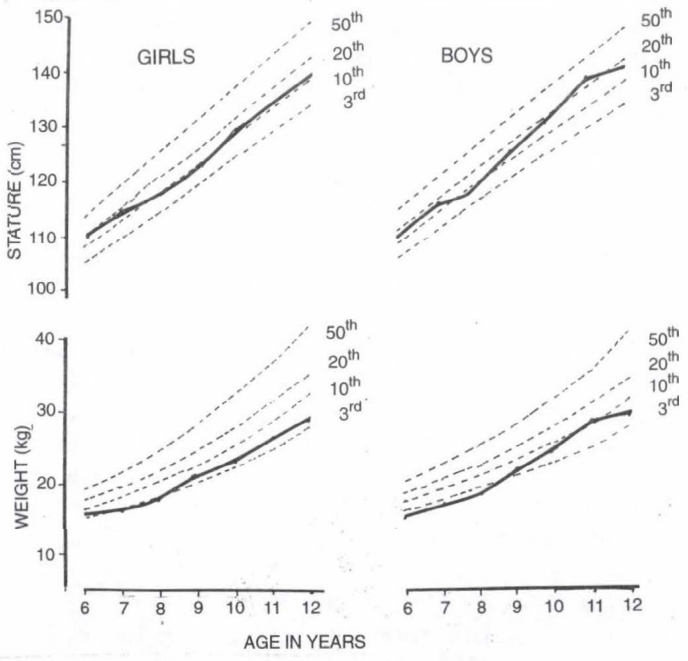

Fig. 1. Weight and stature of rural scheduled caste Punjabi children, related to NCHS percentiles

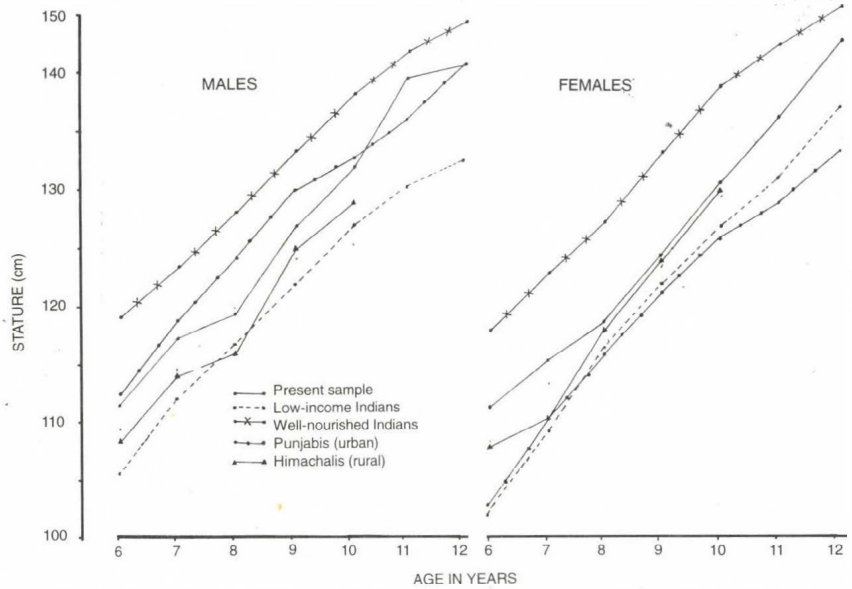

Fig. 2. Comparison of stature of rural scheduled caste Punjabi children with well-nourished, ICMR average, low-socioeconomic Indian, urban Punjabis and rural Himachali children

Figure 1 shows a plot of the *weight* and *stature* of rural scheduled caste children on NCHS percentiles. In stature, the sample children fall between 10th and 20th percentiles of the NCHS reference data, with minor variations. By and large, the mean weights of boys and girls in the present sample were either below the 3rd percentile or remained between 3rd and 10th percentile of NCHS reference standard.

Figures 2 shows a comparison of the *stature* of the present sample with well-nourished and low-socio-economic Indians (Vijayaraghavan et al. 1971), urban Punjabis (Singh et al. 1987), Americans (Hamill et al. 1979), average Indians (ICMR 1984) and rural Himachalis (Gaur et al. 1996). The sample boys were shorter than well-nourished Indians and urban Punjabis, except at 11 years where the urban Punjabis had lesser stature. By and large, the scheduled caste boys in this sample showed greater mean stature than low-income Indian, average Indian and rural Himachali boys. The sample girls were taller than Himachali, average and low-income Indian, and urban Punjabi girls at all ages. However, they were much shorter than well-to-do Indian girls. Since the present girls are from poor rural backgrounds, their better performance in stature than average Indians and urban Punjabis is rather noteworthy. In general, the populations living at higher altitudes tend to be shorter than those giving in plains (Frisancho 1969, Frisancho et al. 1975, Singh 1987, Gaur et al. 1996). Thus the short stature of Himachali children than the sample children may probably be due to the difference in altitude.

Figure 3 depicts a comparison of the *weights* of Chuni Kalan children with well-nourished and low-income Indians (Vijayaraghavan et al. 1971), average Indians (ICMR 1972), Himachalis (Gaur et al. 1996), and urban Punjabis (Singh et al. 1987). The sample boys had lesser

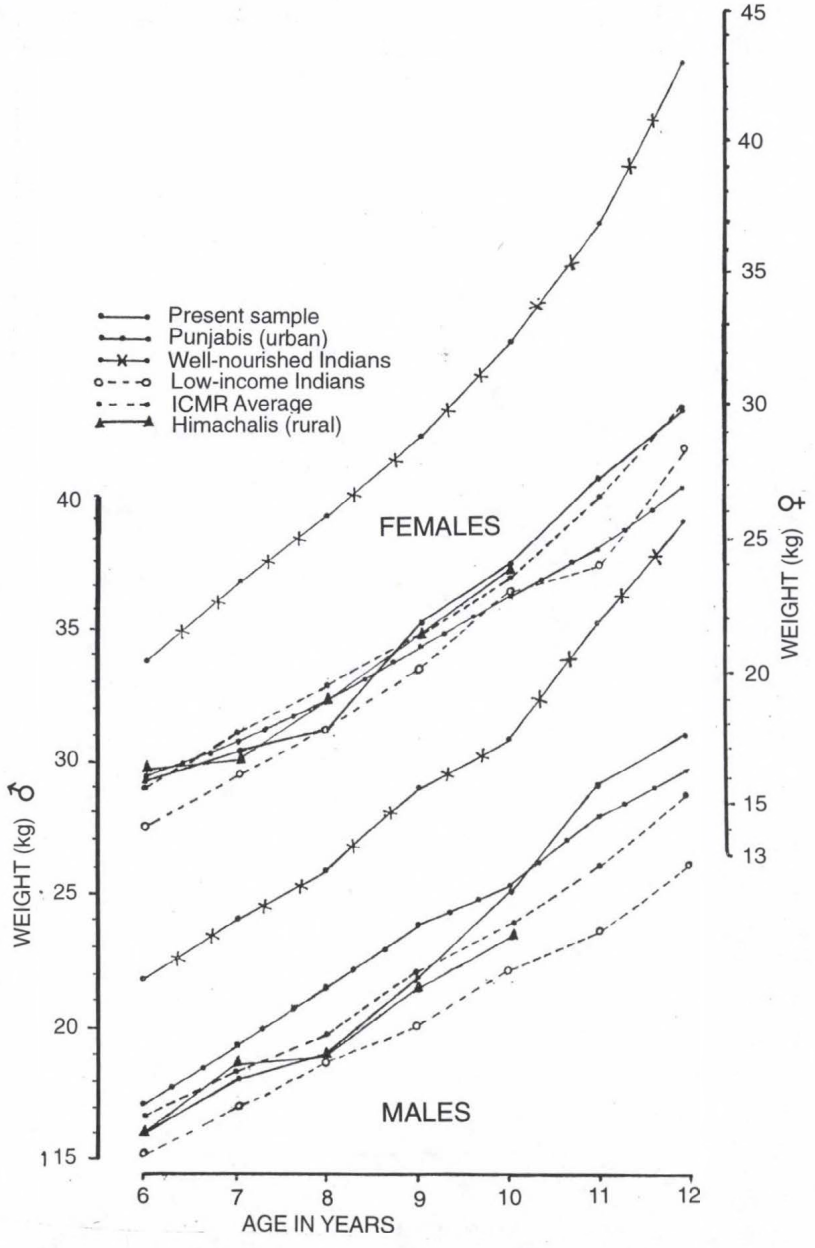

Fig. 3. Comparison of weight of rural scheduled caste Punjabi children with urban Punjabi, rural Himachali, well-nourished Indian, low-socioeconomic Indian, and ICMR average Indian children

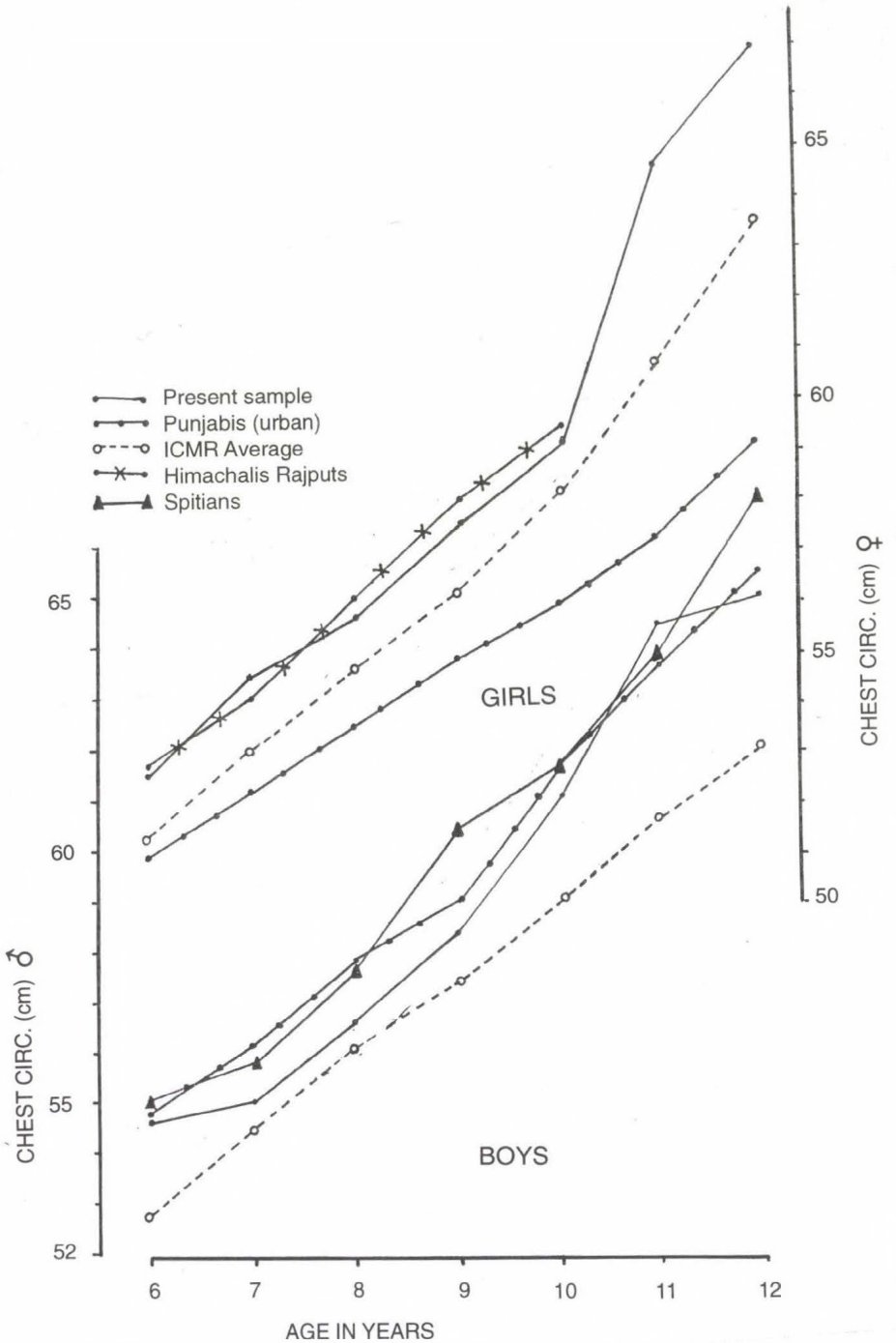

Fig. 4. Comparison of chest circumference of rural Punjabi scheduled caste children with urban Punjabi, ICMR average, Himachali Rajputs, and Spiti children

weight than well-nourished Indians and urban Punjabis, except at 11 and 12 years where the sample boys were heavier than urban Punjabis. Up to 9 years the boys lagged behind the average Indians in weight. As compared to Himachali and low-income boys, the sample boys had, by and large, more weight. Like boys, the girls in this sample were considerably lighter in weight than well-nourished Indians. The sample girls were lighter than urban Punjabis up to 8 years and at 12 years. The girls in this sample had, on the average, more weight than Himachali and low-income Indian girls. The populations inhabiting higher altitudes tend to have lower body mass than populations inhabiting plains (Frisancho 1969). This probably expalins the lesser body weight of Himachali children than the sample children. Overall, the rural scheduled caste Punjabi children remained behind urban Punjabis in weight up to 8 years in girls and 10 years in boys, but tended to overtake their urban peers, thereafter.

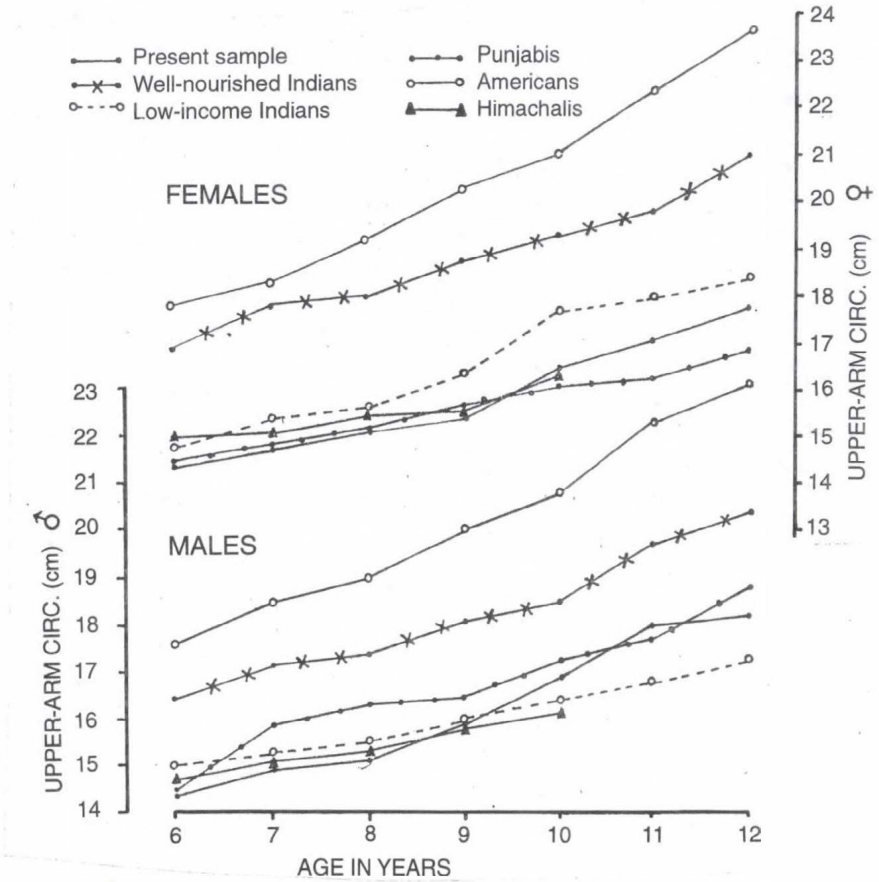

Fig. 5. Comparison of upper-arm circumference of rural Punjabi scheduled caste children with urban Punjabi, well-nourished Indian, low-income Indian, Himachali and American White children

Figure 4 shows a comparison of *chest circumference* of sample children with urban Punjabis (Singh et al. 1986), Average Indians (ICMR 1972), Himachali Rajputs (Ghai 1979) and Spitians (Singh 1987). The sample boys had lesser chest circumference that Spitians and urban Punjabis, with some variations, and greater chest circumference than average Indians. The girls in this sample were ahead of urban Punjabis and average Indians. However, the Himachali girls had higher mean chest circumference than the girls in this sample, except at 7 years. On the whole, the sample children had lesser chest circumference than Himachali Rajputs and Spitians, who are high altitude inhabitants. This may be because of the fact that, in general, the higher altitude populations have greater chest circumference than populations of plains (Frisancho 1969, Stinson 1985, Singh 1987, Gupta and Basu 1991, Gaur et al. 1996).

Figure 5 depicts a comparison of *upper arm circumference* of Punjabi scheduled caste children in the present sample with well- nourished and low-income Indians (Vijayaraghavan et al. 1974), Punjabis (Singh et al. 1987), American Whites (Frisancho 1974), and Himachalis (Gaur et al. 1996). The sample boys had lesser upper-arm circumference than Americans, well-to-do Indians and urban Punjabis, except at 11 years where urban Punjabis showed lesser mean values than boys in this sample. Up to 8 years, the present boys showed less upper-arm circumference than low- income Indians and Himachalis. The scheduled caste girls had clearly inferior upper-arm circumference than Americans and well-nourished and low-income Indians. Up to 9 years, the present girls were also behind the urban Punjabi and Himachali girls.

On the whole, the growth performance of the children in this sample was poor as compared to Americans and well-to-do Indians. By and large, particulary up to 10 years, the rural boys of this sample had inferior growth than their urban counterparts. The rural-urban differences were not clearly marked in case of girls as the rural girls were taller with greater chest circumference at al ages, and were heavier after 9 years than their urban counterparts. It appears that the socio-economic factors probably influenced growth more than urban-rural difference. Urban-rural difference probably affected child growth at younger ages, after which the rural children tended to catch-up with their urban peers. More studies are, however, necessary to corroborate these observations.

Table 5. Calorie and proteins intake of sample children compared to those recommended by ICMR (1984)

Age groups		Calories		Proteins	
		Present Sample	ICMR (1984)	Present Sample	ICMR (1984)
6	M	1454	–	26.20	–
	F	1370	–	23.60	–
	S. C	1412	1720	24.90	29.40
7–9	M	1876	–	32.70	–
	F	1767	–	28.50	–
	S. C	1821	2050	30.60	35.60
10–12	M	2249	2420	35.70	42.50
	F	2197	2260	34.60	42.10
	S. C	2223	–	35.15	–

M = Males, F = Females, S. C = Sexes combined

As far as the nutritional status was concerned, the frequency of stunted children (low St/Age) was comparatively less than children affected by wasting (low Wt/St) (Table 4). This indicates that more children were suffering from current undernutrition. High prevalence of mild to moderate malnutrition among the sample children could probably be linked to their diets. Table 5 compares the average intake of colories and proteins by the children in the present sample with recommended dietary intake for Indian children (ICMR 1984).

It is clear from the table that the average intake of calories as well as proteins of the children under study falls short of the recommended intake of these nutrients for Indians children. The calorie defict, the difference between the recommended and the actual intakes, is more among younger children (308 or 18% at 6 years; 249 or 12% at 7-9 years) which probably explains the relatively higher frequency of low Wt/Age and low Wt/St children among younger age groups.

Although protein intake is also less, but the problem appears to be more of calorie intake. The percentage of malnourished girls was relatively less than that of boys. The female of our species seems to cope better under conditions of environmental stress than boys. Studies by Eveleth (1975), Stini (1985), Stinson (1985), Gaur and Singh (1994) and Gaur et al. (1996) point towards the better buffering of females to stressful environment, as is also indicated by the present study.

Poor socio-economic condition appears to be the main reason for the poor growth and high rate of malnutrition among the rural Punjabi scheduled caste children of Kharar Tehsil. Poor hygiene and sanitation, low level of literacy among parents, and cultural practices and beliefs could be the other contributory factors. The situation can be improved by a multipronged and combined effort of governmental and non-governmental agencies by generating awareness about balanced nutrition, and providing better child health care and diet supplements to children in schools.

Received 9 February, 1996.

References

Eveleth, P. B. (1975): Differences between ethnic groups in sex dimorphism of adult height. – *Ann. Hum. Biol.*, *2* ; 35–39.

Frisancho, A. R. (1969): Human growth and pulmonary function of a high altitude Peruvian Quechua population. – *Hum. Biol., 41* ; 365–379.

Frisancho, A. R. (1974): Triceps skinfold and upper arm muscle size norms for assessment of nutritional status. – *Am. J. Clin. Nutr., 27* ; 1052–1058.

Frisancho, A. R.–Borkan, G.- A.–Klayman, J. E. (1975): Pattern of growth of lowland and highland Peruvian Quechua of similar genetic composition. – *Am. J. Phys. Anthropol., 32* ; 279–292.

Gaur, R.–Singh, N. Y. (1994): Nutritional status among rural Meitei children of Manipur, India. – *Am. J. Hum. Biol., 6* ; 731– 740.

Gaur, R.–Vasishat, R. N.–Vermani, V.–Manku, R. (1996): Nutritional status and growth of Children. – *in:* Sidhu, L. S.– Singh, S. P. (Eds.) *Global Developments in Human Biology*, pp. 105–123. Ludhiana: USG Publishers & Distributors.

Ghai, I. (1979): *A cross-sectional study of physical growth and development in Himachali Rajput females aged six to seventeen years.* – Unpublished Ph.D. Thesis, Panjab University, Chandigarh, India.

Gopalan, C. (1988): *Nutrition problems and programmes in South-East Asia.* – WHO, SEARO Regional Health Papers Number *15*, New Delhi.

Gupta, R.–Basu, A. (1991): Altitude and growth among the Sherpas of the Eastern Himalayas. – *Am. J. Hum. Biol., 3* ; 1– 10.

Hamill, P. V. V.–Drizd, T. A.–Johnson, C. L.–Reed, R. B.–Roche, A. F.–Moore, W. M. (1979): Physical growth: National Center for Health Statistics percentiles. – *Amer. J. Clin. Nutr., 32* ; 607– 629.

ICMR (1972): *Growth and Physical Development of Indian infants and children.* – Technical Report Series Number *18.* Indian Council of Medical Research, New Delhi.

ICMR (1984): *Recommended dietary intakes for Indians.* – Indian Council of Medical Research, New Delhi.

Johnston, F. E. (1981): Anthropometry and nutritional status. – *in: Assessing Changing Food Consumption Patterns*, pp. 252– 264. National Academy Press, Washington.

Singh, S. P. (1987): Variation in adult anthropometry, child growth and development in Western Himalayas – A review. – *J. Ind. Anthrop. Soc., 22* ; 181–204.

Singh, S. P.–Sidhu, L. S.–Malhotra, P. (1987): Growth performance of Punjabi children aged 6–12 years. – *Ann. Hum. Biol., 14* ; 169–179.

Stini, W. A. (1985): Growth rates and sexual dimorphism in evolutionary perspective. – *in:* Gilbert, R. I.–Mielke, J. H. (Eds.) *The Analysis of Prehistoric Diets*, pp. 191–226. Academic Press, New York.

Stinson, S. (1985): Sex difference in environmental sensitivity during growth and development. – *Yearbook of Physical Anthropology, 28* ; 123–147.

Tanner, J. M.–Whitehouse, R. H. (1966): *Notes on the use of height and weight standard charts.* – Creasey, Hertford, London.

Vijayaraghavan, K. (1976): Growth and development of Indian children. – *Ind. J. Physiol. Pharmac., 20* ; 268–276.

Vijayaraghavan, K.–Singh, D.–Swaminath, M. C. (1971): Heights and weights of well-nourished Indian school children. – *Ind. J. Med. Res., 59* ; 648–654.

Vijayaraghavan, K.–Singh, D.–Swaminathan, M. C. (1974): Arm circumference and fat fold at triceps in well-nourished Indian school children. – *Ind. J. Med. Res., 62* ; 994–1001.

Waterlow, J. C.–Buzina, R.–Keller, W.–Lane, J. M.–Nichaman, M. Z.–Tanner, J. M. (1977): The presentation and use of height and weight data for comparing the nutritional status of groups of children under the age of 10 years. – *Bull. WHO, 55* ; 489–498.

Weiner, J. S.–Lourie, J. A. (1969): *Human Biology – A Guide to Field Methods.* Blackwell Scientific Publications, Oxford.

Winer, J. S.–Lourie, J. A. (1981): *Practical Human Biology.* – Academic Press, London.

WHO (1981): Development of indicators for monitoring progress towards heath for all by the year 2000. – *"Health for All"* series No. *4*, World Health Organisation, Geneva.

WHO (1983): *Measuring change in nutritional status.* – World Health Organisation, Geneva.

WHO (1986): Use and interpretation of anthorpometric indicators of nutritional status. – *Bull. WHO, 64* ; 929–941.

Report on Currency and Finance 1993–94 Volume II: Statistical Statements. – Reserve Bank of India, Bombay.

Author's address: Dr. Rajan Gaur
H. No. 1452, Sector 44–B,
Chandigarh – 160047 (India)