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PRINT: ISSN 0972-0073 ONLINE: ISSN 2456-6802
Anthropologist, 3(2): 99-104 (2001)
DOI: 10.31901/24566802.2001/03.02.05

Inter State Comparison of Physical Development of Indian Rural Children

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KEY WORDS Weight. Height. Agro Climatic Zones. ICMR (Indian Council of Medical Research), NCHS (National Centre of Health Statistics).

ABSTRACT The present cross-sectional investigation was carried out in Six State Agriculture Universities under an Indian Council of Agricultural Research (ICAR) funded project. The physical development of rural children between 6-18 years for girls and 6-20 years for boys was measured from different agro climatic zones of each State to have true representation of the respective State. A minimum of 100 children of either sex was sampled at each age cohort starting from 6yrs. to 18/20 yrs. by each centre. Weight and height of each subject was measured as parameter for their physical development. Along with this the influencing factors were also studied through an interview schedule including the socio economic status of their families. The results revealed that the weight and height of children increased with the increase in age. The difference between the two consecutive readings increased with the increase in age. However the weight and height of children of entire age group was below the ICMR and NCHS standards. Inter state comparisons revealed significant differences between almost all the centres. The extent of variation brought about by environmental factors was as high as 20-21percent among boys.

Studies on growth and development of infants, children and adolescents are important as they provide determinants of a nation's health. Several studies are available on western children with very limited data on Indian children. To establish normal growth parameters for a country like ours it is important to collect cross sectional data covering different parts of the country as well as different communities. Rohdel (1993) comments that the remarkably high rate of low birth weight amongst Indian new borns is determined by a major factor of maternal size. Majority of poor and rural mothers is of short stature and remarkably low weight. This may be due to malnutrition, cultural influence, socio-economic factors, medical and educational factors.

The research work of the ICAR project on growth and development of rural children of birth to six years also revealed that the growth and development of rural children in the age group of 1-3 years was very poor. Due to this even by the end of six years, the growth curves were lower than the ICMR & NCHS reference standards.

The age range 6-18/20 years find the child in the beginning of his/her middle childhood followed by adolescence. This period is very important from the point of view of physical and psychological changes. Empirical studies on growth and development are meager in our socio-cultural context, particularly in the rural context.

Thus, the present study was conducted with the aim of generating information on the physical dimensions with objectives of assessment of Heights and Weights of Rural Children from 6-18/20 years.

METHODOLOGY

The present investigation was carried out by the Child- Development department of College of Home Science under an ICAR funded research project namely AICRP in Home Science i.e All India Coordinated Research Project. A multi stage samplinprocedure was adopted. Similar procedure of data collection was adopted by each

state. Each state was divided according to different agro-climatic zones so as to get true representation of the state by all the six participating AICRP (CD) centers. The number of villages selected was proportionate to the number of villages of agro-climatic zones of the respective states. Schools served as the locale of study. The sample was drawn from the yearly age groups 6-18 for girls forming a total of minimum of 1300 girls as approximately 100 subjects were measured for weight and height at each age cohort. In addition to this, 150 boys of 19 and 20 years i.e. 75 at each age group were also measured keeping in view that boys mature a year or two later than girls. Thus, a minimum of 2750 children between 6-18/20 years were sampled for the present investigation by each center accounting for a total of 16500 children at national level. The information on family background was to be collected of each child by interviewing/Questionnaire the mother or the subjects (Older Children). The details of the sample selected for the study is shown in figure 1.

RESULTS AND DISCUSSION

The mean Weights and Heights of Rural (all centres Combined) boys and girls of age 6-18/20 years are presented in table 1 to 4.

Weight: It is inferred from the table 1 that the weight of rural boys increased with increase in age upto nineteen years. The weights of 19 & 20-yr. old boys were the same. There was a consistent difference of 2 kg between two consecutive reading up to the age of 12 years. The difference increased with age, a difference of 3-5 kg was observed for the age group 12-17 years. However, the weight of the children of the entire age group was below the ICMR and NCHS standards (50th percentile), but the values were found to be slightly higher than the 3rd percentile of NCHS standards upto the age of 15 years. The difference between NCHS and Indian boys increased with increase in age (Table 1). A difference of 3-5 kg was observed at six years of age and a difference of 10-20 kg at 18 year, while a difference of only 7 kg was observed at 20 yr. in comparison with ICMR and observed mean.

The weight of rural girls is presented in table 2. It is observed that the weight of the girls also increased with increase in age upto 17 years. There was a consistent difference of 2 kg between two consecutive reading up to the age of 12 years and 3 kgs for the later age groups. However, they were below the 50th percentile throughout the age group (Table 2). But the weight of the girls was more or less equal to the 3rd percentile of NCHS standards.

Height: The mean height of boys is presented in table 3. It is seen from the table that the height of the boys increased with increase in age upto

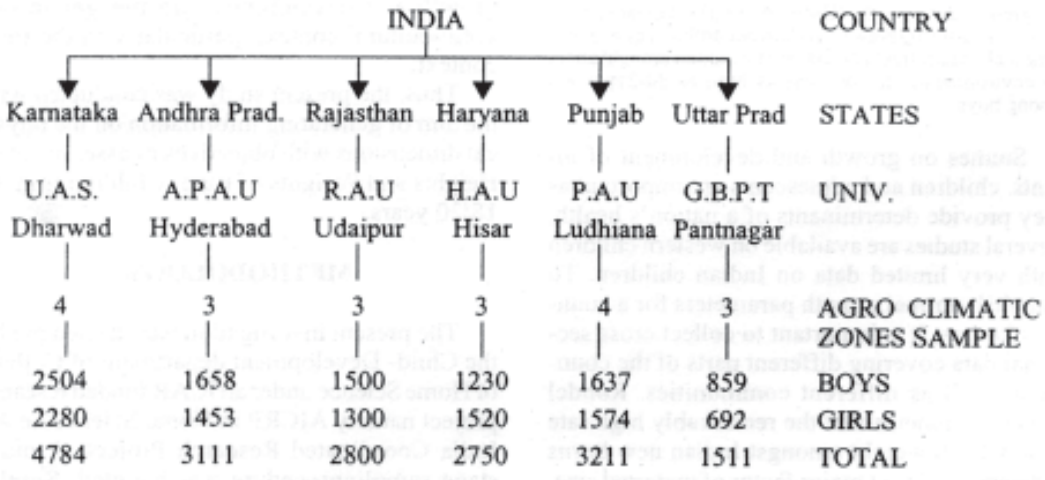

Fig. 1. State-wise distribution of rural boys and girls of 6-18/20 years

Table 1: Comparison of mean weights of Indian rural boys (6-20 yrs) with NCHS and ICMR standards

Age (yr.)	*N*	*Mean*	*SD*	*NCHS*	*ICMR*
6	520	17.67	3.41	20.7	22.14
7	586	19.08	3.19	22.9	24.46
8	641	21.08	4.24	25.3	26.42
9	615	23.81	4.54	28.1	30.00
10	643	25.3	4.67	31.4	32.29
11	655	27.43	5.24	35.3	35.26
12	676	29.32	5.99	39.8	38.78
13	615	33.02	6.49	45.0	42.88
14	636	36.19	7.10	50.8	48.26
15	658	41.01	7.52	26.7	52.15
16	577	44.79	7.17	62.1	55.54
17	603	48.08	7.44	66.3	57.91
18	511	49.15	7.49	68.9	53.38
19	266	52.32	7.04		58.9
20	205	53.32	8.43		59.64

Table 2: Comparison of mean weights of Indian rural girls (6-18 yrs.) with NCHS and ICMR standards

Age (yr.)	*N*	*Mean*	*SD*	*NCHS*	*ICMR*
6	622	16.61	2.82	19.5	21.56
7	565	18.21	3.26	21.8	24.45
8	583	20.08	3.9	24.8	25.97
9	566	23.03	4.64	28.5	29.82
10	622	25.03	5.09	32.5	33.58
11	622	27.35	5.69	37.0	37.17
12	636	30.68	6.13	41.5	42.97
13	600	34.43	6.17	46.1	44.54
14	622	37.09	5.87	50.3	46.7
15	652	39.55	5.76	53.7	48.75
16	563	41.89	6.32	55.9	
17	481	43.02	6.19	56.7	
18	335	42.17	6.55		

Table 3: Comparison of mean heights of Indian rural boys (6-20 yrs.) with NCHS and ICMR standards

Age (yr.)	*N*	*Mean*	*SD*	*NCHS*	*ICMR*
6	520	112.95	8.80	116.0	118.9
7	586	117.43	9.09	121.7	123.3
8	641	122.97	9.55	127.0	127.9
9	615	129.14	8.43	132.2	133.6
10	643	132.12	11.26	137.5	138.5
11	655	135.9	14.44	143.3	143.4
12	676	140.55	9.83	149.7	148.9
13	615	146.85	9.26	156.5	154.9
14	636	151.14	11.96	163.1	161.7
15	658	156.98	10.36	169.0	165.3
16	577	160.6	8.07	173.5	168.4
17	603	162.11	9.95	176.2	173.0
18	511	163.48	6.27	176.8	172.0
19	266	163.35	14.27		172.1
20	205	165.21	6.53		171.8

Table 4: Comparison of mean heights of Indian rural girls (6-18 yr.) with NCHS and ICMR standards

Age (yr.)	*N*	*Mean*	*SD*	*NCHS*	*ICMR*
6	622	110.35	9.81	114.60	117.73
7	565	115.38	7.79	120.60	122.65
8	583	120.88	7.78	126.40	127.22
9	566	127.69	8.52	132.20	133.08
10	622	132.04	9.91	131.30	138.90
11	622	136.98	8.42	144.80	145.00
12	636	142.07	9.11	151.50	150.98
13	600	146.94	7.20	157.10	153.44
14	622	149.78	8.96	160.40	155.04
15	652	151.42	8.42	161.80	155.98
16	563	152.83	6.57	162.40	156.00
17	481	153.58	6.35	163.00	
18	335	152.12	10.56	163.70	

18 to 20 years. Though there was hardly any difference between the height of 18 and 19 years old boys. There was a consistent increase of 5-7 cm between two consecutive age groups. This difference decreased at the age of 17-20 years. However, the height of the rural boys was below the NCHS (50th) and ICMR standards. The heights were below the 3rd percentile from the age 16 years onwards (Table 3). There was a difference of 4-6 cm at the age of 6 years from the reference standards and the difference increased with increase in age with a difference of 8-13 cm at the age of 18 years in comparison with NCHS and ICMR standards. A difference of 5.6 cm was observed in the final heights in comparison with ICMR standards.

The mean height of girls is presented in table 4. It is observed that the height of the girls increased with increase in age upto 17 years. There was a consistent difference of 5-7 cm between two consecutive age groups upto 12 years with a maximum difference of 17 cm between 8 and 9 years and between 11 and 12 years old girls. The difference between two consecutive age groups decreased to a difference of 1 to 2 cm from 12 years onwards. There was no difference between 17 and 18 year old girls. However, the heights were below the NCHS standards (50th) throughout the age period, but the heights were slightly higher than the 3rd percentile of the NCHS standards. A difference of 4-7 cm was observed at the age of 6 years while a difference of 4-11 cm was observed at the age of 18 years in comparison with NCHS and ICMR standards.

Comparison of Weight and Height of Children Between Centers

The comparisons of mean weights and mean heights were also calculated between Centres namely Dharwad, Hyderabad, Udaipur, Hisar, Punjab and Pantnagar separately for boys and girls. The comparisons were made age wise and presented in tables 5 to 8. For statistical comparison the comparisons were made groupwise, grouping the yearly age group as 6 to 8, 9 to 11, 12-14, 15-17 and 18 + and were statistically tested by 't' test.

Weight: The weight of boys for all the age groups in Dharwad centre was the lowest when compared with other centres (Table 5). The weight of boys of Pantnagar was more than other centres during the age of 6-11 years. But from 12 to 17 yr. the boys of Punjab had significantly higher weights. At 18 yr. the boys of Hisar had highest weights (Table 5). Significant differences were observed between almost all the centres. The girls of Dharwad had significantly lower weight than other centres during 6-18 years. The girls of Pantnagar had higher weight than other centres during the age 6-14 years but the girls of Hisar overtook the girls of other centres at the age 15 to 18 years (Table 6). Significant differences were observed between almost all the centres.

It is inferred that among boys of 18 and 20 yr., the extent of variation brought about by the environmental factors was the highest to the extent of 20 to 21 percent and it was about 10 to 15 percent in the age group 10-17 yr. But it was only 3-4 percent in the earlier age groups i.e. upto 8 yr. Among girls similar trend was observed but the extent of variation was to a lesser extent compared to boys.

Height: The results of t-test revealed that in almost all the age groups of 6-18 yrs the height of boys of Udaipur Centre was lower when compared with other centres. Dharwad boys of 6-8 yr. were also significantly lower in height than boys of other centres even at 18 + yr. The height of Udaipur was lowest when compared with

Table 5: Comparison of mean weight of Indian rural boys between six centres

Age (yr)	*Punjab*		*Hisar*		*Udaipur*		*Dharwad*		*Hyderabad*		*Pangnagar*	
	Mean	*SD*	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*
6-8	19.93	3.03	20.12	3.24	18.22	2.73	17.40	2.96	18.86	3.17	22.72	5.49
	(310)		(273)		(87)		(458)		(358)		(265)	
9-11	27.49	4.95	26.27	4.60	23.47	5.52	22.96	3.94	25.78	3.80	28.04	5.83
	(329)		(311)		(89)		(466)		(367)		(337)	
12-14	36.75	7.03	34.22	6.58	29.48	5.95	29.97	6.25	32.95	7.00	35.61	7.01
	(314)		(316)		(91)		(674)		(355)		(165)	
15-17	48.35	7.83	47.24	8.10	42.87	7.16	40.75	6.85	45.03	6.77	45.67	7.84
	(361)		(328)		(87)		(614)		(341)		(82)	
18+	55.64	8.59	56.26	4.98	50.10	4.76	45.58	5.86	49.93	7.03	47.10	7.76
	(170)		(200)		(71)		(292)		(237)		(10)	

Figures in parentheses indicate sample size

Table 6: Comparison of mean weights of Indian rural girls between six centres

Age (yr)	*Punjab*		*Hisar*		*Udaipur*		*Dharwad*		*Hyderabad*		*Pangnagar*	
	Mean	*SD*	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*
6-8	18.97	3.15	18.20	2.98	18.28	2.46	16.71	2.42	18.41	3.16	21.07	6.26
	(314)		(314)		(92)		(523)		(331)		(203)	
9-11	26.8	5.69	25.31	4.53	22.06	4.21	22.45	3.95	25.64	5.20	28.88	6.44
	(343)		(315)		(87)		(462)		(358)		(224)	
12-14	36.87	6.90	35.20	5.72	31.69	4.51	31.19	6.09	34.97	6.36	36.94	6.41
	(337)		(313)		(85)		(626)		(352)		(125)	
15-17	43.27	6.20	44.83	5.80	42.32	5.67	37.85	5.34	41.03	5.60	42.14	5.82
	(311)		(303)		(90)		(516)		(335)		(130)	
18+	43.40	5.85	48.47	5.98	40.33	3.54	39.32	4.54	43.47	7.69	40.35	3.18
	(34)		(52)		(9)		(153)		(77)		(10)	

Figures in parentheses indicate sample size

other centres, where as the height of boys of 6-8 yrs of Pantnagar was higher when compared with other centres. However, at 9-11 yr. and 12-14 yr. no significant differences were observed between Pantnagar and Punjab boys. The boys of these two centres were significantly better than boys of other centres. At 18 + yr. Punjab boys had highest values in height (Table 7). Significant differences were observed between almost all the centers.

Table 7: Comparison of mean heights of Indian rural boys between six centes

Age (yr)	*Punjab*		*Hisar*		*Udaipur*		*Dharwad*		*Hyderabad*		*Pangnagar*	
	Mean	*SD*	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*
6-8	119.2	7.35	117.2	9.15	115.1	12.6	114.9	7.03	116.7	9.03	127.4	14.21
	(310)		(273)		(87)		(415)		(358)		(265)	
9-11	136.3	8.27	130.2	22	127.4	9.39	129.5	7.19	132.1	7.68	136.8	9.62
	(329)		(311)		(89)		(466)		(367)		(337)	
12-14	150.9	9.00	146.9	12.1	139.6	16.4	143.0	10.8	146.9	9.73	149.5	10.71
	(314)		(316)		(91)		(674)		(355)		(165)	
15-17	164.2	7.62	158.4	7.63	155.1	19.7	157.2	10.2	161.8	6.71	162.1	9.09
	(361)		(328)		(87)		(614)		(341)		(82)	
18+	169.1	5.73	162.2	1.16	155.9	17.7	163.0	5.92	164.6	5.89	162.6	8.08
	(170)		(200)		(71)		(292)		(327)		(10)	

Figures in parentheses indicate sample size

Table 8: Comparison of mean heights of Indian rural girls between six centes

Age (yr)	*Punjab*		*Hisar*		*Udaipur*		*Dharwad*		*Hyderabad*		*Pangnagar*	
	Mean	*SD*	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*
6-8	117.2	7.57	113.1	10.94	116.9	4.36	113.2	6.72	115.1	8.59	123.2	15.99
	(312)		(314)		(92)		(523)		(331)		(203)	
9-11	134.9	8.87	132.7	12.75	126.3	9.72	128.8	7.09	132.8	8.47	137.1	9.31
	(343)		(315)		(87)		(462)		(358)		(224)	
12-14	150.0	7.22	147.9	13.62	140.1	6.6	143.8	7.54	146.3	7.28	147.9	6.71
	(337)		(313)		(85)		(626)		(352)		(125)	
15-17	155.8	5.19	155.7	6.72	148.7	17.3	150.7	5.73	150.1	5.57	150.6	5.86
	(311)		(303)		(90)		(516)		(335)		(130)	
18+	154.3	7.43	158.1	5.74	147.4	14.5	151.1	4.94	150.3	18.21	147.2	5.30
	(34)		(52)		(9)		(153)		(77)		(10)	

Figures in parentheses indicate sample size

Table 9: Percent of variation brought about by environmental factors on weights and heights

	Weights						*Heights*			
	Boys			*Girls*			*Boys*		*Girls*	
Age	*N*	*% of varn.*	*Sig.*	*N*	*% of varn.*	*Sig.*	*% of varn.*	*Sig.*	*% of varn.*	*Sig.*
6	520	3.53	NS	622	4.35	0.007**	4.85	0.012**	5.87	.0002***
7	586	9.05	***	565	5.40	0.002**	4.76	0.0057**	4.42	.014**
8	641	3.95	**	583	6.19	0.0002***	3.50	0.032*	4.41	.011**
9	615	7.03	***	566	6.11	0.0004***	4.59	0.005**	5.18	.003**
10	643	10.61	***	622	5.81	0.0002***	3.19	0.056*	4.82	.002**
11	655	10.34	***	622	6.06	0.0001***	4.74	0.002**	7.68	***
12	676	11.21	***	636	12.29	***	6.32	NS	5.40	***
13	615	12.19	***	600	6.90	***	8.23	NS	5.51	***
14	636	7.55	***	622	8.18	***	5.18	NS	6.55	***
15	658	10.57	***	652	11.29	***	4.43	NS	4.37	***
16	577	13.94	***	563	14.83	***	8.12	NS	9.22	***
17	603	16.37	***	481	10.71	***	3.90	0.02*	8.02	***
18	511	19.95	***	335	17.59	***	4.17	0.04*	7.69	0.21NS
19	266	10.60	.004**				6.38	NS		
20		21.50	***				14.20	.002**		

The comparison of mean heights of girls revealed that girls from Hisar and Dharwad had significantly lower heights at 6-8 yr. when compared with other centres. The girls from Udaipur had significantly lower height than the girls from other centres in the age group of 9-17 yr. The girls from Pantnagar had significantly higher heights at 6-11 yr. and the girls from Punjab had significantly higher heights at 12-17 yr. when compared with other centres. The girls of Hisar had highest height at 18 + yr. (Table 8). Significant differences were observed between almost all the centers.

Factors Influencing Weights and Heights of Rural Children of 6-18/20 Years

The influence of factors such as mothers education, fathers education, mothers occupation and fathers occupation, caste, family type, family size, house type, house assets, farm assets on weights and heights of rural children from 6 to 18/20 years was studied through multiple correlation and regression analysis. The extent of variation brought about by these factors i.e. the combined effect is presented in table 9.

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