 Anthropologist, 10(2): 119-128 (2008)

Biology of the People of Jammu and Kashmir: Growth Patterns of the People of Jammu and Kashmir, India with Special Reference to Ladakh region

M.K. Bhasin, L.P. Singh and Balvinder Kaur

Department of Anthropology, University of Delhi, Delhi 110 007, India

KEYWORDS Jammu and Kashmir. Growth Patterns. Percentiles. Ladakh. Himalayas

ABSTRACT The present paper deals with the growth patterns among various population groups of Jammu and Kashmir state, India. The study includes population groups from all the three main divisions of the state. Various population groups for the purpose of this paper have been grouped into two. The first group deals with the three population groups (pooled) of the high altitude Ladakh region, while the second one deals with all the population groups of the state pooled for compiling the state reference values. The total number of subjects studied in the state was 2,043 ranging from 8+ to adulthood. In most of the anthropometric values, the males of Jammu and Kashmir state fair better compared to the Indian reference standards. However when comparisons are made with the US reference data, the 50th percentile values of Jammu and Kashmir males are comparable to and even lower tha the 5th centiles values of Jammu and Kashmir in case of height and weight.

INTRODUCTION

Numerous attempts have been made all over the world to document unique growth patterns of people living at the ranging high altitude. The studies by Clegg et al. (1970, 1972) and Hoff (1972) in various regions of the world are pioneering. Some attempts have been made to document growth patterns of populations groups inhabiting the Himalayan range.

A project to study man-environment interaction in the state of Jammu and Kashmir was launched in 1987 under the UNESCO Man and Biosphere (MAB) Programme. The aim of the study was to document the impact of environment on human being living in the Himalayan zones. This project has special emphasis on Ladakh region, almost unknown to the outside scientific world till then , as there were few reports and studies on the population groups living there. The project undertook a series of studies on the growth patterns of the population groups living in the region. Some of these have been reported in the literature (Bhasin and Singh, 1991, 1992 a,b,c, Singh, 1991). Earlier publications in the series (Bhasin and Singh (1992d,e) the dealt with individual population groups.

The present study was designed to furnish the growth standards in the form of centiles for various population groups of Jammu and Kashmir state. This paper also presents selected percentiles are presented for the boys aged 8+ to 18+ years for male adults. These percentiles can be used to identify potential problems related to health and nutrition, and to facilitate the comparison of one group of children to another. Besides they serve as an invaluable reference for future research.

MATERIAL AND METHODS

Details about the subjects, methodology involved and the results of various anthropometric measurements have already been presented (Bhasin et al., 2008)

In order to get a comprehensive picture of the growth patterns, it was a set of 23 anthropometric measurements was studied for the sample of 2,043 males of the state. However in the present paper only the following measurements were included

- Body Weight

Projective Height Measurements

- Height
- Sitting Height

Diameter

- Biacromial Diameter
- Bicristal diameter
- Humerus Bicondylar Diameter
- Femur Bicondylar Diameter

Circumferences

- Chest circumference
- Mid upper arm circumference
- Calf Girth

Skinfolds

- Biceps Skinfold
- Triceps skinfold
- Subscapular skinfold

This paper attempts to present the state data as a whole and the data on the Ladakhi population groups (pooled).

Table 1: Sample size break up of various population groups of Jammu and Kashmir state and Ladakh region of Jammu and Kashmir state

Age Group (in years)	*Ladakh (Pooled)*	*Jammu and Kashmir (Pooled)*
8+	83	150
9+	93	155
10+	90	179
11+	103	185
12+	106	186
13+	99	176
14+	101	178
15+	114	191
16+	109	180
17+	80	144
18+	74	136
19+ and above	92	174

RESULTS

Sample size in each age group in two groups i.e. Ladakh region and Jammu and Kashmir state are presented in Table 1. For the purpose of results, means, standard deviation and the selected percentiles (*viz*. 5th, 10th, 25th, 50th, 75th, 90th and 95th) at each level for only selected anthropometric measurements were computed. All the population groups of Ladakh were pooled together to furnish the reference standards of the region. In addition, all the data collected for the state of Jammu and Kashmir were pooled to provide detailed information on the growth standards of the state as a whole.

The results of the Ladakhi group are being presented in Table 2. The mean values of body weight of Ladakhi males increases with age. A steady increase is observed upto 12+ years, with the maximum increase occuring at 14+ years after which the gain in body weight slows down. The 50th percentile values of body weight increases from 24.3 kg to 49.2 kg from 8+ to 18+ years respectively. The 50th percentile of adult weight is 54.5 kg in this group.

Mean height and sitting height also increase with age with a maximum increase during 14+ to 15+ years for both the measurements. The 50th percentile values of height range between 124.8 cm to 162.3 cm for age groups 8+ to 18+ years, whereas the 50th centile of sitting height increases from 67.0 cm to 84.9 cm between age 8+ to 18+ years respectively. The variation in height and weight also increases with age.

Biacromial and bicristal diameters increase regularly till 14 years, maximum increase being observed between 14+ and 15+ years. The average adult biacromial and bicristal diameters are 36.6 cm and 28.1 cm respectively. The 50th percentile values also increase in close approximation of mean values.

Table 2: Selected Percentiles of selected anthropometric measurements in Jammu and Kashmir males (Pooled for the state)

1. Height

Age (in years)	*Mean (cm)*	*S.D*	*Percentiles*						
			5	*10*	*25*	*50*	*75*	*90*	*95*
8+	125.4	6.7	116.1	118.4	120.8	125.0	129.5	133.8	137.4
9+	127.7	4.9	120.6	121.6	123.6	128.1	131.5	133.4	135.1
10+	132.5	6.3	121.8	124.5	128.8	132.5	136.8	139.9	141.8
11+	134.3	7.9	122.7	124.3	128.9	133.1	139.0	145.7	148.5
12+	140.7	9.6	126.1	129.1	133.8	140.2	147.3	152.1	157.5
13+	145.2	9.9	130.9	132.5	138.0	144.0	152.6	158.2	161.5
14+	151.9	10.6	133.7	137.7	144.6	153.6	159.7	163.8	166.5
15+	158.6	8.7	142.7	147.5	153.6	159.6	163.9	168.2	172.5
16+	160.6	8.5	144.1	149.3	155.8	161.8	166.1	170.1	171.0
17+	162.9	7.6	147.9	154.4	158.7	162.9	167.6	172.9	173.8
18+	165.3	6.8	155.6	157.6	160.3	164.7	168.9	174.8	178.5
19+ and above	167.1	5.2	158.7	160.0	163.4	167.0	170.8	173.8	175.0

2. Weight

Age (in years)	Mean (kg)	S.D	Percentiles						
			5	10	25	50	75	90	95
8+	21.4	3.2	16.0	17.5	19.0	21.0	24.5	25.5	26.5
9+	23.0	2.8	18.0	20.0	23.0	23.0	24.5	27.0	28.4
10+	24.9	3.8	19.5	21.0	25.0	25.0	26.5	29.5	30.0
11+	27.3	4.5	20.5	23.0	26.0	26.0	29.5	33.0	36.0
12+	30.2	5.9	23.0	24.2	29.0	29.0	32.5	37.5	40.4
13+	32.8	5.6	25.2	26.6	33.0	33.0	36.0	40.1	44.8
14+	37.7	6.9	26.2	28.7	38.0	38.0	43.0	46.7	50.0
15+	43.3	8.4	31.0	34.9	43.0	43.0	47.0	51.5	55.3
16+	45.2	6.8	30.8	34.7	46.8	46.8	49.5	52.0	54.7
17+	48.9	6.3	37.1	42.0	48.5	48.5	53.0	55.9	59.9
18+	50.7	5.3	43.0	44.1	51.0	51.0	53.1	55.0	59.0
19+ and above	57.9	8.3	47.5	50.0	56.0	56.0	62.0	66.5	77.5

3. Sitting Height

Age (in years)	Mean (cm)	S.D	Percentiles						
			5	10	25	50	75	90	95
8+	66.4	5.5	59.4	61.1	63.5	65.6	68.4	71.1	74.5
9+	67.0	4.1	60.2	60.8	64.0	67.1	69.8	72.1	73.6
10+	69.1	8.6	61.5	63.7	66.6	70.0	71.9	74.4	81.2
11+	69.2	6.9	63.3	65.1	67.1	69.4	72.8	74.8	75.8
12+	73.3	5.3	66.4	68.0	69.5	72.4	75.8	79.1	85.4
13+	75.0	4.9	67.8	68.5	70.8	75.4	78.7	81.3	82.7
14+	77.2	8.6	68.2	70.0	73.8	78.2	81.9	84.2	85.5
15+	81.8	4.9	73.2	74.8	78.8	82.8	85.4	87.1	88.5
16+	83.7	4.6	75.3	78.4	80.6	83.8	87.4	89.0	89.9
17+	84.3	4.4	75.8	78.7	82.2	84.6	87.0	88.0	90.6
18+	85.5	4.5	78.9	80.8	83.5	85.9	88.4	89.9	91.4
19+ and above	84.7	8.5	78.7	80.9	83.5	85.6	88.0	89.1	90.1

4. Chest Circumference

Age (in years)	Mean (cm)	S.D	Percentiles						
			5	10	25	50	75	90	95
8+	60.1	4.2	54.0	54.8	57.0	59.8	62.0	66.9	68.4
9+	61.8	4.8	56.6	57.2	58.4	60.0	64.2	68.9	73.4
10+	62.5	7.5	56.4	58.4	60.3	62.9	64.8	67.7	71.4
11+	64.5	7.9	57.9	59.8	62.1	64.8	68.0	70.8	71.9
12+	66.7	7.8	59.8	61.5	64.5	66.9	69.0	73.4	75.5
13+	67.5	10.1	60.0	62.9	65.8	68.8	71.8	75.3	77.5
14+	71.8	8.4	63.4	64.8	67.9	72.4	76.1	79.6	81.4
15+	76.0	8.6	66.3	69.9	73.8	76.8	79.9	82.6	86.0
16+	76.9	10.1	66.5	69.8	74.0	79.1	81.4	84.0	86.2
17+	80.1	12.0	69.4	74.6	78.0	81.9	84.8	88.4	89.9
18+	82.3	3.9	75.9	76.8	79.8	82.4	84.6	87.5	88.8
19+ and above									

5. Upper Arm Circumference:

Age (in years)	Mean (cm)	S.D.	Percentiles						
			5	10	25	50	75	90	95
8+	15.7	1.3	13.4	14.0	14.9	15.8	16.5	17.8	18.3
9+	15.8	1.6	14.0	14.2	14.8	15.5	16.7	17.5	18.4
10+	16.1	1.3	14.0	14.4	15.3	16.2	16.8	17.8	18.3
11+	16.3	2.0	14.1	14.5	15.2	16.2	17.2	18.2	19.0
12+	16.6	1.5	14.5	15.0	15.5	16.4	17.5	18.5	20.4
13+	17.2	2.0	14.5	15.2	16.0	17.3	18.3	19.5	20.2
14+	18.2	1.9	15.0	15.6	17.0	18.0	20.0	21.0	21.5
15+	19.3	1.9	16.0	16.9	18.0	19.3	20.4	21.8	22.4
16+	20.1	2.0	16.5	17.5	18.6	20.3	21.4	22.3	23.0
17+	21.1	1.8	18.0	19.0	20.0	21.1	22.1	23.2	24.0
18+	21.4	1.8	18.9	19.0	20.0	21.4	22.8	23.8	24.5
19+ and above	23.2	2.1	20.4	20.8	21.8	23.0	24.0	25.5	27.5

6. Calf Girth

Age (in years)	*Mean (cm)*	*S.D.*	*Percentiles*						
			5	*10*	*25*	*50*	*75*	*90*	*95*
8+	22.4	2.0	19.7	19.9	21.0	22.0	23.5	24.8	25.5
9+	22.4	1.8	19.2	19.8	21.0	22.4	23.8	24.4	25.2
10+	23.1	1.7	20.3	21.0	22.0	23.2	24.0	25.0	25.8
11+	23.8	2.1	20.6	21.7	22.4	23.6	25.0	26.2	26.8
12+	24.5	2.2	22.0	22.1	23.2	24.0	25.3	27.2	29.2
13+	25.4	2.2	22.4	23.0	24.0	25.2	26.5	28.3	29.2
14+	26.8	2.2	22.7	23.5	25.4	27.0	28.3	29.5	30.8
15+	28.4	2.3	23.9	25.6	27.2	28.4	29.9	31.0	32.1
16+	29.0	2.7	23.3	25.0	27.0	29.4	30.7	31.8	32.6
17+	30.0	2.3	25.7	27.0	28.7	30.0	31.6	32.9	33.6
18+	30.5	2.2	27.4	28.0	29.2	30.1	31.8	33.1	34.7
19+ and above	32.1	3.3	27.6	28.9	30.0	32.1	33.3	35.7	39.0

7. Biacromial Diameter

Age (in years)	*Mean (cm)*	*S.D.*	*Percentiles*						
			5	*10*	*25*	*50*	*75*	*90*	*95*
8+	26.9	2.1	23.5	24.0	25.5	27.0	28.3	29.3	30.0
9+	27.8	1.7	25.5	25.8	26.8	27.8	29.0	30.3	30.9
10+	28.5	1.9	25.5	26.4	27.3	28.5	29.8	31.0	31.8
11+	28.3	2.5	24.8	25.5	26.5	28.0	29.6	31.6	32.6
12+	29.8	2.9	25.4	26.4	28.0	29.5	31.5	33.5	34.5
13+	31.2	2.8	26.6	27.5	29.3	31.5	33.1	34.6	36.4
14+	32.5	3.4	27.1	28.1	30.2	32.1	35.5	36.8	38.0
15+	34.5	2.8	29.9	31.0	33.0	34.7	36.0	37.9	39.0
16+	35.5	4.1	30.0	31.6	34.0	36.0	37.7	38.5	39.2
17+	36.4	4.5	31.2	33.0	35.0	36.6	38.1	39.5	40.0
18+	37.7	4.5	34.5	35.0	36.0	38.0	39.0	40.3	41.0
19+ and above	38.4	4.4	33.5	34.9	37.0	38.7	40.0	41.5	42.8

8. Bicristal Diameter

Age (in years)	*Mean (cm)*	*S.D.*	*Percentiles*						
			5	*10*	*25*	*50*	*75*	*90*	*95*
8+	19.9	1.6	18.0	18.4	18.9	19.8	21.0	22.0	22.8
9+	20.5	1.9	18.4	18.4	19.4	20.3	21.4	22.5	23.9
10+	20.9	1.7	18.4	19.1	19.8	20.6	22.0	22.6	24.9
11+	21.1	1.9	18.0	18.5	19.8	21.0	22.4	23.6	24.7
12+	22.5	2.1	19.5	20.2	21.0	22.4	23.6	24.9	25.5
13+	23.3	2.0	20.0	20.8	21.9	23.5	25.0	25.5	26.4
14+	24.6	2.2	21.4	22.0	23.0	24.5	26.1	27.5	28.4
15+	26.3	2.3	22.4	23.6	25.0	26.5	27.5	28.7	29.2
16+	26.9	3.4	23.0	23.8	26.0	27.1	28.1	29.5	30.0
17+	27.2	3.1	24.0	24.6	26.0	27.4	28.5	29.5	30.0
18+	28.2	3.2	25.4	26.0	27.4	28.4	29.4	30.1	30.5
19+ and above	28.5	3.8	25.2	26.2	27.2	28.2	30.0	31.6	32.1

9. Biceps Skinfolds

Age (in years)	*Mean (mm)*	*S.D.*	*Percentiles*						
			5	*10*	*25*	*50*	*75*	*90*	*95*
8+	3.6	0.8	2.0	3.0	3.0	4.0	4.0	4.0	5.0
9+	3.8	0.9	2.6	3.0	3.0	4.0	4.0	5.0	5.4
10+	4.2	-	2.0	2.0	3.0	3.0	4.0	5.0	6.0
11+	3.5	2.7	2.0	2.0	2.0	3.0	4.0	5.0	5.0
12+	3.0	0.8	2.0	2.0	2.0	3.0	4.0	4.0	4.0
13+	3.1	1.3	2.0	2.0	2.0	3.0	3.0	4.0	5.0
14+	3.1	0.9	2.0	2.0	2.0	3.0	4.0	4.0	5.0
15+	3.6	2.5	2.0	2.0	3.0	3.0	4.0	4.0	5.0
16+	3.3	1.0	2.0	2.0	3.0	3.0	4.0	4.0	5.0
17+	3.3	0.9	2.0	2.0	3.0	3.0	4.0	4.0	5.0
18+	3.5	1.1	2.0	2.0	3.0	3.0	4.0	4.0	5.0
19+ and above	4.3	2.1	2.0	3.0	3.0	4.0	5.0	7.0	8.0

10. Triceps Skinfolds

Age (in years)	*Mean (mm)*	*S.D.*	*Percentiles*						
			5	*10*	*25*	*50*	*75*	*90*	*95*
8+	6.5	1.8	4.0	5.0	5.0	6.0	8.0	10.0	10.0
9+	6.7	1.7	4.6	5.0	6.0	6.0	8.0	9.0	9.4
10+	6.3	1.9	4.0	4.1	5.0	6.0	7.0	9.9	11.0
11+	6.1	2.2	3.0	4.0	5.0	6.0	7.0	9.0	9.1
12+	5.7	1.6	4.0	3.0	4.0	5.0	7.0	8.0	8.0
13+	5.6	2.2	3.0	4.0	4.0	5.0	6.5	8.0	9.0
14+	5.6	1.5	3.4	4.0	4.8	5.0	7.0	8.0	8.0
15+	5.5	2.0	3.0	4.0	4.0	5.0	6.0	8.0	9.0
16+	5.8	1.7	4.0	4.0	5.0	5.0	7.0	8.0	8.4
17+	6.2	1.8	4.0	4.0	5.0	6.0	7.0	8.0	9.0
18+	6.1	1.9	4.0	4.0	5.0	6.0	7.0	8.0	10.0
19+ and above	7.5	3.1	4.0	4.0	6.0	7.0	9.0	11.0	13.0

11. Subscapular Skinfolds

Age (in years)	*Mean (mm)*	*S.D.*	*Percentiles*						
			5	*10*	*25*	*50*	*75*	*90*	*95*
8+	4.6	0.9	3.0	4.0	4.0	5.0	5.0	6.0	6.0
9+	4.6	1.0	3.0	3.0	4.0	4.0	5.0	6.0	6.4
10+	4.7	1.4	3.0	3.0	4.0	4.0	5.0	6.0	8.0
11+	4.4	1.4	3.0	3.0	4.0	4.0	5.0	6.0	6.0
12+	4.3	1.1	3.0	3.0	4.0	4.0	5.0	6.0	6.0
13+	4.7	1.4	3.0	3.0	4.0	5.0	5.0	6.0	7.0
14+	4.9	1.3	3.0	3.0	4.0	5.0	6.0	7.0	7.0
15+	5.6	1.4	4.0	4.0	5.0	5.0	6.0	7.3	8.0
16+	5.7	1.4	4.0	4.0	5.0	6.0	6.7	8.0	8.0
17+	6.5	1.6	4.0	5.0	5.0	7.0	7.0	9.0	9.0
18+	6.8	1.7	4.0	5.0	5.0	6.0	7.0	8.0	9.0
19+ and above	8.9	3.6	4.0	5.9	7.0	8.0	10.0	13.0	18.0

Chest circumference, like other anthropometric measurements, also increases regularly between 8+ and 18+ years. The maximum increase is noticed at 14+ years. The standard deviation values of chest circumference show maximum dispersion during 14+ - 16+ years. The 50th percentile value also exhibit the same trend as the mean values. The average adult chest circumference is 81.4 cm at 18 years.

A regular increase in upper arm and calf girths continues upto 17+ years after which only a little increase could be observed. Maximum increase in arm and calf girth measurements is noticed at 14+ years. The 50th percentiles values increase from 17.0 cm to 20.5 cm from 8+ to 18+ years respectively for arm girth and from 23.3 cm to 29.9 cm for calf girth. The average adult arm girth and calf girth measurements are 22.5 cm and 31.0 cm respectively. It is evident from Table 2 that no regular trend could be observed for skinfold measurements.

The mean, SD and selected percentile values (5th, 10th, 25th, 50th, 75th, 90th and 95th) for the males of Jammu and Kashmir state have been presented in Table 3. The mean values of body weight increase with age with a maximum increase being observed at 14+ years. A total increase of about 29.3 kgs is observed between 8+ and 18+ years among the males of Jammu and Kashmir state. The mean values of height and sitting height also increase with age. Regular increase in height and sitting height is observed up to 13 years after which the highest gain is observed at 14+ in both the measurements. The 50th percentile values of height range between 125.0 cm to 164.7 cm for the age groups 8+ to 18 years. The 50th centile values of sitting height increase from 65.6 cms at 8+ to 84.6 cm at 18+ years. The peak gain in sitting height, like height vertex, is noticed at 14+ years among the males of Jammu and Kashmir state.

There is a regular increase in the mean values of chest circumference up to 18+ years. The maximum increase again occurs at 14+ years among the males of Jammu and Kashmr state. The avearge adult chest circumference is 86.8 cm.

The mean and 50th percentile values of upper arm and calf circumference exhibit a continuous

Table 3: Selected Percentiles of selected anthropometric measurements Ladakhi males.

1. Height

Age (in years)	*Mean (cm)*	*S.D*	*Percentiles*						
			5	*10*	*25*	*50*	*75*	*90*	*95*
8+	125.6	4.0	119.6	120.3	122.4	124.8	127.7	133.2	-
9+	128.0	4.5	120.5	121.5	123.0	128.8	133.0	133.4	134.2
10+	129.5	6.7	121.7	123.1	125.7	129.5	134.7	139.4	140.0
11+	131.3	6.1	121.6	123.9	127.7	130.7	134.2	139.0	143.1
12+	135.9	7.7	124.2	125.9	130.4	135.2	140.5	147.4	148.4
13+	139.5	7.7	129.3	130.7	134.1	138.3	144.2	149.4	152.5
14+	146.1	10.7	129.6	133.3	139.7	144.9	151.4	160.0	163.1
15+	154.1	8.2	136.8	142.6	149.3	154.6	161.0	163.8	166.3
16+	157.0	8.9	141.2	144.8	152.3	158.6	163.0	166.1	170.3
17+	160.3	7.2	145.7	150.2	156.9	160.5	165.5	168.6	171.0
18+	162.3	5.4	154.5	155.8	158.6	162.3	165.2	168.3	174.1
19+ and above	164.3	4.6	154.1	159.6	162.4	164.1	165.9	170.9	173.7

2. Weight

Age (in years)	*Mean (kg)*	*S.D*	*Percentiles*						
			5	*10*	*25*	*50*	*75*	*90*	*95*
8+	23.5	2.5	19.0	19.6	21.3	24.3	25.0	27.6	28.5
9+	25.2	3.1	20.0	20.3	23.0	25.0	27.0	29.7	32.0
10+	25.7	3.9	19.6	21.5	23.3	25.3	27.8	30.8	37.2
11+	26.9	4.0	23.0	24.0	24.5	26.0	28.5	31.8	34.5
12+	29.3	5.2	23.2	24.4	25.6	28.5	31.0	35.5	39.8
13+	30.9	4.3	25.0	26.0	28.0	30.0	33.1	37.1	39.0
14+	34.8	6.4	26.0	26.9	30.0	34.0	38.0	44.5	47.3
15+	41.0	6.3	29.0	33.0	38.0	41.0	45.0	48.0	51.8
16+	43.8	7.4	30.3	32.0	39.5	45.0	49.0	51.4	53.7
17+	48.4	6.3	34.1	41.1	45.6	48.0	52.0	55.5	59.9
18+	49.7	4.4	36.9	43.7	46.5	49.2	53.0	55.0	57.3
19+ and above	55.6	6.8	46.2	47.5	52.0	54.5	59.0	63.6	70.0

3. Sitting Height

Age (in years)	*Mean (cm)*	*S.D*	*Percentiles*						
			5	*10*	*25*	*50*	*75*	*90*	*95*
8+	66.9	3.3	61.1	61.5	64.9	67.0	69.0	72.2	-
9+	68.6	2.7	63.7	64.0	66.6	68.9	71.1	72.4	-
10+	68.9	3.5	62.2	63.0	66.3	69.9	71.0	72.5	76.3
11+	69.4	3.7	64.3	65.5	67.0	68.9	71.6	74.6	75.6
12+	72.1	4.8	65.4	67.0	68.8	71.5	74.7	77.0	81.9
13+	72.9	4.4	66.4	68.1	69.8	72.4	75.6	78.9	80.8
14+	75.5	4.8	67.9	69.4	71.5	75.5	78.5	81.9	83.4
15+	80.2	5.4	71.3	73.2	76.8	80.8	84.8	86.6	88.1
16+	82.5	5.0	73.0	75.5	80.3	82.4	86.2	88.8	90.3
17+	83.6	4.7	74.4	77.5	81.4	83.8	86.8	88.9	90.2
18+	84.8	5.0	75.2	80.3	83.2	84.9	87.4	90.1	91.9
19+ and above	86.1	3.5	79.4	80.9	84.0	86.3	88.0	90.3	92.0

4. Biacromial Diameter

Age (in years)	*Mean (cm)*	*S.D*	*Percentiles*						
			5	*10*	*25*	*50*	*75*	*90*	*95*
8+	28.6	1.3	26.4	26.5	27.4	28.8	29.5	30.4	-
9+	29.0	1.6	26.8	26.9	27.5	28.8	30.5	31.4	31.6
10+	28.2	1.9	26.9	27.4	28.1	29.0	29.5	31.0	32.1
11+	27.2	1.9	24.2	25.0	26.0	27.0	28.1	29.4	29.8
12+	28.6	2.4	25.1	25.4	27.0	28.5	29.5	31.6	33.2
13+	29.4	2.3	25.7	26.5	27.6	29.5	31.1	32.5	32.9
14+	30.5	2.9	25.0	27.2	28.8	31.0	32.0	34.2	35.6
15+	33.2	3.0	29.0	29.9	31.5	33.0	34.9	37.5	38.8
16+	34.5	2.9	29.2	30.0	33.0	34.8	36.1	38.0	39.5
17+	35.5	2.6	31.0	32.0	34.0	56.6	37.5	38.5	39.9
18+	36.7	1.9	33.9	34.5	35.1	36.5	38.4	39.0	39.5
19+ and above	36.6	2.7	33.1	33.3	34.9	36.5	38.6	39.9	40.6

5. Bicristal Diameter

Age (in years)	*Mean (cm)*	*S.D*	*Percentiles*						
			5	*10*	*25*	*50*	*75*	*90*	*95*
8+	21.4	1.0	19.5	19.8	20.6	21.5	22.9	22.6	-
9+	21.8	1.8	17.0	19.0	20.8	21.9	23.5	24.1	24.5
10+	21.4	1.8	18.3	19.1	19.8	21.5	22.5	24.9	25.3
11+	20.6	1.9	17.6	18.1	19.1	20.8	21.8	22.5	23.5
12+	21.8	2.0	18.2	19.4	20.4	21.9	23.2	24.3	24.8
13+	22.6	1.8	19.3	20.0	21.2	22.6	24.0	25.1	25.5
14+	23.7	2.1	20.0	21.2	22.1	23.9	24.9	26.5	27.5
15+	25.7	2.0	21.7	22.4	24.5	25.8	27.4	28.3	28.9
16+	26.6	2.5	21.6	23.8	25.0	27.0	28.4	29.9	30.8
17+	26.9	1.8	23.9	24.0	25.5	26.8	28.2	29.5	30.0
18+	27.9	1.7	25.2	25.6	26.8	28.3	29.3	29.9	30.3
19+ and above	28.1	2.1	24.4	25.8	27.1	27.7	29.2	31.4	31.9

6. Chest Circumference (Normal)

Age (in years)	*Mean (cm)*	*S.D*	*Percentiles*						
			5	*10*	*25*	*50*	*75*	*90*	*95*
8+	66.9	2.3	62.6	63.3	64.9	66.9	68.8	69.8	-
9+	69.4	4.1	64.4	64.6	66.3	68.4	73.0	78.8	-
10+	66.4	4.7	58.6	59.6	63.3	65.6	70.2	74.7	76.1
11+	65.7	4.4	59.6	59.8	62.8	65.4	68.1	70.8	72.5
12+	67.3	4.6	59.8	61.2	64.7	66.9	69.0	73.9	76.3
13+	68.4	3.7	60.8	64.6	65.9	68.1	71.2	73.2	74.6
14+	71.6	5.6	63.5	64.7	66.8	70.2	75.6	79.6	81.5
15+	76.6	5.3	66.6	69.8	73.8	76.3	79.1	83.6	86.1
16+	77.7	6.2	65.9	68.2	73.9	78.0	82.4	84.5	86.7
17+	81.9	5.7	69.8	73.9	79.3	82.4	84.8	89.0	91.1
18+	81.4	3.5	73.5	76.4	78.9	81.0	84.0	88.6	89.8
19+ and above	85.4	4.6	78.2	84.1	87.0	90.0	92.1	94.0	99.4

7. Arm Girth

Age (in years)	*Mean (cm)*	*S.D*	*Percentiles*						
			5	*10*	*25*	*50*	*75*	*90*	*95*
8+	16.8	1.1	15.1	15.2	16.0	17.0	17.7	18.4	18.5
9+	17.1	1.1	15.5	15.7	16.4	17.1	18.0	19.0	19.4
10+	16.1	1.2	14.0	14.4	15.5	16.1	16.7	18.2	19.0
11+	16.2	1.5	14.1	14.5	15.0	16.0	17.0	18.0	20.5
12+	16.5	1.6	14.5	15.3	16.0	17.2	18.4	20.6	21.0
13+	16.6	1.6	13.9	14.5	15.3	16.4	18.0	18.4	19.0
14+	17.2	1.6	15.0	15.2	16.0	17.0	18.1	19.5	20.1
15+	18.7	1.8	15.7	16.4	17.5	18.5	20.0	21.0	21.8
16+	19.5	2.0	15.4	16.6	18.1	20.0	21.0	21.9	22.5
17+	20.8	1.8	17.4	19.0	19.6	21.0	22.0	23.0	23.1
18+	20.9	1.6	18.7	19.0	19.7	20.5	22.2	23.1	23.7
19+ and above	22.5	1.5	20.2	20.5	21.5	22.6	23.5	24.0	25.0

8. Calf Girth

Age (in years)	*Mean (cm)*	*S.D*	*Percentiles*						
			5	*10*	*25*	*50*	*75*	*90*	*95*
8+	23.2	1.1	22.0	22.0	22.1	23.3	23.9	24.7	-
9+	23.8	0.9	22.4	22.5	23.1	23.8	24.3	25.2	25.4
10+	23.7	2.2	22.8	23.1	24.7	25.2	26.5	27.3	30.3
11+	23.7	1.8	20.7	21.7	22.5	23.6	25.0	26.0	26.7
12+	24.3	2.2	21.5	21.9	22.8	24.0	25.1	27.8	29.8
13+	24.7	1.9	21.2	22.7	23.8	25.0	26.0	27.0	28.5
14+	26.0	2.2	22.4	22.8	24.1	26.3	27.3	28.4	29.1
15+	27.8	2.3	23.0	23.9	26.7	28.0	29.4	30.2	31.1
16+	28.5	3.1	22.5	23.4	27.0	29.2	30.6	31.8	32.6
17+	30.0	2.3	25.4	27.0	28.8	30.0	31.5	32.9	33.2
18+	30.1	1.9	27.2	27.8	28.9	29.9	31.6	32.8	33.5
19+ and above	31.0	2.5	27.4	28.0	29.3	31.0	32.5	33.4	35.2

9. Biceps Skinfolds

Age (in years)	*Mean (mm)*	*S.D*	*Percentiles*						
			5	*10*	*25*	*50*	*75*	*90*	*95*
8+	4.2	0.7	3.0	3.3	4.0	4.0	4.0	5.7	-
9+	4.1	0.9	3.0	3.0	3.0	4.0	5.0	5.4	6.0
10+	3.6	1.5	2.0	2.0	3.0	3.0	4.0	6.9	7.0
11+	2.7	1.0	2.0	2.0	2.0	2.0	3.0	4.0	5.0
12+	2.8	0.8	2.0	2.0	2.0	3.0	3.0	4.0	4.0
13+	2.7	0.8	2.0	2.0	2.0	3.0	3.0	4.0	4.1
14+	2.8	0.9	2.0	2.0	2.0	2.0	3.0	4.0	4.1
15+	2.9	0.7	2.0	2.0	2.0	3.0	3.0	4.0	4.0
16+	3.0	0.7	2.0	2.0	3.0	3.0	3.0	4.0	4.0
17+	3.1	0.8	2.0	2.0	3.0	3.0	3.0	4.0	5.0
18+	3.1	0.9	2.0	2.0	3.0	3.0	3.3	4.0	4.3
19+ and above	3.8	1.6	2.0	2.0	3.0	3.0	5.0	6.0	7.4

10. Triceps Skinfolds

Age (in years)	*Mean (mm)*	*S.D*	*Percentiles*						
			5	*10*	*25*	*50*	*75*	*90*	*95*
8+	9.3	1.4	7.0	7.3	8.0	10.0	10.0	11.4	12.0
9+	8.5	2.0	6.0	6.0	7.0	9.0	9.0	11.6	14.0
10+	6.6	2.3	4.1	5.0	5.0	6.0	7.8	10.0	12.9
11+	5.9	2.0	3.0	4.0	5.0	5.0	7.0	9.0	9.8
12+	5.6	1.7	4.0	4.0	4.0	5.0	7.0	8.0	8.2
13+	5.2	1.8	3.0	3.0	4.0	5.0	6.0	8.0	10.0
14+	5.4	1.5	3.0	4.0	4.0	5.0	7.0	8.0	8.1
15+	5.2	1.8	3.0	3.0	4.0	5.0	6.0	7.2	8.6
16+	5.7	1.8	4.0	4.0	4.0	5.0	6.0	8.0	8.4
17+	6.2	1.6	4.0	4.1	5.0	6.0	7.0	8.0	9.9
18+	5.7	1.7	4.0	4.0	5.0	5.0	6.0	8.0	10.0
19+ and above	7.0	2.4	3.6	4.0	5.0	7.0	8.0	9.8	11.8

11. Subscapular Skinfolds

Age (in years)	*Mean (mm)*	*S.D*	*Percentiles*						
			5	*10*	*25*	*50*	*75*	*90*	*95*
8+	5.3	1.0	4.0	4.0	4.3	5.5	6.0	6.7	7.0
9+	5.3	1.4	4.0	4.0	4.0	5.0	6.0	7.8	9.0
10+	4.8	1.9	3.0	3.0	3.0	5.0	5.0	7.9	10.9
11+	3.9	1.0	3.0	3.0	3.0	4.0	4.0	5.0	6.0
12+	4.1	1.1	3.0	3.0	3.0	4.0	5.0	6.0	6.0
13+	4.2	1.0	3.0	3.0	3.0	4.0	5.0	6.0	6.0
14+	4.4	1.1	3.0	3.0	3.0	4.0	5.0	6.0	6.0
15+	5.1	1.2	3.4	4.0	4.0	5.0	6.0	6.2	7.0
16+	5.5	1.5	3.6	4.0	4.0	5.0	6.0	7.0	8.0
17+	6.4	1.6	4.0	4.0	5.0	7.0	7.0	8.0	9.0
18+	6.0	1.2	4.0	5.0	5.0	6.0	7.0	8.0	8.0
19+ and above	8.2	2.8	5.0	6.0	6.7	8.0	9.2	10.9	14.2

up to 17 years. The 50th percentile values increase from 15.8 cm to 21.4 cm from 8+ to 18+ years of age in case of upper arm circumference. An increase from 22.0 cm at 8+ to 30.1 cm at 18+ years is noticed for calf circumference in case of males of Jammu and Kashmir.

DISCUSSION

The state of Jammu and Kashmir has been of immense interest to scholars from all the disciplines due to ethnic, political and geographic reasons. However, data on biological anthropological investigations of the natives of the state has been extremely meagre. The state of Jammu and Kashmir is of extreme interest to anthropologist since it has people living at various altitudes and belonging to various ethnic origins.

The purpose of presenting the pooled data for the males of Jammu and Kashmir state is two

fold. The first purpose is to present the reference standards for the state, which have not been presented so far. The second purpose is to compare the growth patterns of the people of the state with the available national and international data for assessment of growth status of the people of the state. Since it has been argued (Eveleth and Tanner, 1976) that even the simple values of height and weight can give fairly accurate estimate of the nutritional status of the people. The paper attempts to contribute in this regard by making an attmept to present data on the people of Jammu and Kashmir state.

The growth potential of individuals is an outcome the interaction of their genetic make up and environmental factors. It has been reported in numerous studies that in order to achieve the genetic potential to the fullest, there have to be optimal support from environmental factors (Harrison et al, 1990, Falkner and Tanner, 1978). The environmental factors known to effect the growth process include good socio-economic factors, nutritional intake, disease and infection free environment, conducive psychological environment among others (Harrison et al., 1990).

Compared to the Indian national standards (All India pooled) given by the Indian Council of Medical Research (ICMR, 1972) which were based on a nation-wide survey conducted between 1956-65, the present sample for Jammu and Kashmir males (pooled) shows higher mean values is for height and weight in all age groups. When the present data is compared to the US reference standards (Hamill et al., 1979), males of Jammu and Kashmir state are significantly shorter and lighter at all ages. The median values of height of the present sample fluctuate between 5th and 25th percentiles for age groups 8+ to 10+ years and subsequently the values dip to the 5th percentile and ultimately fall below the 5th percentile when comparisons is made at 18+ years. The comparison between the Jammu and Kashir populations and the US reference values is made for body weight, the Jammu and Kashmir people fair even poorly. The 50th percentile values of Jammu and Kashmir males are corresponding with the 5th percentile of the US data, after which the values dip even below the 5th percentile. Thus the NCHS boys are taller by approximately 12 cms and heavier by about 17 kgs than their peers of the Jammu and Kashmir at between 17+ and 18+ years. This shows that even though the males of Jammu and Kashmir have better average values when compared with the Indian standard, they fair very poorly when they are compared with the US reference values.

Previous studies have documented the fact that altitudinal difference in physique and body size are reflected in the form of larger body size resulting in larger surface area / body weight relationship. This suggests that highlanders may be under some degree of cold stress and it might be expected that differences in physique between people living at higher altitude and plains would be in the direction of heavier build in the former. The results of the present study also show similar trend when compared to All India pooled values.

ACKNOWLEDGEMENTS

The financial assistance provided by the Ministry of Environment and Forests, Government of India, New Delhi for the project entitled, "Environment, Human Settlements and Human Activities in Jammu and Kashmir Himalayas with special reference to Ladakh" under MAB (Man and Biosphere Programme, UNESCO). Ref. No. 14/122/84 RE MAB, under the guidance of Dr. M.K. Bhasin (Principal Investigator, Department of Anthropology, University of Delhi, Delhi 110 007).

REFERENCES

Bhasin, M.K. and Singh, L.P.: Somatotype changes in Adolescence among Dogras of Jammu and Kashmir, India. *J. Hum. Ecol.,* **1**: 169-174 (1990).

Bhasin, M.K. and Singh, L.P.: Study of physical growth and respiratory functions in two high altitude population groups - Bodhs and Baltis of Ladakh, Jammu and Kashmir, India *J. Hum. Ecol.,* **3**: 27-34 (1992a.).

Bhasin, M.K. and Singh, L.P.: A study of anthropometric somatotype in two high altitude populations - Bodhs and Baltis of Ladakh, Jammu and Kashmir, India. *J. Hum. Ecol.,* **3**: 35-38 (1992b).

Bhasin, M.K. and Singh, L.P.: Body composition of two high altitude populations - Bodhs and Baltis of Ladakh. *J. Hum. Ecol.,* **3**: 39-42 (1992c).

Bhasin, M.K. and Singh, L.P.: Body morphology and respiratory functions in Bodhs and of Changthang of Ladakh, Jammu and Kashmir, India. *J. Hum. Ecol.,* **3**: 69-70 (1992d).

Bhasin, M.K. and Singh, L.P.: A study of body morphology and lung functions in Dards of Ladakh, Jammu and Kashmir. *J. Hum. Ecol.,* **3**: 71-72 (1992e).

Bhasin, M.K. Singh, L.P. and Kaur, B.: Biology of the People of Jammu and Kashmir: Part I: The Growth Patterns and Physiological Variables of Various

Population Groups of the State. *Anthropologist*, 10(2): 89-118 (2008).

Clegg, E.J., Harrison, G.A. and Baker, P.T.: The impact of high altitude on human populations. *Hum. Biol.*, **42**: 486-518 (1970).

Clegg, R.J., Pawson, I.G., Ashborn, E.H. and Flinn, R.M.: The growth of children at different altitudes in Ethiopia: *Phil. Trans. Royal Soc.*, **264**: 403 (1972).

Eveleth, P.B. and Tanner, J.M.: *Worldwide Variationin Human Growth*, IBP Handbook 8, Cambridge University Press, Cambridge, UK, (1976).

Hamill, P.V., Drizd, C.A., Johnston, C.L., Reed, R.D., Roche, A.F., Moore, W.M.: Physical growth. National Center for Health Statistics percentiles. *Am. J. Clini. Nutr.*, **32**: 607-629 (1979).

Indian Council of Medical Research: *Growth and Physical Development of Indian Infants and Children*. Technical Report Series 18, ICMR, New Delhi (1972)

Hoff, C.J.: Altitudinal variations in the physical growth and development of Peruvian Quencha. *Homo*, **24**: 87 (1972).

Pawson, I.G.: Growth characteristic of population of Tibetan origin in Nepal, *Amer. J. Phys. Anthrop.* **47**: 473-482 (1977).