

Body Composition of Five Population Groups of Jammu and Kashmir, India

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KEY WORDS Body Composition, Surface Area, Body Fat, Jammu and Kashmir.

ABSTRACT In the present paper, lower extremity length, trunk index, chest index, height index, height weight ratio, body mass index, ponderal index, surface area and body fat are being reported for Gujjars, Dogra Brahmans, Dogra Rajputs, Dogra Scheduled Castes and Tibetans of Jammu and Kashmir state. Trunk index, chest index, height index, height weight ratio change much during adolescence. As per norms for undernourishment, all the population groups are malnourished in most of the age group. Surface area and body fat also show continuous increments at all study levels.

The development in different parts of body can be measured through anthropometric techniques for assessing body proportions and body composition. Each measure has its own significance in growth studies as each organ and segment of body is growing at a rate that is uniquely its own. Anthropometric somatotype and growth patterns of various population groups have earlier been reported (Singh and Bhasin, 1990; Bhasin and Singh, 1991 a, b). In the present paper, various indices, height weight constants and body fat and surface area are being reported for Gujjars, Dogra Brahmans, Dogra Rajputs, Dogra Scheduled Castes and Tibetans of Jammu and Kashmir.

MATERIAL AND METHODS

In the present paper, five population groups of Jammu and Kashmir being reported are Gujjars, Dogra Brahmans, Dogra Rajputs, Dogra Scheduled Castes and Tibetans. A cross sectional sample of 1025 males was studied (Age-wise distribution is given in table 1). Details of methodology and population groups have been reported in earlier communication (Bhasin and Singh, 1991a). For calculating various indices, ratio etc. the following formulae have been used:

- (1) Lower Extremity Length =
Height vertex - Sitting height

- (2) Trunk Index =

Bicristal diameter/Biacromial diameter

- (3) Chest Index = Antero-posterior diameter of chest/Transverse diameter of chest

- (4) Height Index = Sitting height/Height vertex

- (5) Height-Weight-Ratio = Weight/Height²

- (6) Body mass Index = Weight/Height²

- (7) Ponderal Index = Height/3√Weight

- (8) Surface area was computed after DuBois and DuBois (1916), and (9) body fat was computed by equations given by Slaughter et al. (1988).

RESULTS AND DISCUSSION

The results of the present study are being presented in table 2.

1. Lower Extremity Length

Lower extremity length continues to increase from 8+ to 18+ years in all the population groups under study. Dogra Scheduled Castes show maximum increase in lower extremity followed by Dogra Brahmans, Gujjars, Dogra Rajputs and Tibetans. For age group 19+ and above, Dogra Rajputs show maximum lower extremity length followed by Gujjars, Dogra Brahmans, Dogra Scheduled Castes and Tibetans in the given order (Table 2).

2. Trunk Index

Trunk index does not show any regular trend in any of the population groups under study from 8+ to 18+ years. For trunk index, highest and lowest values have been observed at 18+ and 10+ years; 15+ and 11+ years; 15+ and 9+ years; 14+ and 18+ years and 14+ and 8+ years respectively for Gujjars, Dogra Brahmans, Dogra Rajputs, Dogra Scheduled Castes and Tibetans, for age group 19+ and above, the highest value of trunk index has been observed in case of Tibetans, followed by Dogra Scheduled Castes, Dogra Brahmans, Gujjars and Dogra Rajputs (Table 2).

3. Chest Index

Chest index also does not show any regular trend during 8+ to 18+ years in all the population groups. For chest index, the highest and lowest values have been observed at 14+ and 10+ years; 10+ and 18+ years; 15+ and 13+ years, 18+ and 10+ years and 10+ and 13+ years respectively for Gujjars, Dogra Brahmans, Dogra Rajputs, Dogra Scheduled Castes and Tibetans. For age group 19+ and above highest chest index has been observed in Tibetans, followed by Dogra Rajputs, Dogra Brahmans, Dogra Scheduled Castes and Gujjars (Table 2).

4. Height Index

Like trunk index and chest index, height index too does not show any regular trend in any population group from 8+ to 18+ years. The highest and lowest values of height index have been observed at 9+ and 18+ years; 9+ and 18+ years; 10+ and 14+ years; 9+ and 11+ years; 11+ and 18+ years respectively in Gujjars, Dogra Brahmans, Dogra Rajputs, Dogra Scheduled castes and Tibetans. In the age group 19+ and above, height index decreases in the order; Dogra Scheduled Castes, Dogra Brahmans, Tibetans, Gujjars and Dogra Rajputs (Table 2).

5. Height Weight Ratio

Height-weight ratio increases regularly from 8+ to 18+ years in all the population groups under

study. Dogra Scheduled Castes show highest increase in height weight ratio followed by Dogra Rajputs, Dogra Brahmans, Tibetans and Gujjars. In the age group 19+ and above, highest height weight ratios have been recorded in Dogra Rajputs, Gujjars, Dogra Brahmans, Tibetans and Dogra Scheduled Castes follow in the order (Table 2).

6. Body Mass Index

Body mass index is also known as Quetlet's index. It increases continuously in all the age groups from 8+ to 18+ years in all the population groups. The highest increments in body mass index has been observed in Dogra Rajputs, followed by Dogra Scheduled Castes, Tibetans, Dogra Brahmans and Gujjars. In age group 19+ and above, Tibetans show highest value of body mass index followed by Dogra Rajputs, Gujjars, Tibetans and Dogra Brahmans (Table 2).

7. Ponderal Index

Body weight is a three dimensional entity, whereas height is unidimensional one. As per dimensional rule, the best representation of weight and height is to take cube-root of weight *vis-a-vis* height. This measure is known as Ponderal Index. For ponderal index, no regular trend has been seen in general in any population group under study. The highest and lowest values of ponderal index has been observed at 15+ and 14+ years; 18+ and 9+ years; 15+ and 18+ years; 13+ and 8+ years and 13+ and 15+ years respectively for Gujjars, Dogra Brahmans, Dogra Rajputs, Dogra Scheduled Castes and Tibetans (Table 2). In the age group 19+ and above, the highest value of ponderal index have been observed in case of Dogra Scheduled Castes, followed by Dogra Brahmans, Gujjars, Dogra Rajputs and Tibetans (Table 2).

8. Surface Area

In all the population groups under study from 8+ to 18+ years, body surface area increases continuously. Dogra Scheduled Castes show maximum increase in body surface area followed by Dogra Brahmans, Dogra Rajputs, Gujjars and Tibetans in the order given. In the age-groups 19+

Table 1: Sample size for various population groups of Jammu and Kashmir

Age in years	Gujjars	Dogra- Brahmins	Dogra- Rajputs	Dogra- Scheduled Castes	Tibetans
8+	-	21	24	22	12
9+	06	19	20	17	15
10+	09	20	27	33	11
11+	08	20	22	32	10
12+	14	20	21	22	10
13+	10	20	20	27	11
14+	09	21	22	25	07
15+	08	22	22	25	13
16+	10	20	20	21	20
17+	04	20	20	20	09
18+	06	18	18	18	05
19+ and above	14	21	27	20	12

Table 2: Various indices, body components of five population groups of Jammu and Kashmir

Age (in years)	Gujjars		Dogra Brahmins		Dogra Rajputs		Dogra Scheduled Castes		Tibetans	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
1. Lower Extremity Length (cm)										
8+	-	-	59.48	2.12	61.45	5.27	56.06	3.63	58.65	2.89
9+	63.18	3.85	59.72	5.45	61.81	4.76	61.47	4.94	59.43	3.59
10+	67.32	3.85	63.87	6.11	63.85	6.49	64.29	13.92	60.32	3.17
11+	69.80	6.33	66.25	4.52	69.48	11.83	71.12	14.66	60.92	3.69
12+	74.45	5.03	70.92	7.05	70.25	8.29	70.27	5.61	65.08	4.07
13+	75.96	2.60	72.33	4.66	72.76	5.85	74.41	5.63	68.73	3.60
14+	76.14	4.44	76.61	5.53	80.07	12.38	77.78	6.57	65.44	8.22
15+	83.70	5.64	80.67	5.70	79.75	3.84	78.39	3.60	73.57	3.62
16+	82.41	5.11	80.27	3.95	79.75	3.72	79.29	4.02	75.58	3.65
17+	83.57	3.79	81.26	6.80	81.21	4.89	81.08	4.15	75.78	3.06
18+	84.01	1.07	85.34	4.67	80.85	4.80	81.96	5.42	76.08	3.12
19+ and above	86.37	3.72	84.78	3.20	87.06	16.55	83.94	5.70	76.35	4.13
2. Trunk Index										
8+	-	-	73.03	5.88	75.11	6.28	75.31	5.31	74.76	2.15
9+	73.88	4.30	74.47	11.24	71.50	2.24	75.05	6.12	75.09	5.29
10+	71.37	2.59	73.25	6.02	74.35	6.31	72.52	4.77	75.56	2.72
11+	74.37	2.59	73.02	3.12	73.67	5.37	74.96	3.63	75.62	2.75
12+	73.62	3.44	75.79	6.80	73.57	4.34	75.35	3.87	75.27	3.78
13+	74.88	4.10	71.84	5.50	73.00	3.34	73.48	3.52	77.55	5.58
14+	74.53	7.74	74.75	5.83	72.31	3.14	75.36	5.61	80.70	11.20
15+	73.14	4.58	76.07	6.71	75.39	2.79	74.16	6.17	77.96	12.23
16+	73.25	4.98	74.60	5.25	73.23	3.35	74.98	4.89	76.33	3.54
17+	75.16	3.93	73.69	3.80	73.91	3.83	73.03	4.74	76.63	11.80
18+	76.69	1.91	74.28	3.25	72.77	5.47	71.98	2.98	76.53	3.75
19+ and above	72.98	3.60	72.78	3.48	71.06	4.52	74.33	7.95	78.02	4.28

Age (in years)	Gujjars		Dogra Brahmans		Dogra Rajputs		Dogra Scheduled Castes		Tibetans	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
3. Chest Index										
8+			75.09	4.93	75.86	4.84	75.40	5.08	77.04	4.41
9+	72.25	2.67	77.18	3.90	76.97	4.56	74.67	5.25	77.54	5.12
10+	68.19	8.02	77.91	9.17	75.98	5.67	74.57	5.82	80.27	5.22
11+	73.27	4.85	75.98	5.88	75.24	5.32	75.29	4.35	79.67	4.32
12+	69.81	5.18	77.15	5.83	73.98	4.51	76.94	5.17	79.23	4.48
13+	68.57	9.35	74.77	5.91	76.55	4.38	75.55	5.73	75.06	9.20
14+	74.50	5.53	74.45	5.24	75.32	5.18	76.63	5.41	75.32	4.81
15+	72.47	3.24	76.47	5.12	72.77	5.79	75.68	6.38	76.11	6.74
16+	73.82	2.92	77.78	5.60	74.36	7.04	74.90	5.67	76.23	5.96
17+	72.82	2.06	74.99	6.86	74.27	5.70	75.19	5.34	76.56	6.04
18+	69.94	4.51	70.99	5.87	74.43	9.23	83.05	15.18	78.54	8.05
19+and above	69.14	10.32	74.76	6.53	77.43	6.18	73.74	5.97	79.41	4.93
4. Height Index										
8+			52.56	1.41	51.92	2.15	53.29	1.91	54.17	3.79
9+	54.50	6.31	53.07	3.33	51.36	2.65	53.58	1.85	54.28	3.07
10+	50.84	1.52	52.43	3.89	52.49	3.75	52.96	1.42	51.24	9.96
11+	50.83	2.07	51.62	1.48	49.91	5.73	54.03	1.51	49.04	9.07
12+	50.48	1.09	51.29	3.64	51.76	3.43	52.82	1.23	51.15	2.09
13+	50.57	0.64	51.23	1.44	51.14	1.69	52.61	0.66	51.25	1.02
14+	51.42	1.36	51.01	2.03	48.42	10.93	53.39	3.00	50.77	2.78
15+	49.55	1.41	50.51	2.01	51.36	1.53	52.46	1.61	51.72	1.56
16+	51.01	2.02	51.26	1.74	52.13	1.35	52.84	0.79	51.44	1.23
17+	50.34	1.23	50.94	2.51	51.69	1.36	53.04	1.61	51.03	1.73
18+	49.04	1.04	50.41	1.72	51.73	1.88	52.17	1.23	51.16	1.72
19+and above	49.19	1.57	50.09	1.25	48.63	9.86	52.78	1.61	50.06	2.23
5. Height-weight Ratio (kg/cm)										
8+			16.45	1.10	17.07	2.20	16.57	1.86	18.70	1.84
9+	20.43	1.97	17.45	1.45	17.59	1.25	17.47	1.65	19.62	1.95
10+	19.96	1.87	19.17	2.02	18.62	2.37	18.06	1.78	19.27	1.76
11+	21.66	2.59	19.98	1.93	19.89	2.67	19.78	3.03	20.88	2.43
12+	23.52	2.85	21.35	1.93	21.89	4.51	20.51	1.75	22.18	2.69
13+	25.15	2.60	22.36	2.89	23.29	3.27	22.90	3.16	23.63	2.29
14+	27.38	2.44	25.25	2.74	25.63	3.52	25.55	3.40	23.44	2.27
15+	29.07	3.85	28.30	3.06	26.17	6.50	28.86	6.62	28.97	3.10
16+	30.59	2.62	28.07	2.91	29.07	2.05	28.17	3.59	30.20	2.98
17+	30.54	2.69	28.55	2.69	31.06	3.28	29.52	3.21	31.28	3.36
18+	29.61	0.34	29.58	3.10	31.56	3.86	31.34	2.46	29.53	2.14
19+and above	35.89	1.74	35.47	2.20	36.52	6.66	33.20	4.01	34.93	4.43
6. Body Mass Index (kg/m²)										
8+			13.10	0.76	13.33	1.20	13.48	1.11	14.90	1.44
9+	14.70	0.96	13.71	0.85	13.85	0.88	13.56	1.11	15.32	1.29
10+	14.56	1.13	14.27	1.25	13.84	1.24	13.70	1.99	15.00	1.03
11+	15.23	1.17	14.60	1.31	14.34	1.14	14.16	1.67	15.72	1.22
12+	15.60	1.20	14.68	1.09	15.00	1.99	14.25	0.74	16.06	1.61

Age (in years)	Gujars		Dogra Brahmans		Dogra Rajputs		Dogra Scheduled Castes		Tibetans	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
13+	16.33	1.30	15.05	1.39	15.64	1.95	14.98	1.65	16.27	1.12
14+	17.48	1.51	16.12	1.32	16.35	1.84	16.13	1.60	16.90	2.85
15+	17.48	1.80	17.37	1.77	15.91	3.88	17.79	4.23	18.70	1.68
16+	18.20	1.58	17.04	1.76	17.52	1.29	17.22	1.86	18.83	1.54
17+	18.16	1.74	17.27	1.89	18.48	1.78	17.80	1.70	19.37	1.89
18+	17.96	0.27	17.25	1.85	18.83	2.10	18.72	1.70	18.56	1.24
19+and above	21.11	0.93	20.28	1.39	21.51	3.68	19.81	2.74	21.62	2.62
7. Ponderal Index (cm/kg^{1/3})										
8+	-	-	46.23	0.98	46.27	1.24	45.09	1.53	44.40	1.82
9+	46.05	0.86	45.77	1.01	45.59	1.25	46.15	1.26	44.24	1.16
10+	46.01	1.32	46.04	1.39	46.49	1.25	46.35	1.45	44.54	0.99
11+	45.86	0.99	45.99	1.35	46.37	0.95	46.77	1.61	44.36	1.10
12+	46.41	0.87	46.84	1.41	46.56	1.48	47.09	0.97	44.69	1.56
13+	46.08	0.95	46.81	1.75	46.30	1.87	47.36	1.89	45.23	1.25
14+	45.38	1.50	46.54	1.19	46.39	1.59	46.73	1.18	44.32	3.23
15+	46.28	1.46	46.09	1.64	46.86	1.62	45.92	2.41	44.19	1.45
16+	45.86	1.46	46.57	1.89	46.22	1.41	46.28	1.57	44.60	1.31
17+	45.91	1.59	46.44	1.94	45.64	1.63	45.97	1.38	44.32	1.37
18+	45.70	0.36	47.13	1.88	45.34	1.74	45.42	1.85	44.67	1.06
19+and above	43.78	0.64	43.97	1.22	43.72	2.29	44.70	2.35	42.81	1.71
8. Surface Area (m²)										
8+	-	-	0.86	0.04	0.89	0.10	0.84	0.10	0.91	0.05
9+	1.06	0.09	0.90	0.06	0.90	0.06	0.91	0.06	0.95	0.06
10+	1.03	0.08	0.99	0.08	0.98	0.10	0.95	0.07	0.94	0.07
11+	1.11	0.13	1.03	0.08	1.04	0.13	1.05	0.13	1.01	0.11
12+	1.23	0.13	1.14	0.09	1.16	0.21	1.11	0.10	1.09	0.10
13+	1.30	0.10	1.19	0.12	1.21	0.12	1.24	0.14	1.19	0.12
14+	1.38	0.09	1.33	0.12	1.34	0.14	1.35	0.14	1.13	0.06
15+	1.51	0.18	1.46	0.11	1.39	0.33	1.46	0.13	1.39	0.12
16+	1.57	0.08	1.48	0.08	1.51	0.07	1.47	0.13	1.48	0.11
17+	1.57	0.07	1.50	0.09	1.58	0.12	1.52	0.11	1.51	0.09
18+	1.51	0.02	1.59	0.09	1.58	0.13	1.58	0.07	1.45	0.07
19+and above	1.70	0.05	1.69	0.07	1.70	0.15	1.62	0.07	1.59	0.10
9. Per cent Body Fat										
8+	-	-	6.72	1.71	6.98	1.77	6.11	2.24	5.71	2.16
9+	3.78	1.06	7.34	1.35	6.48	2.27	6.14	1.35	5.42	2.50
10+	3.44	2.47	7.77	3.42	6.48	2.28	7.00	2.50	5.77	2.36
11+	5.86	3.89	6.59	2.15	7.33	2.49	8.01	4.59	5.34	1.50
12+	5.23	2.32	5.62	1.77	7.48	2.55	5.59	1.81	6.17	2.16
13+	4.48	1.81	6.77	2.75	8.31	4.86	6.91	2.32	5.97	2.22
14+	7.70	4.02	7.74	2.13	7.98	2.43	6.78	2.03	5.62	2.01
15+	7.21	2.93	8.33	4.15	7.04	2.65	8.08	2.36	7.27	1.76
16+	6.38	2.05	8.46	2.77	8.09	1.81	7.83	2.32	8.32	2.56
17+	7.90	0.97	8.63	2.33	10.23	3.99	8.41	2.69	8.50	0.88
18+	7.13	1.30	8.28	2.19	9.91	4.06	11.17	2.88	7.95	1.33
19+and above	10.45	5.57	11.96	3.51	15.12	7.03	11.44	4.66	11.25	2.94

and above; Dogra Rajputs show maximum value of surface area, Gujjars, Dogra Brahmans, Dogra Scheduled Castes and Tibetans follow in the given order (Table 2).

9. Per cent Body Fat

Per cent body fat increases continuously in all the population groups under study. The maximum increase in body fat occurs in Dogra Scheduled Castes, followed by Gujjars, Dogra Rajputs, Tibetans and Dogra Brahmans, during the period 8+ to 18+ years. In the age group 19+ and above, Dogra Rajputs show highest per cent body fat, followed by Dogra Brahmans, Dogra Scheduled Castes; Tibetans and Gujjars in the order given (Table 2).

In earlier communication, it has been reported (Bhasin and Singh, 1991a) that for height versus and sitting height that Dogra groups show higher increase than Gujjars and Tibetans. Similar trend has been followed in case of lower extremity length except in Gujjars, they show higher values of lower extremity length than other population groups being discussed.

For height index, chest index and trunk index more or less constant values have been observed suggesting that a similar growth pattern have been observed in all body segments. Similar findings have been reported by Malina (1974).

Norgan and Jones (1990) reported that body mass index (BMI) of less than 16 kg/m^2 has been proposed as cut off point for severe chronic energy deficiency. According to this cut off point the populations reported in the present study are under nourished even by standards of developing countries. Dogra population groups are more undernourished than Gujjars and Tibetans.

Body fat is most variable of the body's major constituents, both in individual and within population. Bone remains relatively constant and the total protein can be altered only by heroic measures and diseases, but quantity of fat depends upon a simple everyday experience—difference between energy output and calorie input because of its variability fat commands special interest in studies of body composition.

Body fat in case of age group 19+ and above

(adults) is highest in Dogra Rajputs, followed by Dogra Brahmans, Dogra Scheduled Castes, Tibetans and Gujjars. Per cent body fat in Dogra Brahmans, Dogra Rajputs is higher than sea-level population of Tamilian (Bhardwaj et al., 1973), whereas Dogra Scheduled castes, Tibetans and Gujjars show lower fat content than Tamilians. All the population groups under study show higher per cent body fat than high altitude Ladakhs except Gujjars, which show lower per cent of body fat.

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