

A Study of Anthropometric Somatotype in Two High Altitude Populations—Bodhs and Baltis of Ladakh, Jammu and Kashmir, India

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ABSTRACT Anthropometric somatotype of Bodhs and Baltis of Ladakh division of Jammu and Kashmir has been studied for 1009 males from 8+ to 50 years in 1989. Bodhs show higher endomorphy and mesomorphy than Baltis, whereas Baltis are more ectomorphs than Bodhs.

With the introduction of Heath-Carter method in 1967, study of anthropometric somatotype became much easier and objective. Many Indian populations have been studied by the method (Singh and Sidhu, 1980; Singh, 1981; Singh and Bhasin, 1990; Bhasin and Singh 1991 and Singh and Singh, 1991). From these studies, it has been observed that Indian population groups are ectomorph, endo-ectomorph, mesoectomorph and balanced ectomorphy but their ratings are considerably lower than their western counterparts (Malcolm, 1974; Heath and Carter, 1971; and Parizkova and Carter, 1976). In the present paper, an attempt has been made to study somatotype changes in adolescent years, as well as, in adults Bodh and Balti of Ladakh. These population groups inhabit high altitude zone in Inner Himalayan zone of Western Himalaya.

MATERIAL AND METHODS

The present study is based on a cross-sectional sample of 1009 male subjects of Leh and Kargil districts of Ladakh division of Jammu and Kashmir state of which 483 are Bodhs and 526 subjects are Baltis (Shia Muslims). The details of

area, population and methodologies have been described elsewhere (Bhasin and Singh, 1991, 1992). The anthropometric somatotype has been calculated using Heath-Carter method (Carter, 1975).

RESULTS AND DISCUSSION

The results of the present investigation are represented in table 1 and figures 1 and 2. It has been observed that in general, no regular trend has been observed for any of the somatotype components.

Endomorphy: For endomorphy no regular trend has been seen for Bodhs and Baltis of Ladakh. For Bodhs, maximum and minimum value of endomorphic component have been observed at 8+ and 15+ years respectively, whereas Baltis show maximum rating of endomorphy at 17+ years and minimum at 13+ years. No significant change like adolescent growth spurt have been observed for any of the two population groups. In general, Bodhs show higher rating of endomorphy than Baltis during adolescent years. For the age groups 19+ and above, endomorphy ratings are considerably higher than adolescent years. Bodh adults are more endomorphic than Baltis (Table 1).

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Table 1: Anthropometric somatotype components in Bodhs and Baltis of Ladakh, Jammu and Kashmir, India

Age Years	Endomorphy (I)				Mesomorphy (II)				Ectomorphy (III)			
	Bodhs		Baltis		Bodhs		Baltis		Bodhs		Baltis	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
8+	1.86	0.54	1.28	0.40	3.94	0.87	3.33	0.66	2.90	1.03	3.21	1.29
9+	1.63	0.51	1.30	0.37	3.58	0.91	3.27	0.67	3.42	0.94	3.54	0.89
10+	1.66	0.68	1.21	0.33	3.33	0.71	3.20	0.63	3.87	1.02	3.82	0.94
11+	1.63	0.56	1.31	0.42	3.43	0.82	3.13	0.68	3.88	1.08	3.93	0.90
12+	1.51	0.59	1.34	0.38	3.27	0.65	3.07	0.69	4.35	0.70	4.16	0.92
13+	1.44	0.39	1.23	0.38	3.38	0.80	3.02	1.02	4.15	1.30	4.38	1.24
14+	1.47	0.32	1.28	0.34	3.22	0.64	2.77	0.71	4.44	0.83	4.78	0.96
15+	1.33	0.39	1.24	0.30	3.10	0.71	2.80	0.70	4.60	0.76	4.83	0.87
16+	1.69	0.50	1.33	0.37	3.30	0.72	2.68	0.77	4.03	0.83	4.84	0.88
17+	1.85	0.53	1.61	0.40	3.64	0.78	3.01	0.85	4.92	0.94	4.32	0.93
18+	1.62	0.34	1.57	0.43	3.51	0.83	2.71	0.90	3.86	0.88	4.54	1.16
19+ & above	1.94	0.77	1.89	0.85	3.42	0.82	3.03	0.86	3.51	1.15	4.00	1.03

Mesomorphy: Like endomorphy, no regular trend has been observed for mesomorphy also. In Bodhs, maximum and minimum values of mesomorphy have been observed at 8+ and 15+ years respectively, while in case of Baltis, maximum mesomorphic rating has been observed at 8+ and minimum at 16+ years. No abrupt increase corresponding to adolescent growth spurt has been observed. Bodhs are more mesomorphic than Baltis throughout adolescent phase. In the age group 19+ and above Bodhs are rated higher than Baltis by considerable margin (Table 1).

Ectomorphy: Like endomorphy and mesomorphy no regular trend have been observed for ectomorphy. Bodhs show maximum value of ectomorphy at 17+ and minimum at 8+ years respectively, whereas for Baltis maximum and minimum value of ectomorphy have been observed at 16+ and 8+ years respectively. Baltis are more ectomorphic than Bodhs at most of the yearly intervals. In the age group 19+ and above, it has been seen that Bodhs are less ectomorphic than Baltis.

No change corresponding to adolescent growth spurt has been observed in somatotype components of Bodhs and Baltis. Mean somatotype component vary in the given order; 'first component is lower than the second, while the thirds' ratings are higher than first and second compo-

nent (Table 1). According to system of sector division, Bodhs and Baltis are represented in Mesomorph-Ectomorph and Meso-ectomorph, whereas Bodhs at 8+ years lie in Ectomesomorph sectors (Figs. 1 and 2). Somatoplot of both the population groups is scattered and does not follow any regular pattern. There is no component dominance change. Change in component dominance has been reported in various studies (Parizkova and Carter, 1976; Walker, 1978). The findings of Tanner (1970); Classens et al. (1986); Singh and Bhasin (1990); Bhasin and Singh (1991) show that constancy of three somatotype component is fairly high during adolescence. In the age group, 19+ and above, ectomorph ratings are higher followed by mesomorphy and endomorphy in given order for both the population groups.

Bodhs and Baltis of Ladakh show comparable endomorphy with various Dogra groups; mesomorphy component is higher and ectomorph component is lower in Bodhs and Baltis than Dogras (Singh and Bhasin, 1990). While comparing somatotype ratings with Tibetans and Gujjars, varied trends have been observed. For endomorphic component Bodhs and Baltis are lower than Tibetans and higher than Gujjars (Bhasin and Singh, 1991). For mesomorphy Bodhs and Baltis are higher than Gujjars and lower than Tibetans and for ectomorphy, both the population groups

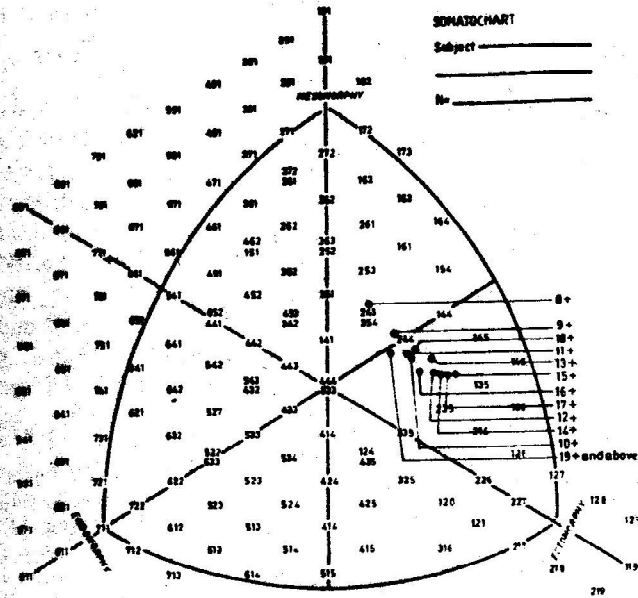


Fig. 1. Somatotype distribution in Bodhs of Ladakh, Jammu and Kashmir

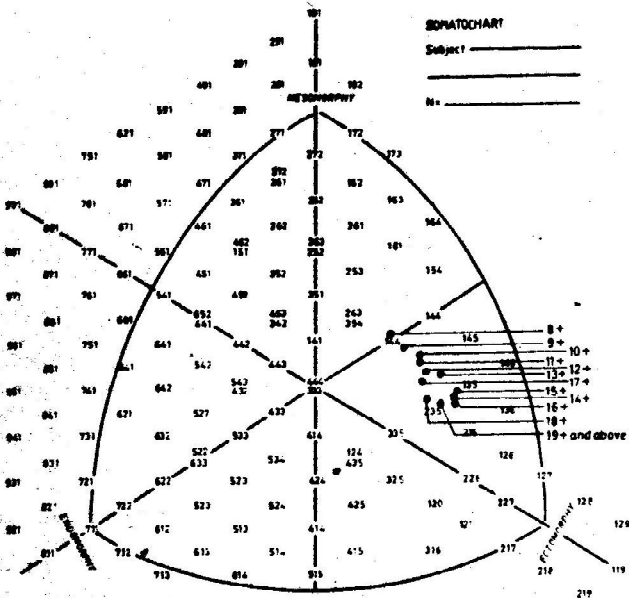


Fig. 2. Somatotype distribution in Baltis of Ladakh, Jammu and Kashmir

are higher than Tibetans and lower than Gujjars. It has been observed that there is trend shift towards mesomorph-ectomorph in Bodhs and Baltis from meso-ectomorph in Dogras and Gujjars and balanced-ectomorph in Tibetans.

Somatotype Attitudinal Distance (SAD) and Somatotype Dispersion Distance (SDD) have been calculated after Carter (1975). In Bodhs the highest and lowest values of SAD have been observed between 17+ -18+ and 10+ -11+ years whereas for Baltis highest SAD has been observed between 14+ -15+ years and lowest value between 10+ and 11+ years respectively (Table 2). Somatotype dispersion distance has been calculated for obtaining the distances between pairs of average somatoplots. The highest value of SDD for Bodhs has been observed between 17+ -18+ years and lowest between 10+ and 11+ years, whereas for Baltis highest and lowest values of SDD have been observed between 16+ -17+ and 14+ and 15+ years respectively (Table 2). In order to quantify the changes between successive years for mean somatotype, the migratory distance (MD) has been calculated by summing up SDDs' between successive somatotype means from 8+ to 18+ years. Bodhs show higher MD as compared to Baltis which is one to the higher values SDDs' (Table 2).

Table 2: Somatotype Attitudinal Distance (SAD), Somatotype Dispersion Distance (SDD) and Migratory Distance (MD) for Bodhs and Baltis of Ladakh, Jammu and Kashmir, India

Age interval	Somatotype Attitudinal Distance		Somatotype Dispersion Distance	
	Bodhs	Baltis	Bodhs	Baltis
8+ - 9+	0.67	0.33	1.62	0.71
9+ - 10+	0.51	0.30	1.48	0.72
10+ - 11+	0.10	0.16	0.23	0.35
11+ - 12+	0.51	0.24	1.22	0.51
12+ - 13+	0.21	0.27	0.53	0.61
13+ - 14+	0.33	0.47	0.91	0.61
14+ - 15+	0.24	0.70	0.58	0.16
15+ - 16+	0.70	0.34	1.72	0.36
16+ - 17+	0.96	0.67	1.31	0.79
17+ - 18+	1.09	0.37	1.76	0.75
		Migratory distance	11.36	5.57

To sum up, it may be concluded that Bodhs

have higher rating than Baltis for endomorphy and mesomorphy and lower rating in ectomorphy.

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REFERENCES

- Bhasin, M.K. and Singh, L.P.: Somatotype changes during adolescence in Gujjars and Tibetans of Jammu and Kashmir, India. *J.Hum. Ecol.*, 2: 81-84 (1991).
- Bhasin, M.K. and Singh, L.P.: Study of physical growth and respiratory functions in two high altitude populations—Bodhs and Baltis of Ladakh, Jammu and Kashmir, India. *J.Hum. Ecol.*, 3: 27-34 (1992).
- Carter, J.E.L.: *The Heath - Carter Somatotype Method* - San Diego, California (1975).
- Classens, A., Bennen, Cr. and Simons, J.: Stability of anthroposcopic and anthropometric estimates of physique in Belgian boys followed longitudinally from 13 to 18 years of age. *Ann. Hum. Biol.*, 13: 235-244 (1986).
- Heath, B.H. and Carter, J.E.L.: Growth and somatotype pattern of Manus children territory of Papua and New Guinea: Application of modified somatotype method to the study of growth patterns. *Am. J. Phys. Anthropol.*, 35: 49-68 (1971).
- Malcolm, L.A.: Growth and development of Bundi child of Papua New Guinea highlands. *Hum. Biol.*, 42:293-328 (1970).
- Parizkova, J. and Carter, J.E.L.: Influence of physical activity on stability of somatotype in boys. *Am. J. Phys. Anthropol.*, 44: 327-340 (1976).
- Singh, L.P. and Bhasin, M.K.: Somatotype changes in adolescence among Dogras of Jammu and Kashmir, India. *J.Hum. Ecol.*, 1:169-174 (1990).
- Singh, L.P. and Singh, S.P.: Physical growth and anthropometric somatotype of Rajput and Brahmin boys of Chamba district, Himachal Pradesh. *J.Hum. Ecol.*, 2:121-126 (1991).
- Singh, S.P.: Body morphology and anthropometric somatotype of Rajput and Brahman Gaddi boys of Dhaura Dhar range, Himalayas. *Z. Morph. Anthropol.*, 72:315-323 (1981).
- Singh, S.P. and Sidhu, L.S.: Changes in somatotypes during 4 to 20 years in Gaddi Rajput boys. *Z. Morph. Anthropol.*, 71:285-293 (1980).
- Tanner, J.M.: Physical growth. In: *Carmichael's Manual of Child Psychology*. P.H. Mussen, (Ed.) Wiley, New York, 3rd Edition (1970).
- Walker, R.N.: Pre-school physique and late adolescent somatotype. *Ann. Hum. Biol.*, 5:113-129 (1978).