

Regional Variation in Body Dimensions of the Deoris of Assam and Arunachal Pradesh

G. Begum¹ and J. Deori²

Citation: Begum G and Deori J. 2017. Regional Variation in Body Dimensions of the Deoris of Assam and Arunachal Pradesh. Human Biology Review, 6 (2), 130-140.

¹Gulrukh Begum, Dept of Anthropology, Gauhati University, gulrukhbegum@yahoo.co.in

²Junumai Deori, Anthropological Survey of India, Dehradun, junumaideori@yahoo.com

Corresponding author: Gulrukh Begum, Dept of Anthropology, Gauhati University, gulrukhbegum@yahoo.co.in

ABSTRACT

Regional variation in the adult body dimensions should be taken into consideration when assessing the growth or nutritional status of any population. The finding of significant regional variation helps in planning priorities for research and preventive measures, even programs could be tailored according to the needs of each region. With this intention in mind the present study was undertaken cross-sectionally to assess the magnitude of regional differences in respect of certain anthropometric measurements of adult Deoris from Assam and Arunachal Pradesh. The data was collected from two districts of Arunachal Pradesh and four districts of upper Assam in respect of stature, sitting height, lower extremity length, head circumference, girth of bicep, chest circumference, waist circumference, hip circumference, calf circumference, bi-acromial diameter, bi-iliac diameter and body weight. No significant difference has been found in all the anthropometric measurements under study between the adult Deoris of Assam and Arunachal Pradesh. The Deoris of both the states have medium legs and have a medium body build for both the sexes. The present finding therefore points towards similar genetic endowment in both the population as well as the prevailing conditions also show similar influence on the body measurements. This suggests that may be both the population is from the same parental population and then bifurcating in two different regions. This goes in conformity with what the legends say in the region.

Key Words: Deoris, Arunachal Pradesh, Assam, regional variation, body dimensions, growth, nutritional status

INTRODUCTION

Physical growth as a dynamic process is considered to be the product of interaction between genetic endowment which the organism inherits and a host of environmental factors in which it lives. The relationship of man to total environment constitutes the ecological approach to the study.

Regional variation in the degree of development are well known in many countries but are more important in developing countries where more resources are usually assigned to urban than more remote areas. Many factors come into play for the expression of full genetic potential for growth. Disparity in socio economic status, availability of food, access to adequate health services, environmental hygiene, parental educational level and altitude (El Mouzan et al., 2009).

Shen et al. (1996) while comparing the effects of reforms on the growth of children in urban and rural areas, concluded that despite an overall improvement in child growth during the economic reforms in China, the improvement has not been uniform, as judged by increased differences in height between rural and urban children's and increased disparities within rural areas.

Balgir (2003) has found a regional variation in the body dimensions of Gujjars in the Ropar district of Punjab and Muslim Gujjars in the Chamba district of Himachal Pradesh in the North Western part of India. They differed significantly from each other in many physiognomic measurements and it was suggested that it could be because of founder effect, genetic drift and breeding and geographical isolation of the populations under study and not to secular trends.

El Mouzan et al. (2009) found a significant difference in growth between regions that varied according to age, gender, growth parameter and region. They have suggested that a regional variation in growth needs to be taken into consideration when assessing the growth of children and adolescents.

Zhang and Wang (2010) in a study among children and adolescents in China about the regional variations have suggested that regional variations in growth need to be taken into considerations when assessing the growth of children and adolescents in different areas of China.

Harrison et al. (2009) in a survey of psychometric, personality and anthropometric variation among adults resident in nine villages in the Otmoor region of Oxford shire found variation between sexes ,social / occupational groups and the villages. Anthropometric variation apparently existed between the villages independently of social class composition.

The present study therefore was undertaken to investigate the variation in respect of a few body measurements among the adult Deoris living in the Assam and the Deoris living in the

State of Arunachal Pradesh. The legends say that the Deoris of Assam have migrated from the then NEFA i.e. Arunachal Pradesh and have settled in the different districts of Assam. A time period of fifty years is enough to show the differences between populations because of environmental factors. The measurements are in respect of certain linear, circumferential, diameters and body weight. The study investigates the relationship between height, sitting height, subischial leg length and cormic index, conicity index, waist hip ratio and waist stature ratio.

MATERIALS AND METHODS

The present cross sectional study was conducted among the adult Deoris (aged 18 and above) of two states- Assam and Arunachal Pradesh. Deoris in Arunachal Pradesh are found only in Lohit and Changlang districts and data has been collected from both. Villages covered under Lohit district are Mahadevpur no. I, II, III, IV, Dharampur, Mohong and Gelenja. From Changlang district the villages covered are Sumpoi no. I, II, III and Diyun village.

In Assam, Deoris are mainly concentrated in the districts of Dibrugarh, Sibsagar, Lakhimpur, Sonitpur, Jorhat, Dhemaji and in the Sadiya region of Tinsukia. Data has been collected from Dibrugarh, Sadiya, Sibsagar and Jorhat district.

A total of 250 males and 245 females were measured in Assam and 200 males and 185 females were measured from Arunachal Pradesh.

Anthropometric Measurements

All anthropometric measurements were taken using standard anthropometric techniques (Weiner and Lourie, 1969; Lohman et al. 1988; Lee and Nieman, 2007). Technical Errors of measurements were within acceptable limits.

The linear measurements were taken with the help of Martins anthropometer. Subischial leg lengths were obtained by subtracting setting height from height. Cormic index was calculated (sitting height/stature) \times 100. Circumferential measurements were taken with the help of a non-stretch tape. Waist circumference was measured at the minimum circumference between the iliac crest and the rib cage. Hip circumference was measured at the maximum protuberance of the Buttocks and the WHR was calculated.

The conicity index was calculated as

$$\text{Conicity Index} = \text{waist circumference (m)} / [.109 \times \sqrt{\text{weight (kg)} / \text{height (m)}}]$$

Weight was measured with a portable weighing machine to the nearest 0.1 kg without shoes and wearing light clothing. Height and other linear measurements were recorded to the nearest 0.1 cm.

Waist hip ratio which is an indicator of obesity indicating abdominal fat accumulation was assessed using the following norms

Waist Hip ratio norms

Gender	Excellent	Good	Average	At Risk
Males	< 0.85	0.85 – 0.89	0.90 – 0.95	≥ 0.95
Females	< 0.75	0.75 – 0.79	0.80 – 0.86	≥ 0.86

The cut off point for waist- stature ratio was taken as

	Men	Women
Abnormally slim to underweight	< 35	< 35
Extremely Slim	35 – 43	35 – 42
Healthy	43 – 46	42 – 46
Healthy, Normal weight	46 – 53	46 – 49
Overweight	53 – 58	49 – 54
Seriously overweight/Obese	58 – 63	54 – 58
Highly Obese	>63	>58

Body- build index was calculated by

$$= \frac{(\text{weight})^{1/3} \times 100}{\text{Stature}}$$

Cut off points for body build index:

Very strong	Strong	Good	Medium	Weak	Very weak	Bad
10	11 – 15	16 – 20	21 – 25	26 – 30	31 – 35	36 –

RESULTS

The mean and standard errors of the different measurements of the adult Deoris from Assam and Arunachal Pradesh are presented in Table: 1 for males and Table: 2 for females. It could be seen that the Deori males from Arunachal Pradesh have a higher mean value of all the anthropometric measurements except waist circumference when the Deoris of Assam show a higher value than the Deoris of Arunachal Pradesh. Same is the case among the females also when the Deoris from

Arunachal Pradesh have higher mean values in almost all the measurements except chest circumference, biacromial diameter and bi-iliac diameter. But all these measurements (Table: 3) are at an insignificant level of difference in both the sexes. The difference between sexes in all the measurements under consideration is at a significant level except hip circumference, girth of bicep in both the states, head circumference and bi-iliac diameter in Assam, calf circumference and body weight in Arunachal Pradesh.

Table: 4 shows the mean value of different anthropometric indices. For the calculation of indices the Deoris of both the states have been combined as no significant differences have been found among them in their anthropometric parameters. Table: 5 presents the body build index when all the females (100%) are of medium build and 98.67% males have medium and 1.33% have weak body build. The Deoris have medium legs for both the sexes. The waist- stature ratio shows a normal index in both the sexes. The Deori males have a conicity index of 1.20 and the females have 1.21.

DISCUSSION

Differences in size and shape of the adults are due to difference in their gene pools, in their environments and in the interaction between the two (Eveleth and Tanner, 1976). The present study tries to find out the heterogeneity in body dimensions among the Deoris in two different locations.

The Deori males of Assam and Arunachal Pradesh both do not show any significant difference among themselves in all the anthropometric measures under consideration. Same is the case with the females also. Genetic inheritance has a decisive influence on growth patterns and body size of adults (Pavlica et al., 2010). However, there is evidence that numerous social, demographic and economic factors are also important. The nature and intensity of their influence varies from region to region. The present finding therefore points towards similar genetic endowment in both the population as well as the prevailing conditions also show similar influence on the body measurements. If any negative environmental factor has an impact over a longer period of time, growth patterns and morphological variables in adults will be considerably below the individual's genetic potential. Since in both the populations similar morphology is observed, we may say that a similar environmental condition prevails in both the states and may be both the populations are biologically similar.

Adult height can be a marker of living conditions in early life. This variable is often used to assess the relationship between nutritional deprivation, low socio- economic status (SES) and chronic health problems during childhood (Velasquez- Melendez et al., 2005). In the present study no significant difference has been found in the body height of the Deoris in both the regions, so maybe this is another pointer towards similar environmental conditions since early life. Dangour (2001) and Habicht et al. (1974) have also proposed that differences between populations in the body size is more likely to represent the influence of environmental factors on

growth than the variation in genetic potential for growth of different ethnic groups. In the present population, the legends say that the Deoris of different districts in Assam have migrated from the then NEFA i.e. Arunachal Pradesh. So both the population is from the same parental population and then bifurcating in two different regions but may be the environmental conditions prevailing in both the regions are similar enough to show similarity in their body dimensions.

The body shape and size with longer legs is a useful adaptation to the climate and one of the most common indices for body proportion is cormic index. Mean sitting height ratio for populations of adult varies from minimum values i.e. relatively longest legs, for Australian Aborigines (SHR= 47.3 for men and 48.1 for women) to the maximum sitting height ratio values, i.e. relatively shortest legs for Guatemala Maya man and Peruvian women (SHR=54.6 and 55.8 respectively) [Bogin and Varela Silva, 2010]. The present population has the adult sitting height ratio of 51.94 among the males and 51.70 among the females. So the Deoris have medium legs. The Asians and far Eastern populations have proportionally shorter legs with cormic index of 53-54 (Pheasant, 1986).

There are evidences that adults with skeletal disproportion , especially high SHR (short legs) are at greater risk for coronary heart disease (CHD), impaired glucose and insulin regulation , increased pulse pressure and systolic blood pressure and high fibrinogen levels (Ferrie et al., 2006).

Influences of environment and lifestyle on the cormic index over time have been described in some populations. Increase in cormic index was observed and this was attributed to better living conditions or modern way of life (Wadsworth et al., 2002; Manolis et al., 1995). It has also been noted that human beings growing up in adverse bio cultural environments , including childhood health , diet and family circumstances : parental height, divorce and death (Thomson and Duncan ,1954) ; as well as under nutrition , exposure to infection, economic oppression/poverty, heavy workloads, high altitude, war, racism, and religious/ethnic oppression, may be stunted, have asymmetric body proportions, be wasted, be overweight, and be at greater risk for disease (Bogin, 2001).

The Deoris of the present study have a medium body build as calculated by body build index. They have a normal index of waist- stature ratio which is 0.50 in males and 0.48 in females. Waist circumference and ratio such as waist to hip (WHR) indicate central distribution of fatty tissue and are used for the early detection of the diseases related to obesity, even in individuals with normal body weight. WHR of ≥ 0.95 for men and ≥ 0.85 for women is used as a measure of central obesity. The Deori males as well as females are below the risk level of WHR.

Central obesity has been recognized as a main risk factor for cardiovascular (CV) events. Body Mass Index, waist circumference, waist- height ratio, waist- hip ratio, Conicity Index all are found to associate with cardiovascular risk factors (Yasmin and Mascie-Taylor, 2000). Valdez et al. (1993) proposed that conicity index seems to be a viable approach to assess abdominal adiposity and its concomitant health risks in large –scale studies. Of the three central obesity indices of waist circumference, waist-hip ratio (WHR), waist-to-height ratio (WHtR),

conicity index (Cindex) has been found to have a more discriminatory accuracy (Motamed et al., 2015). The predicted range of conicity index is between 1.00 (perfect cylinder) and 1.73 (perfect double cone) [Flora et al., 2009]. In the present study the Deori male and females present a conicity index of 1.20 and 1.21 respectively. A person having a conicity index of 1.20 means that, he/she has a waist circumference which is 1.20 times larger than the circumference of a cylinder with height and weight of that person. So the Deori females have a little higher conicity index than their male counterparts. This may be because of biological differences between a male and a female body type. The Deori women are hard working and work equally in the agricultural field as the men. They do transplanting of paddy, irrigation as well as harvesting. They work from dawn till evening, taking care of home and working in the field. They are in the category of normal body build with no risk of cardio vascular diseases. The Deoris also have a healthy waist-stature ratio which is 0.50 for the males and 0.48 among the females. Perhaps an in-depth nutritional study among the Deoris may further help in planning priorities in their upliftment. Special programs may be tailored for them keeping in mind their requirements.

REFERENCES

- Balgir RS. 2003. Morphological and regional variations in body dimensions of the Gujjars of different localities in north-western India. *Anthropologischer Anzeiger*/ **61**(3): 275-85.
- Bogin B, Kapell M, Varela SMI, Orden AB, Smith PK , Loucky J, Dasgupta P, Hauspie R. 2001. How genetic are human body proportions? In: Dasgupta P, Hauspie R, editors. *Perspectives in human growth, development and maturation*. The Kluwer Academic Press. p 205-221.
- Bogin B, Varela-Silva MI. 2010. Leg length, body proportion, and health: a review with a note on beauty. *Int J Environ Res Public Health* / **7**(3): 1047-75.
- Dangour A D. 2001. Growth of upper- and lower-body segments in Patamona and Wapishana Amerindian children (cross-sectional data). *Ann Hum Biol*/ **28**(6):649-63.
- El Mouzan MI, Foster P, Al Herbish A, Al Salloum A , Al Omer A, Alqurashi M and keojevic T. 2009. Regional variations in the growth of Saudi children and adolescents. *Ann Saudi Med*/ **29**(5): 348-356.
- Eveleth P B and Tanner J M. 1976. *Worldwide variation in Human Growth*, Cambridge University Press.

- Flora MS, Mascie-Taylor N and Rahman M .2009. Conicity Index of adult Bangladeshi population and their socio-demographic characteristics. *Ibrahim Med Coll J*, **3**(1): 1-8.
- Ferrie JE, Langenberg C, Shipley MJ, Marmot MG. 2006. Birth weight, components of height and coronary heart disease: evidence from the Whitehall II study. *Int J Epidemiol*, **35**(6): 1532-1542.
- Habicht J P, Martorell R, Yarbrough C, Malina RM, Klein RE .1974. Height and weight standards for preschool children: How relevant are ethnic differences in growth potential? *Lancet*, **303**(7858): 611- 615.
- Harrison GA, Gibson JB, Hiorns RW, Wigley M, Hancock C , Freeman CA, Küchemann CF, Macbeth HM, Saatcioglu A and Carrivick PJ. 2009. Psychometric, personality and anthropometric variation in a group of Oxford shire villages. *Ann Hum Biol*, **1**(4)1974 (Published Online: 9th july 2009).
- Lee R D, Nieman D C. 2007. *Nutritional Assessment*. McGraw–Hill, New York.
- Lohman T G, Roche A F, Martorell R. 1988. *Anthropometric Standardization Reference Manual* (ed). Human Kinetics Books, Champagne, Illinois.
- Manolis S, Neroutsos A, Zafeiratos C and Pentzou-Daponte A. 1995. Secular changes in body formation of greek students. *Hum Evol*/ **10** (3):199-204.
- Motamed N, Perumal D, Zamani F, Ashrafi H, Haghjoo M, Saeedian F S, Maadi M, Akhavan-Niaki H, Rabiee B, Asouri M. 2015. Conicity Index and Waist-to-Hip Ratio Are Superior Obesity Indices in Predicting 10-Year Cardiovascular Risk Among Men and Women. *Clin Cardiol*/ **38**(9):527-534.
- Pavlica Tatjana , Bozic-krstic V and Rakic R. 2010. Relationship between adult stature, BMI and WHR in Backa and Banat. *Anthrop Anz, J. Biol. Clinic. Anthropol.***68**(1): 31-41.
- Pheasant S. 1986. Bodyspace: anthropometry, ergonomics and design. *Taylor and Francis, London*.
- Shen T, Habicht J P, Chang Y .1996. Effects of economic reforms on child growth in urban and rural areas of China. *N Engl J Med* / **335**: 400-406.
- Thomson A M, Duncan D L. 1954. The diagnosis of malnutrition in man. *Nutr Abstr Rev*/ **24**(1): 1-18.
- Valdez R, Seidell JC, Ahn YI & Weiss KM. 1993 .A New Index of Abdominal Adiposity as an

Indicator of Risk for Cardiovascular Disease. A Cross-population Study. *Int J Obes Relat Metab Disord*/17(2):77-82.

Velásquez-Meléndez, Silveira E A, Allencastro-Souza P, Kac G. 2005. Relationship between Sitting-height-to-stature ratio and adiposity in Brazilian women. *Am J Hum Biol* /17 (5): 646-653.

Wadsworth M E J, Hardy R J, Paul A A, Marshall S F, Cole T J. 2002. Leg and trunk length at 43 years in relation to childhood health, diet and family circumstances; evidence from the 1946 national birth cohort. *Int J Epidemiol* / 31(2): 383-390.

Weiner J S, Lourie J A. 1969. *Human Biology: A Guide to Field Methods*. International Biological Program (IBP), Hand Book No. 9. Blackwell Scientific Publications, Oxford-Edinburgh.

Yasmin and Mascie-Taylor CGN. 2000. Adiposity Indices and their relationship with some risk factors of coronary heart disease in middle – aged Cambridge Men and Women. *Ann Hum Biol* /27(3): 239-248.

Zhang YX and Wang SR. 2010. Differences in development among children and adolescents in eastern and western China. *Ann Hum Biol*/ 37(5): 658-667.

Table 1: Statistical constants of anthropometric variables among the adult Deori males of Assam and Arunachal Pradesh

Measurements	Assam	Arunachal Pradesh
Stature	161.62 ± 1.08	163.38 ± 0.94
Sitting Height	83.66 ± 0.66	85.14 ± 0.66
Lower Extremity Length	77.96 ± 0.71	78.24 ± 0.56
Head Circumference	53.64 ± 0.24	54.19 ± 0.30
Girth of Bicep	22.77 ± 0.31	23.49 ± 0.30
Chest Circumference	83.88 ± 0.43	84.09 ± 0.88
Waist Circumference	82.74 ± 1.39	80.00 ± 1.42
Hip Circumference	85.57 ± 1.26	88.12 ± 1.00
Calf Circumference	32.77 ± 0.27	32.91 ± 0.33
Biacromial Diameter	38.36 ± 0.21	38.00 ± 0.24
Bi-iliac Diameter	25.98 ± 0.17	26.35 ± 0.17
Body Weight	60.33 ± 1.56	61.14 ± 1.33

Table 2: Statistical constants of anthropometric variables among the adult Deori females of Assam and Arunachal Pradesh

Measurements	Assam	Arunachal Pradesh
Stature	152.11 ± 1.07	154.37 ± 0.70
Sitting Height	78.86 ± 0.73	79.59 ± 0.45
Lower Extremity Length	73.25 ± 0.64	74.78 ± 0.51
Head Circumference	52.89 ± 0.22	53.53 ± 0.28
Girth of Bicep	21.86 ± 0.23	22.54 ± 0.31
Chest Circumference	80.99 ± 0.56	80.97 ± 0.57
Waist Circumference	79.01 ± 1.36	83.01 ± 1.64
Hip Circumference	83.09 ± 1.40	83.96 ± 1.03
Calf Circumference	31.22 ± 0.32	31.77 ± 0.43
Biacromial Diameter	34.81 ± 0.21	34.42 ± 0.17
Bi-iliac Diameter	25.67 ± 0.21	25.66 ± 0.18
Body Weight	57.14 ± 0.69	57.95 ± 1.25

Table 3: Level of significance (t-values) in the anthropometric variables between the two sexes and between the males and females of Assam and Arunachal Pradesh

Measurements	Between Sexes		Between Assam and Arunachal Pradesh	
	Males × Females		Males × Males	Females × Females
	Assam	Arunachal Pradesh		
Stature	9.24*	8.68*	1.23	1.77
Sitting Height	4.88*	6.93*	1.58	0.86
Lower Extremity Length	4.93*	4.59*	0.31	1.87
Head Circumference	2.28	4.59*	1.38	1.79
Girth of Bicep	2.34	2.19	1.65	1.75
Chest Circumference	4.06*	2.76*	0.24	0.02
Waist Circumference	2.89*	4.03*	1.47	1.26
Hip Circumference	1.69	0.60	1.81	1.30
Calf Circumference	3.70*	2.10	0.32	1.03
Biacromial Diameter	11.82*	12.29*	1.12	1.14
Bi-iliac Diameter	1.72	2.72*	1.49	0.11
Body Weight	4.08*	2.30	0.41	1.70

* Significant at the level of $p < 0.05$

Table 4: Mean anthropometric indices among the Deori males and females

Indices	Males	Females
Cormic Index	51.94	51.70
Relative subischial leg length	48.06	48.30
Conicity Index	1.20	1.21
Waist hip ratio	0.93	0.95
Waist stature ratio	0.50	0.48

Table 5: Distribution of Deori males and females as per body build index

	Very strong	Strong	Good	Medium	Weak	Very weak	Bad
Males				444 (98.67%)	6 1.33%		
Females				430 (100%)			