LETTER

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Impact of Socio-Economic Status on Anthropometric Characteristics and Somatotype in Male Aborigine Santal People of West Bengal, India

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Abstract

Introduction: Socioeconomic Status represents the economic and social condition of a person or a family in respect of income, education and profession or occupation. Socioeconomic status reflects the economic or wealth level besides social position which influence health, education and overall wellbeing. The present study was aimed to find out the impact of Socio-economic status on male Aborigine Santal population of India. **Methods:** 65 Santal aborigine male from rural areas of West Bengal province of India were measured for their physical characteristics and somatotyping. The Socio-economic status of these Santal males were in Poor category of Upper Lower class or Lower Class according Kuppuswamy Scale of classification. **Results:** The average Somatotype of Upper Lower class Santals was 2.4 (±1.6) - 4.0 (±0.9) -3.0(±1.1) whereas that of Lower class was 2.0(±0.5) -2.4(±02) -2.7(±0.4). **Conclusion:** Less muscularity was observed in Lower Claas people compare to Upper lower class. This might be due pooe nutrition along with less intake of proten in food. Thus, Socio-economic status has impact on anthropometrical measurement and somatype. More studies are required for other population of same socio-economic status.

Keywords: Socio-Economic Status, Somatotype, Santal, Aborigine, Muscularity.

Resumen

Introducción: El estatus socioeconómico representa la condición económica y social de una persona o familia en relación con sus ingresos, educación y profesión u ocupación. El estatus socioeconómico refleja el nivel económico o de riqueza, además de la posición social, que influyen en la salud, la educación y el bienestar general. El presente estudio tuvo como objetivo determinar el impacto del estatus socioeconómico en la población masculina aborigen Santal de la India. **Métodos:** Se midieron las características físicas y se realizó la somatotipificación de 65 hombres aborígenes Santal de zonas rurales de la provincia de Bengala Occidental, India. El estatus socioeconómico de estos hombres Santal se clasificó en la categoría de pobreza, dentro de la clase baja superior o clase baja, según la escala de clasificación de Kuppuswamy. **Resultados:** El somatotipo promedio de los Santal de clase baja superior fue de 2.4 (±1.6) - 4.0 (±0.9) - 3.0 (±1.1), mientras que el de la clase baja fue de 2.0 (±0.5) - 2.4 (±0.2) - 2.7 (±0.4). **Conclusión:** Se observó menor musculatura en las personas de clase baja en comparación con las de clase baja superior. Esto podría deberse a una nutrición deficiente y a un bajo consumo de proteínas. Por lo tanto, el estatus socioeconómico influye en las mediciones antropométricas y el somatotipo. Se requieren más estudios en otras poblaciones con el mismo estatus socioeconómico.

Palabras Clave: Estatus socioeconómico, Somatotipo, Santal, Aborigen, Musculatura.

Introduction

Socioeconomic Status represents the economic and social condition of a person or a family in respect of income, education and profession or occupation. Socioeconomic status reflects the economic or wealth level besides social position which influence health, education and overall wellbeing (Lareau, 2011). As Socioeconomic

status has an impact on Health and wellbeing, of a person, so it must have impact on body shape and size of a person. Somatotype represents the body shape and size of a person which comprises of three components like Endomorphy, Mesomorphy and Ectomorphy (Carter & Heath, 1990).

Aborigine population in India is known Tribes. Santal population is also a tribal population in India most of them who lives in rural areas. The economic condition of Santals who lives in rural areas is poor or very poor. When classified according to Socio-economic status classification (Majumder, 2021, Mandal, & Hossain,.2025), Santals of rural areas fell into Poor category (Cavallaro & Rahman, 2009; Dhargupta, *et al.,* 2009; Dash &Adhikari, 2017; Adhikari & Dash, 2020; Mukherjee & Malik, 2020, Adhikari *et. al*. 2021; Adhikari & Ghosh, 2025). The Santals in West Bengal, who lives in rural areas, most of them are in "Lower class" of socioeconomic category with Poor economic condition. Interestingly, Santals who lives in Rural areas far away from suburban areas are comparatively very poor than the Santals lives in near suburban areas (Adhikari and Dash. 2020) though both groups are in Poor status. Thus, the present study was aimed to find out the impact of socio-economic status on anthropometrical aspects and somatotype especially on Endomorphy (Fattiness) and Mesomorphy (Muscularity) component.

Material and Methods

Selection of Study Area: The study was conducted in rural areas of Bankura and Paschim Medinipur Distrcts of West Bengal province of India.

Subjects: 24 Santal adult males were studied for their anthropometrical measurements from a village in Bankura District of West Bengal Province of India. All of them were from Upper Lowers class of society according to the Kuppuswamy Socio-Economic classification of India (Majumder, 2021; Mandal & Hossain, 2025). Another 41 Santal males who belongs to Lower class according to Socio-Economic status classification from the villages of Belda of nearby distrct. Both the studied population were from very poor community. The economic condition of 'Upper Lower' class people are slightly better compare to very poor economic condition 'Lower' class peoples of Indian Socio-economic status category.

Socio-Economic Status: Socio-economic status were identified from the preliminary questionaries' following the Modified Kuppuswamy scale updated for the year 2025 (Mondal & Hossain, 2025).

Ethical Part: Consent was taken from each individual verbally during the survey for identifying socioeconomic status. Ethical consent was also taken before the Anthropometric measurements

Socio-Economic Status: Socio-economic status were recorded from preliminary questionaries' following the Modified Kuppuswamy scale updated for the year 2025 (Mondal & Hossain, 2025).

Anthropometrical Measurements: Anthropometrical measurements were taken according to the standard methods following the manual of International Society for the Advancement of Kinanthropometry (Esparza-Ros 2024). ISAK Accredited Anthropometrists measured the Anthropometric parameters. Stature was measured with a Stadiometer and body mass was measured with an electronic weighing scale. Harpenden Skinfold caliper (Baty International, UK) was used to measure the skinfold thicknesses of triceps, subscapular and supraspinale skinfold sites. Circumferences of Upper Arm and calf were measured with an Anthropometric Tape (CESCORF, Brazil). Humerus and Femur breadths were measured with a small sliding caliper (CESCORF, Brazil)

Somatotype: Heath - Carter (1967) method was followed for somatotype rating. The following equations were used for calculating somatotype:

Endomorphy = ─ 0.7182 + 0.1451 × ΣSF ─ 0.00068 × ΣSF2 + 0.0000014 × ΣSF3

Where ΣSF = (sum of triceps, subscapular and supraspinale skinfolds) multiplied by (170.18/height in cm). This was called height-corrected endomorphy and was preferred

Method for calculating endomorphy)

Mesomorphy = 0.858 × humerus breadth + 0.601 × femur breadth + 0.188 × corrected arm girth + 0.161 × corrected calf girth ─ height × 0.131 + 4.5

Three different equations were used to calculate ectomorphy according to the height -weight ratio (HWR):

If HWR was greater than or equal to 40.75 then, Ectomorphy = 0.732 × HWR ─ 28.58

If HWR was less than 40.75 and greater than 38.25 then, Ectomorphy = 0.463 × HWR ─ 17.63

If HWR was equal to or less than 38.25 then, Ectomorphy = 0.1

Results

Table 1. Average physical characteristics and somatotype of Male Santal population of Upper Lower class of Socio-economic status (n-24)

	Age (yr)	Height (cm)	Weight (kg)	Somatotype		
				Endomorph	Mesomorph	Ectomorph
Mean	29.5	163.0	54.8	2.4	4.0	3.0
Sd	7.1	3.8	7.1	1.6	0.9	1.1
Min	18	153.0	45.9	1.2	2.5	1.3
Max	46	167.6	66.4	4.8	5.4	5.2

Table 1 showed the Physical Characteristics and somatotype components of 20 male Santals who belongs to Upper Lower class. Average age was 29.5 (7.1) yr with a range of 18 to 46 yrs. Ectomorphic mesorph body type was observed in average Somatotype value of 2.4-4.0-3.0.

Table 2. Average physical characteristics and somatotype of Male Santal population of Lower class (n=41).

	Age (yr)	Height (cm)	Weight (kg)	Somatotype		
				Endomorph	Mesomorph	Ectomorph
Mean	29.3	162.8	51.1	2.0	2.4	2.7
Sd	6.5	3.8	2.9	0.5	0.2	0.4
Min	19	153.4	45	1.2	2.1	2.1
Max	44	167.6	54	2.8	3.	3.7

Table 2 shows the Physical Characteristics and Somatotype of male Santals population who belongs to Lower class with very poor economic condition according to Socio-economic status. Central body type category was observed with a Somaotype of 2.0-2.4-2.7 was observed.

Table 3. Relative adiposity, Relative musculo-skeletal robustness and Relative linearity of Santal male population of Upper Lower Class with Poor economic condition.

Category	Endomorphy	Mesomoprhy
Low relative	0	35%
Moderate relative	65%	0
High relative	0 %	0 %
Extreme High relative	0 %	0 %

Table 3 shows the relative category of Fattiness and Muscularity of Santal population of Upper Lower class category of Socio-economic status. Mesomorphy component as well as Endomorphy components are either low or moderate, especially muscularity was very low.

Table 4. Relative adiposity, Relative muscularity in Santal male population of Lower Class with very poor economic condition.

	Endomorphy	Mesomoprhy
Low relative	100 %	100 %
Moderate relative	0	0
High relative	0	0
Extreme High relative	0	0

Table 4 shows Low relative muscularity as well as low relative Fattiness in the studies Santal population who were very poor with Lower class socio-economic status. There were no moderate or high relative muscularity indicating poor muscularity.

Table 5. Somatotype categories in percent in Santal males of both Upper Poor and Poor Socio-economic Status groups.

Somatotype category	Upper Lower Class Percentile	Lower Class Percentile
Endomorph Mesomorph	5 %	5 %
Ectomorphic Mesomorph	15 %	
Mesomorph Endomorph	15 %	
Mesomorph Ectomorph	5 %	30 %
Endomorph Ectomorph		5 %
Central		40%
Mesomorphic Ectomorph	20 %	20 %
Balanced Mesomorph	10 %	
Endomorphic Mesomorph	30 %	

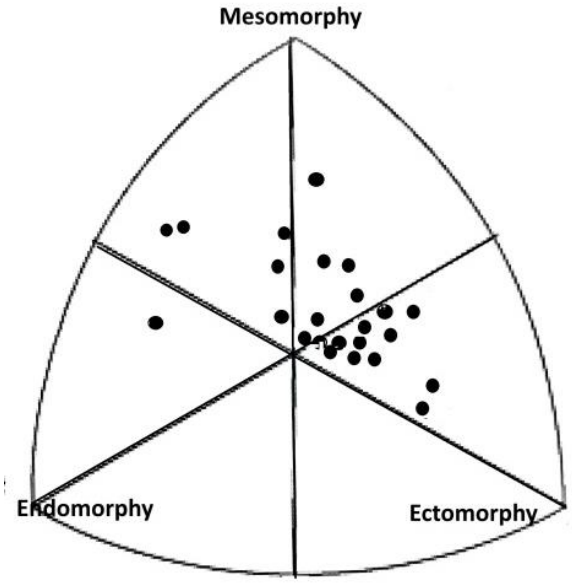

Figure 1. Somatotype of Upper Lower Class Santals.

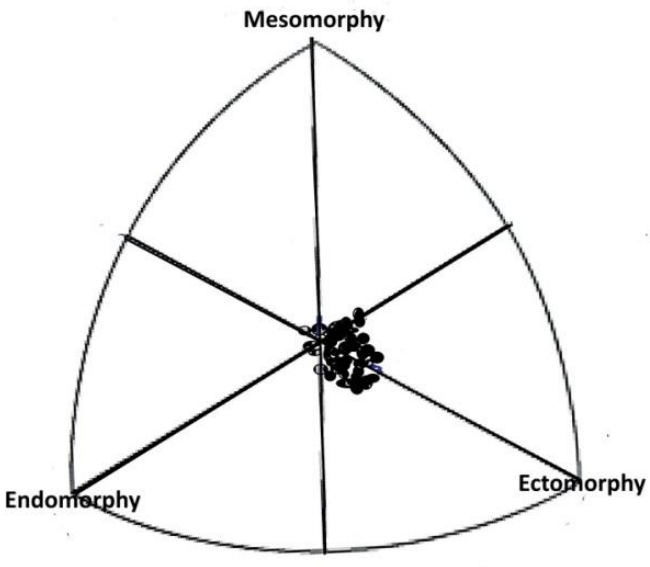

Figure 2. Somatotype of Lower Class Santals

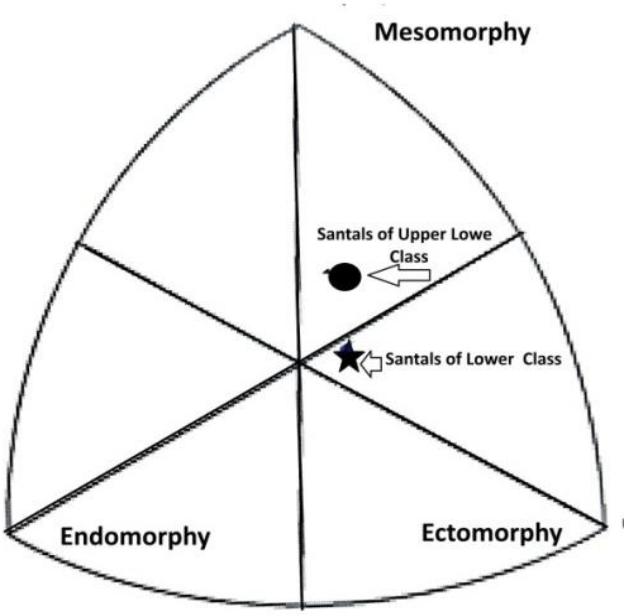

Figure 3. Somatochart of Santals of Uppler Lower and Lower Class.

Discussion

Santals are the largest aborigine community of Indian Sub-continent. The professions of Santal population in India are basically hunting, cultivating Agriculture, seasonal forest collection and hunting are the main source of earning and living in rural areas. As economic condition of Santals in rural areas depends on sustenance agriculture like paddy, millets, forest resources, etc., poverty is very common in Santal population (Maharanam & Patel, 2018; Chaudhary & Murmu 2024).

Though the studied two Santal populations from two different rural areas were with poor socio-economic condition, but one group's socioeconomic status was slightly better than the other group though both groups were with Lower socioeconomic status. This was reflected in their muscularity. 35 % of Upper lower class Santals were with moderate relative muscularity whereas 100 % of Lower class Santals were with Lower Relative muscularity (Table 3 and Table 4). This might be due to poor nutrition with less protein (Das & Roy, 2013; Dash & Adhikari, 2017)

The average Somatotype characteristics of the Upper Lower category Santals was 2.4(± 1.6) - 4.0(±0.9) - 3.0 (±1.1), whereas that of Lower category Santals was 2.0(± 0.5)-2.4(±0.2)-2.7 (±0.4) . The average Somatotype of Santals of Upper Lower category was Ectomorphic Mesomorph whereas that of Lower Category was Central with low muscularity component of 2.4 (Table 1 and Table 2). Table 5 compares the Somatotypes of both Upper Poor and Poor Socio-economic Status groups.

Mesomorphic Ectomorph or Ectomorphic Mesomorph category are more in Upper Lower class Santals with few in Endomorphic Mesomorph category (Figure 1). This might be due intake of protein in terms of animal protein from different sources like poultry, Fishing or Hunting. Only few in Endomorphic Mesomorph category which might be due to some kind of Fatty food intake or Pathophysilogical reason which needs future Research. But this was absent in Lower class Santals where Somatotype of all Lower Class Santals were located near the central but slightly toward Mesomorphic Ectomorph zone of Somatochart (Figure.2). This might be due to poor nutrition with less intake of proten by any source.

Muscle growth depends on proper nutrition besides other Physiological factors like Growth Hormone, IGF1, FGF, Testosterone etc. Not only that Ectomorphy (Leanearity) and Mesmorphy (Muscularity) components are also Race specific in certain population .But a minimum muscularity depends on proper intake of protein in diet besides proper nutrition. In the present study, the average mesomorphy component was 4.0 in Upper Lower class whereas that Lower poor class was only 2.4 which was in low relative category (Table 1, Table 2, and Table 4). Both groups of Santal were from rural areas of neighbor districts of same province. Hence, the very less muscularity in Santals of the present study was due to insufficient protein intake in their daily intake of food. As proverty is common in rural areas in India so poor economic condition barred the poor Santal people to take sufficient protein along with balance diet. Though some studies on Santal reported average range of mesomorphy of 4.8 to 5.3 , but reliability of the values are questionable as the measurers were not internationally accredited Anthropometrists and

Somatochart represented in the published articles were completely wrong and misleading. . There were also some studies where predominantly mesomorphic body type was observed (Ghosh & Malik, 2007; Adhikari & Dash, 2020; Das *et al.,* 2021; Adhikari *et al.,* 2021; Ghosh, 2022; Adhikari & Ghosh, 2025).

The Male Santals of the present study were from very poor families where proper regular diet along with protein is very rare and sometimes escaping of regular meal is also very common due to extreme poverty in Lower class people in India. This was reflected in very less muscularity in terms of mesomorph component in the Lower Socio-Economic Group compare to Uppler lower class which was reflected in Somatochart (Figure 3). Thus Socio-economic status has a great impact on somatotype besides other physiological and Anthropological aspects.

Conclusion

The present study highlights the strong influence of socio-economic status on the somatotype and muscularity of Santal populations. Although both studied groups belonged to lower socio-economic strata, the Upper Lower class Santals exhibited relatively better muscularity and mesomorphic components compared to the Lower class. These differences are primarily attributed to variations in nutritional intake, especially protein availability. Persistent poverty, food insecurity, and limited access to balanced diets among Lower class Santals resulted in reduced muscular development and central somatotypes with low mesomorphy. Overall, the findings emphasize that socio-economic deprivation significantly shapes physical development, underscoring the need for nutritional and economic interventions among marginalized tribal communities.

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Conflicts of Interest

The authors declared no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

Informed Consent Statement

All the athletes included in the study provided written informed consent.

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