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Health Status in terms of Muscularity and Somatotype of Indigenous Santals of India

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Abstract

Introduction: The Santals are the largest Indigenous population of India and Bangladesh. They are Austroasiatic-speaking Munda ethnic Aborigine group. Most of the Santals live in Villages with poor Socio-economic status. Intake of food especially balance diet is absent in poor Santal familes of remote village areas of India due to poverty. Thus, less intake of proper nutrient, results impaired development of skeletal muscles along with body shape and size. Thus, the aim of the present study was to find out the muscularity and Somatotype characteristics. **Methods**: 74 females and 82 males were studied for their physical characteristics and Somatotype. Different components like Endomorph, Mesomorph and Ectomorph components were noted. Economic status of the family were was also noted according to Indian categories of Socio-economic status. Somatype characteriwas were observed for both male and female Santals. **Results:** An average somatotype of 2.2(±0.9)-3.0(±0.7)-2.9(±0.6) for males and 3.6(±1.1)-3.3(±0.4)-2.7(±0.8) for Females were observed. The average Muscularity or both male and Female Santals were in Low Relative Category. The Low muscularity might be due to poor nutrition besides other Pathophysiological factors. **Conclusion**: The health status of the indigenous Santal population in India was not well which was also reflected in their poor body shape and size beside Muscularity.

Keywords: Indigenous, Santal, Somatotype, Muscularity.

Resumen

Introducción: Los santales constituyen la mayor población indígena de la India y Bangladés. Son un grupo étnico aborigen munda de habla austroasiática. La mayoría de los santales residen en aldeas con un estatus socioeconómico precario. El consumo de alimentos —y, en particular, de una dieta equilibrada— es inexistente en las familias santales pobres de las zonas rurales remotas de la India, debido a la pobreza. En consecuencia, la ingesta insuficiente de nutrientes adecuados conlleva un desarrollo deficiente de la musculatura esquelética, así como alteraciones en la forma y el tamaño corporal. Por lo tanto, el objetivo del presente estudio fue determinar las características de muscularidad y somatotipo de esta población. **Métodos:** Se estudiaron 74 mujeres y 82 hombres para analizar sus características físicas y su somatotipo. Se registraron los diferentes componentes somatotípicos: endomorfia, mesomorfia y ectomorfia. Asimismo, se registró el estatus económico de las familias, clasificándolo según las categorías socioeconómicas establecidas en la India. Se observaron las características somatotípicas tanto en los hombres como en las mujeres santales. **Resultados:** Se observó un somatotipo promedio de 2,2 (±0,9) - 3,0 (±0,7) - 2,9 (±0,6) para los hombres, y de 3,6 (±1,1) - 3,3 (±0,4) - 2,7 (±0,8) para las mujeres. La muscularidad promedio, tanto en hombres como en mujeres santales, se situó en la categoría de «baja relativa». Esta baja muscularidad podría atribuirse a una nutrición deficiente, entre otros factores fisiopatológicos. **Conclusión:** El estado de salud de la población indígena santal en la India resultó ser deficiente, lo cual se vio reflejado en su escasa muscularidad, así como en la precariedad de su forma y tamaño corporal.

Palabras Clave: Indígenas, Santal, Somatotipo, Muscularidad.

Introduction

The Santal are an Austroasiatic-speaking Munda ethnic Aborigine group of Indian subcontinent (Cavallaro,& Rahman, 2009). Santals are the largest aborigine population in India who lives in different provinces of like Jharkhand, West Bengal, Odisha, Bihar and Assam. Most of Santals live in Rural areas. The Aborigine population in India is called as Tribes. Most of the Santals in India lives in rural areas (Dash & Ray,2013; Dash & Adhikari,2017). Santal families who live in villages especially in very remote areas of rural areas are economically very poor as source of income is very less due to lack of resources. According to Indian classification of Socio-economic status (Kuppuswamy, 1981, Majumder, 2021; Mandal & Hossain,.2025), most of Santals live in rural areas are under Upper poor or Poor socio-economic status (Cavallaro & Rahman, 2009, Dhargupta et al., 2009; Dash & Adhikari, 2017; Dash & Adhikari, 2018; Adhikari & Dash, 2020; Ghosh & Malik, 2020, Adhikari et al., 2021). In India, the Kuppuswamy Scale is used for assessing a family's Socioeconomic status by scoring the education, occupation, and total monthly income of a family head with a total score which categories the specific families into five classes of Upper to Lower status. The Scaling score is modified in regular frequencies by changing and modifying the Score pattern according to changed economy and life style (Majumder, 2021; Mandal & Hossain,2025).

The Indigenous population in India especially those who live in rural areas face significant health challenges like Malnutrition and related health problem (Ghosh & Malik, 2007; Dash & Adhikari, 2017; Dash & Adhikari, 2018; Ghosh, 2022). One of which is poor development of Muscularity and stagnant growth including moderate or poor Body shape and size in terms of Somatotype. Somatotype is the expression of body shape and size of a Human. It expresses the Human body type in three categories, like Endomorphy (Fattiness), Mesomorphy (Myuscularity) and Ectomorphy (Linearity).

The study was aimed to find out the health status in term of Muscularity and body shape & size (Somatotype) of Santal Indigenous people of West Bengal province of India.

Material and Methods

Selection of Study area

The study was conducted in Rural areas of Bankura and Paschim Medinipur Districts of West Bengal province of India.

Participants

82 Male and 74 Female adult Santals were studied for their anthropometrical evaluation from different villages in Medinipur and Bankura District of West Bengal Provinces of India Subjects were belongs Upper Lower and Lower class according to Socio-Economic status.

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). All of them were from Upper Lowers class and Lower class of the society according to the Kuppuswamy Socio-Economic classification of India (Mandal & Hossain, 2025).

Ethical part

Verbal consents were taken from each individual while identifying the Socio-economic status Verbal consent was also taken before the Anthropometric measurements.

Anthropometrical measurements

Anthropometrical measurements were taken according to the standard methods following the manual of International Society for the Advancement of Kinanthropometry (Esparza-Ros, 2019). ISAK Accredited Anthropometrists measured the Anthropometric parameters Standard Stadiometer was used to record stressed Height and a calibrated electronic portable weighing scale was used to measure body weight. Skinfold thicknesses of Triceps, Subscapular, Supraspinale and medial calf skinfold sites were taken with a Harpenden Skinfold caliper

(Baty International, UK). Upper Arm and Mideal calf circumferences were taken with an Anthropometric Tape (CESCORF, Brazil). Humerus and Femur breadths were measured with a small sliding caliper (CESCORF, Brazil).

Somatotype: Somatotype express the body shape and size of a Human being (Carter & Heath, 1990).

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).

Results

Table 1. Physical characteristics and Somatotype of Male Santal Indigenous population (n=82)

	Age (yr)	Height (cm)	Weight (kg)	Somatotype		
				Endomorph	Mesomorph	Ectomorph
Mean	31.1	165.6	51.7	2.2	3.0	2.9
SD±	7.2	3.4	2.8	0.9	0.7	0.6
Min	18	153.0	42	1.2	2.1	1.3
Max	49	172	58	4.8	4.2	4.2

Physical characteristics and somatotype components of 82 male Santals were swon in Table 1.31.1 (± 7.2) yr in average was observed for average age with a range from 18 to 49 years. Average Mesomorph Ectomorph body type (2.2-3.0-2.9) was observed with an average Muscularity of 3.0(±0.7).

Table 2. Physical characteristics and Somatotype of Female Santal Indigenous population (n=74)

	Age (yr)	Height (cm)	Weight (kg)	Somatotype		
				Endomorph	Mesomorph	Ectomorph
Mean	30.8	154.8	44.5	3.6	3.3	2.7
SD±	7.3	2.3	4.5	1.1	0.4	0.8
Min	19	150.1	36.2	1.7	2.0	1.1
Max	48	162	57.7	5.6	4.0	4.3

Table 2 showed the Physical characteristics and Somatotype of Female Santals. Somatotype observed was Endomorph Mesomorph (3.6-3.3-2.7) with moderate muscularity.

Table 3. Relative musculo-skeletal robustness of male (n=82) and Female (n=74) Santal population.

	Muscularity	
Category	**Male**	**Female**
Low relative	62.2 %	39.2 %
Moderate relative	37.8 %	60.8%
High relative	0 %	0 %
Extreme High relative	0 %	0 %

Table 3 showed the relative category of Muscularity in male and female Santal population of the present study. Both male and female Santals possessed either low or moderate relative muscularity.

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

Corrected calf girth = Calf girth (cm) –Calf skinfold (mm) /10

Corrected arm girth =Arm girth (cm) – Biceps skinfold (mm)/10

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.

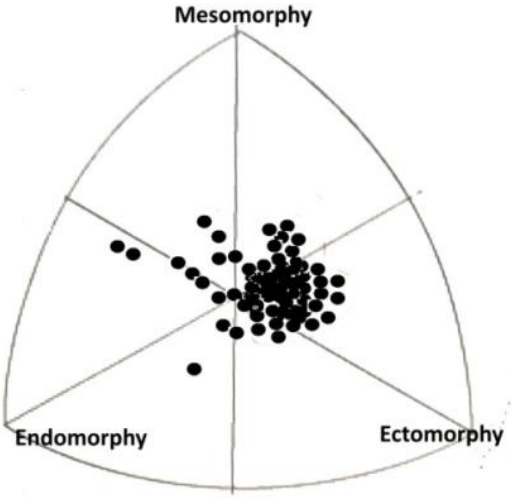

Figure 1. Somatotype of Santal Males**. (n=82)**

Figure 1 showed the distribution of Santali males in Somatochart. The studied population were with central body type category with less muscularity and thinner body shape.

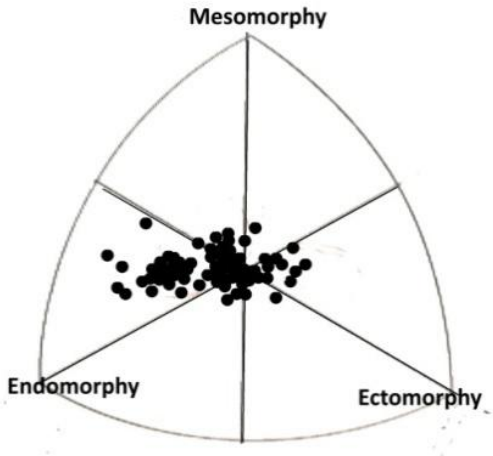

Figure 2. Somatotype of Santal Women (n=74)

Figure 2. showed the distribution of Santali females in Somatochart. The studied Santli women were with Endomorphic body type with less or moderate muscularity.

Figure 3 represented the average body type of male and female Santali population. The Male Santalis were with Ectomorphic Mesomorph character wheras the Female Santalis were near the central with a tendency of fattiness. Thus males were Lean but Muscular whereas Females were less muscle with more fattiness.

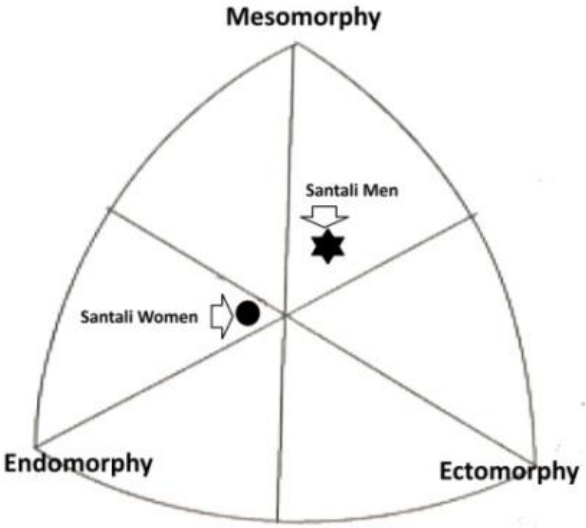

Figure 3. Somatochart of Santali Males and Females in Average.

Discussion

Santal are the largest indigenous population in Indian Sub-continent. The profession of Santals in rural areas in India is agriculture, seasonal forest collection, Hunting and Fishing, Handicrafts and carpentry and Animal Husbandry. Santal people are increasingly diversifying their livelihood to modern economic opportunities in India, but in Villages especially in remote rural areas, it is still based on traditional occupations like Agriculture, seasonal Forest collection, Hunting etc. 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; Mukherjee & Malik, 2020; Chaudhary & Murmu, 2024).

The body shape and size of male Santals was Mesomorph Endomorph category in average with a Somatotype rating of 2.2(±0.9)-3.0(±0.7)-2.9(±0.6) indicting a low category Muscle mass with less fattiness (Table 1). Similarly, the females Santals were with less muscularity with an average Somatotype of 3.6(±1.1)-3.3(±0.4)-2.7(±0.8) indicating Endomorph Mesomorph body type. (Table 2). Body shape and size of most of the male Santals were with less or moderate muscularity with a lean body shape which could be identify easily when plotted on Somatochart (Figure1). But the body shape of Female Santals were also with less muscularity but with more fattiness (Fig 2). But average Body type of male Santals was with less muscle with lean body shape (Ectomorphic Mesomorph), whereas the average Santal females was with body shape of Central category with less muscle mass with fatty tendency (Fig 3).

In the present study, the average mesomorph component was 3.0 ±0.7 for Santal males whereas that of Santal Females was 3.3 ±0.4 (Table 1, Table 2). 62.2% Santal males were with Low relative muscularity whereas only 39.2 % Santal women possessed Low relative muscularity. But a large number of Santal women possessed Moderate relative muscularity compared to men which was 60.8 % to 37.8% (Table 3). It is well known that quantity of muscularity reflects health status of any individual besides other Physiological and pathological factors. Muscle growth depends on proper nutrition besides other physiological factors like Growth hormone, IGF1, FGF, Testosterone level, etc. Muscularity (Mesomorphy component of Somatotype) also Linearity (Ectomorphy component) and some level of muscularity (Mesomorphy component) components are also race specific in certain population (Carter and Heath,1990). But a certain minimum level of muscularity depends on proper intake of protein in diet besides proper nutrition. Poverty is common in rural areas in India. The Indigenous Santal population of the present study were from economically very poor Socio-economic class. Poor economic condition striped them to take proper nutrition with sufficient protein. Thus very less muscularity in the present study was due to poverty.

Conclusion

The Health status in terms of musicality of the indigenous Santal population in India was not well which was also reflected in their body shape and size. Health status should be improved by improving their Socio-economic status besides other factors. For improvement of Health status in terms of Muscularity, proper nutrition along with proper intake of protein is required along with balance diet. This is possible if socio-economic status improves.

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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.