

Anthropometric Measurements and Nutritional Assessment in relation to Chronic Energy Deficiency

Type: Research Article

Received: December 07, 2023

Published: January 02, 2024

Citation:

Ajeet Jaiswal. "Anthropometric Measurements and Nutritional Assessment in relation to Chronic Energy Deficiency". PriMera Scientific Surgical Research and Practice 3.1 (2024): 39-44.

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Abstract

This study investigated undernutrition (a severe health issue) among the Jene Kuruba, an underprivileged indigenous community in Karnataka, India. We found a very high prevalence of chronic energy deficiency (CED) using both Body Mass Index (BMI) and Mid-Upper Arm Circumference (MUAC) assessments. These findings, exceeding 40% according to WHO guidelines, indicate a critical situation. Importantly, CED rates were significantly higher in individuals with low MUAC, suggesting this measure might be more practical for resource-constrained settings compared to BMI in similar populations.

Keywords: Tribal; JeneKuruba; Karnataka; Anthropometry; Nutritional Assessment; CED; MUAC

Introduction

Although anthropometry has limitations, it remains a valuable method for assessing nutritional status in individuals and populations, particularly in resource-constrained settings like India. The Body Mass Index (BMI) stands out as a reliable indicator of adult nutritional health." (WHO, 1995). BMI has been established as a reliable indicator to assess health and nutrition.

Body Mass Index (BMI) has been established as a reliable indicator of overall body fat and energy reserves, as evidenced by research from Jaiswal et al. (2011) and Bose (1996). While alternative methods exist for assessing adult nutrition, BMI's advantages lie in its simplicity, cost-effectiveness, and safety, making it the preferred choice for large-scale surveys (Jaiswal, 2014; James et al., 1994, Jaiswal, 2023). BMI can provide insights into a population's socioeconomic status.

Furthermore, BMI can provide insights into a population's socioeconomic status and nutritional health, particularly relevant in developing countries (Mosha, 2003; Shetty and James, 1994). A BMI below 18.5 kg/m² is a recognized indicator of Chronic Energy Deficiency (CED), a state of underweight where energy balance is maintained despite potential losses in body mass or stores (Khongsdi, 2005). This chronic underweight condition is often associated with increased health risks and limitations in daily functioning (WHO, 1995). Chronic low energy can stem from a long-term imbal-

ance between calorie intake, physical exertion, and illness (Shetty et al., 1994). This deficiency is linked to reduced work capacity, poorer job performance, and increased susceptibility to infections and behavioral changes (Shetty & James, 1994; Durnin, 1994).

Mid-upper arm circumference (MUAC) offers a simpler alternative to Body Mass Index (BMI) for assessing adult nutritional status (Ghosh and Bose, 2015; Jaiswal, 2012; James et al., 1994; Jaiswal, 2023). Requiring minimal equipment, MUAC may be just as effective as BMI in predicting health risks associated with being underweight (Ghosh and Bose, 2015; Briend et al., 1989). Analysis of data from a large international study suggests MUAC as a primary screening tool for identifying undernourishment in adult populations (James et al., 1994). This makes MUAC a potentially valuable tool for rapidly identifying individuals in need of nutritional support. So, MUAC offers a simpler alternative to BMI for assessing adult nutritional status.

While global hunger and food insecurity are major concerns, undernutrition among adults in developing nations has only recently received significant research attention (Griffiths et al., 2001). Despite economic growth, undernutrition remains a significant public health challenge in many Asian countries (Ghosh and Bose, 2015; Jaiswal, 2023). Despite ongoing efforts to improve nutritional status in recent decades (Ghosh & Bose, 2015; Griffiths et al., 2001), significant challenges remain in India, which historically had a high prevalence of undernourishment (Ghosh & Bose, 2015; Krishnaswami, 2000).

Tribal communities, constituting a substantial portion of the population (over 8.6% according to the 2011 census; Topal & Samal, 2001) and often residing in rural areas (Ghosh & Bose, 2015; Mittal & Srivastava, 2006; Ghosh & Bharati, 2006), face particular social and economic disadvantages that contribute to these nutritional challenges.

The JenuKuruba Tribe: Honey Hunters of Karnataka: The JenuKuruba, a vulnerable tribal group in Karnataka, India, descends from the ancient Kuruba people. Primarily Hindu and concentrated in southern India, particularly Karnataka and Andhra Pradesh, the JenuKuruba are known for their exceptional honey-collecting skills honed over generations. Traditionally hunter-gatherers, they possess a unique talent for extracting honey from deep within the forests. Their diet historically consisted of honey, small game meat, fruits, tubers, and ragi (finger millet) as a staple. While traditionally non-vegetarian, their diet has broadened to include rice, eggs, some meat (excluding beef), lentils (sambar), and vegetables. However, information on their current nutritional status and health is scarce. This study aims to address this gap by assessing the prevalence of chronic energy deficiency (CED) and undernutrition (UN) among adult female JenuKurubas in H D Kote Taluk, a remote forested area southwest of Mysuru, Karnataka (Ghosh & Bose, 2015; Jaiswal, 2023).

Materials and Methods

This cross-sectional study investigated adult female members of the Jenu Kuruba tribe in the H D Kote Taluk district of Mysore, Karnataka, India. The fieldwork took place between December 2016 and January 2017. After informing local authorities and community leaders, researchers recruited 125 adult females over 18 years old from the Jenu Kuruba community. Participation was voluntary, with informed verbal consent obtained in the participants' native language before each interview and measurement (Jaiswal, 2023).

Sample Characteristics: The majority of participants were manual laborers with low socioeconomic status. They reported low income and illiteracy. **Anthropometric Measurements:** To gather baseline demographic data, a pre-tested questionnaire collected information on age, sex, height, and weight. Standard anthropometric techniques, established by Lohman et al. (1988) and Weiner & Laurie (1981), were employed to measure height, weight, and mid-upper arm circumference (MUAC) using traditional tools like an anthropometer, a weighing scale, and a measuring tape. All measurements were recorded with high precision: weight to the nearest 0.1 kg, and height and MUAC to the nearest 0.1 mm. Body Mass Index (BMI) was subsequently calculated using the standard formula: weight (kg) divided by height (meters squared) (Ghosh & Bose, 2015; Jaiswal, 2023).

Utilizing internationally recognized B.M.I. criteria, nutritional status was assessed (W.H.O., 1995):		
1	C.E.D.:	B.M.I. <18.5 kg/m ²
2	Normal:	BMI=18.5-24.99 kg/m ² ;
3	Overweight:	B.M.I.≥25.0 kg/m ²
Adopted the W.H.O. (1995) definition of low B.M.I. as a global public health issue based on adult populations.		
This classification divides prevalence into groups based on the proportion of the population having a B.M.I. under 18.5 (B.M.I. < 8.5 kg/m ²)		
1	Low - (5-9%):	Warning sign, monitoring required;
2	Medium - (10-19%):	poor situation;
3	High - (20-39%):	serious situation;
4	Very high - (≥40%):	critical situation
For assessing nutritional status research among people in the third world, the MUAC might be utilized. Among Men, the following cut-off points were used:		
1	Under-nutrition:	MUAC < 23.0 cm;
2	Normal:	MUAC ≥ 23.0 cm.

The study employed descriptive statistics, calculating average age and body measurements along with their standard deviations. Additionally, researchers determined the proportion of participants exhibiting each condition. To assess whether these proportions differed significantly between groups, chi-square tests were conducted. Furthermore, the analysis explored the likelihood of developing specific conditions, such as undernutrition, by calculating the odds ratio (OR) and its corresponding 95% confidence interval (CI). SPSS software facilitated the statistical analysis, with a p-value of 0.05 or lower considered indicative of statistical significance [Jaiswal, 2014; Jaiswal, 2023].

Results

<i>Jenu Kurubas Tribes</i>	<i>Mean</i>	<i>±SD</i>	
<i>Age (months)</i>	33.6	12.4	
<i>Anthropometric Characteristics</i>			
Height (cm)	152.4	6.2	
Weight (kg)	41.6	4.2	
M.U.A.C. (cm)	22.4	3.4	
B.M.I (kg/m ²)	18.2	1.4	
<i>Nutritional status</i>		<i>N=125</i>	
<i>Body Mass Index (B.M.I)</i>	<i>Category</i>	<i>Frequency</i>	<i>(%)</i>
< 16.0	CED- Grade-III	18	14.4
16 - 16.99	CED- Grade-II	9	7.2
17 - 18.49	CED- Grade-I	46	36.8
18.5 - 24.99	Normal	56	44.8
≥25.0	Overweight	01	0.8
≥ 30.0	Obese	00	00
<i>MUAC (cm)</i>			
<23.0	Under-nutrition	60	48.0

≥23.0	Normal	65	52.0
Relationship between B.M.I. and MUAC (N (%))			
Nutritional condition by B.M.I. (row) and MUAC (column)	Under-nutrition B.M.I.< 18.5 kg/m ²	Normal B.M.I.≥ 18.5 kg/m ²	Total
Under-nutrition: UN (MUAC <23 cm)	49(81.6)	11(18.4)	60 (48.3)
Normal (MUAC≥23 cm)	18(27.7)	47(72.3)	65 (51.7)
Total	67 (53.6)	58 (46.4)	125 (100)
Chi-square = 54.66, p <0.001. OR=11.62 (95%CI: 5.26 -22.59)			

Table 1: Distribution of adult female JenuKurubas tribes According to Their Age, Anthropometric Characteristics (A.C.) and Nutritional status.

A table presents data on adult female Jenu Kuruba tribes, including their age, body measurements (anthropometric characteristics), and nutritional status. Measurements of mid-upper arm circumference (MUAC) and body mass index (BMI) showed average values with some variation (22.4 ± 3.4 cm and 18.2 ± 1.4 kg/m², respectively). Analysis of MUAC revealed that nearly more than fifty percent of the participants were malnourished, with a more or less similar percentage being undernourished. Additionally, the prevalence of edema (fluid buildup) varied across grades, with the highest being Grade I (36.8%). When looking at MUAC, nearly half of the participants were undernourished, compared to slightly over half having normal nutritional status. The rates of low BMI (53.8%) were similar to those found with MUAC, more or less a similar response was also observed in the case of male (Jaiswal, 2023).

There's a connection between chronic energy deficiency (C.E.D.) and undernutrition, as shown by both Body Mass Index (BMI) and Mid-Upper Arm Circumference (MUAC) measurements. Undernutrition was found in just less than 50% of individuals based on MUAC and just little bit more than 50% based on BMI. Interestingly, BMI revealed a significant difference in undernutrition rates between those with low MUAC (less than 23 cm) and those with normal MUAC (81.6% vs 18.4%). This association between low BMI and low MUAC was statistically significant, with a Chi-square value of 54.66 (p-value < 0.01). This suggests that people with low MUAC were 11.62 times more likely to have chronic energy deficiencies, a more or less a similar response was also observed in the case of male (Jaiswal, 2023).

Discussion

There's a critical public health issue in developing nations like India, where undernutrition disproportionately affects disadvantaged social and economic groups, including tribal communities. Studies by Jaiswal (2013) and others confirm the economic and social marginalization of these populations. Body Mass Index (BMI) has been widely used in Indian research (Jaiswal & Rajan, 2021; Ghosh & Bose, 2015; etc.) to assess undernutrition among tribal groups, supporting the World Health Organization's (WHO) recommendation for its use with established cut-offs for Chronic Energy Deficiency (CED) evaluation. The high prevalence of adult CED documented by Jaiswal & Rajan (2021), Ghosh & Bose (2015), and others signifies a significant financial and health burden. Existing evidence suggests a connection between frequent CED and functional limitations, highlighting the need to understand how BMI-related limitations impact different ethnicities. Additionally, investigating the link between undernutrition and adult mortality/morbidity is crucial.

Our investigation revealed a disturbingly high prevalence of Chronic Energy Deficiency (CED) among female Jenu Kuruba in H D Kote Taluk, Mysuru. Both Body Mass Index (BMI) and Mid-Upper Arm Circumference (MUAC) assessments indicated rates exceeding 40%, surpassing the World Health Organization's (WHO) critical threshold for "very high" prevalence. This concerning finding aligns with documented cases of high CED in other Indian tribal communities (provide citations here). These studies reported concerning rates ranging from 30.6% to 55%, with an average BMI of 18.4-19.5, which falls within the WHO's classification of "critical nutritional stress." Interestingly, our study identified a significant correlation between CED and low MUAC (below 23 cm) (Jaiswal, 2023), suggesting the potential utility of both methods for assessing nutritional status in this population. However, the observed discrepancies

between the prevalence estimates derived from these two measures highlight potential public health implications, particularly when conducting large-scale surveys.

Due to its ease of measurement compared to Body Mass Index (BMI), Mid-Upper Arm Circumference (MUAC) might be a more practical choice for large-scale studies, particularly in resource-limited settings like rural communities of developing countries (WHO, 1995; Ulijaszek et al., 1999; Jaiswal, 2023). This is because MUAC assessment requires less manpower and expertise. While both BMI and MUAC can assess nutritional status, MUAC's simplicity makes it a potentially preferable option.

Conclusion

Malnutrition is a serious concern not only for female Jenu Kuruba tribes but also for men in H.D. Kote Taluk, Mysuru. Adequate nutrition is vital for their health, as deficiencies are linked to illness and even death. While Body Mass Index (BMI) and Mid-Upper Arm Circumference (MUAC) can both assess nutritional status, MUAC's ease of use makes it a potentially better option in this context therefore MUAC and BMI values must be appropriate and as per the standard of WHO.

Acknowledgements

My sincere gratitude extends to all the Jenu Kuruba tribe's family and members in Karnataka who participated in this study. Their cooperation was instrumental in data collection. I am deeply thankful to Sir Professor Anup K. Kapoor for his invaluable support and guidance throughout my research journey.

I would also like to express my appreciation to the Anthropology Departments of both Universities i.e. Pondicherry University and Dr. Hari Singh Gour University, Sagar, MP, India, for providing the necessary infrastructure that facilitated the completion of this research.

The competing interests

The author declares that there are no competing interests.

Conflict of Interest

No conflict of interest.

Funding

Self.

Reference

1. Bose K., et al. "High Prevalence of Undernutrition among Adult Kora Mudi Tribals of Bankura District, West Bengal". India. Anthropol. Sci 114 (2006): 65-68.
2. Bose K and Chakraborty F. "Anthropometric Characteristics and Nutritional Status Based on Body Mass Index of Adult Bathudis: A Tribal Population of Keonjhar District, Orissa, India". Asia. Pac. J. Clin. Nutr 14 (2005): 80-82.
3. Bose K. "Generalized Obesity and Regional Adiposity in Adult White and Migrant Muslim Males from Pakistan in Peterborough". J. Roy. Soc. Prom. Health 116 (1996): 161-167.
4. Briend A., et al. "Nutritional Status, Age and Survival: The Muscle Mass Hypothesis". Eur. J. Clin. Nutr 43 (1989): 715-716.
5. Deurenberg P, Weststrate JA and Seidel JC. "Body Mass Index as a Measure of Body Fatness: Age and Sex-Specific Prediction Formulas". Brit. J. Nutr 65 (1991): 105-114.
6. Durnin JVA. "Low Body Mass Index, Physical Work Capacity and Physical Activity Levels". Eur. J. Clin. Nutr 48.Supp.13 (1994): S39-S44.

7. Ferro-Luzi A., et al. "A Simplified Approach of Assessing Adult Chronic Deficiency". *Eur. J. Clin. Nutr* 46 (1992): 173-186.
8. Ghosh M and Bose K. "Assessment of Undernutrition among Male Bhumijis of West Bengal, India: A Comparison of Body Mass Index and Mid-Upper Arm Circumference". *Hum. Bio. Revi* 4.2 (2015): 140-149.
9. Ghosh R and Bharati P. "Nutritional Status of Adults among Munda and Pod Populations in a Peri-Urban Area of Kolkata City, India". *Asia. Pac. J. Pub. Health* 18.2 (2006): 12-20.
10. Griffiths PL and Bently ME. "The Nutrition Transition is Underway in India". *J. Nutr* 2 (2001): 692-700.
11. Gogoi G., Sengupta S. "Body Mass Index among the Dibongiya Deoris of Assam, India". *J. Hum. Ecol* 13 (2002): 271-273.
12. Goodyear ME, Krleza-Jeric K and Lemens T. "The Declaration of Helsinki". *B.M.J* 335 (2007): 624-625.
13. James WPT, et al. "The Value of Arm Circumference Measurements in Assessing Chronic Energy Deficiency in Third World Adults". *Eur. J. Clin. Nutr* 48 (1994): 883-894.
14. Jaiswal A. "Health and Nutritional-Status of a Primitive Tribe of Madhya Pradesh: Bhumia". *Global J. Hum. Soc. Sci. Hist. Archaeol. Anthropol* 13.1 (2013): 14-19.
15. Jaiswal A. "Nutritional Assessment: Comparison of The Two Useful Anthropometric Measures of Chronic Energy Deficiency in Adult Male Jene Kuruba Tribe, Karnataka". *İMGELEM* 7 (2023): 269-280
16. Jaiswal A. "Naxalism and Tribes in India". *Indialogs* 7 (2020): 81-91.
17. Jaiswal A and Rajan J. "Women and Child Nutritional-Status Among the Irular Tribe in Villupuram District of Tamil Nadu". *Inter. J. of Nur. Care* 1 (2021): 1-7.
18. Jaiswal A and Rajan J. "Nutritional-Status of Children Under Five Years of Age among the Irular Tribe in Villupuram District of Tamil Nadu". *Gradiva Rev. J* 7.3 (2021): P.38-43.
19. Khongsdiar R. "BMI and Morbidity in Relation to Body Composition: A Cross-Sectional Study of a Rural Community in North East India". *Br. J. Nutr* 93 (2005): 101-107.
20. Krishnaswami K. "Country Profile: India. Nutritional Disorders- Old and Changing". *Lancet* 351 (2000): 1268-1269.
21. Lee RD and Nieman DC. "Nutritional Assessment". New York: Mc Graw Hill (2003).
22. Lohman TG, Roche AF and Martorel R. "Anthropometric Standardization Reference Manual". Chicago: Human Kinetics Books (1988).
23. Mittal PC and Srivastava S. "Diet Nutritional Status and Food Related Tradition of Oraon Tribes of New Mal (West Bengal), India". *Rural Remote Health* 6.1 (2006): 385.
24. Mosha TE. "Prevalence of Obesity and Chronic Energy Deficiency (CED) among Females in Morogoro District, Tanzania". *Ecol. Food. Nutr* 42 (2003): 37-67.
25. Naidu AN and Rao N. "Body Mass Index: A Measure of The Nutritional Status in Indian Populations". *Eur. J. Clin. Nutr* 48 (1994): 5131-5140.
26. Nube M, Asenso-Okyere WK and Van Den Bloom GJM. "Body Mass Index as an Indicator of Standard of Living in Developing Countries". *Eur. J. Clin. Nutr* 77 (1998): 1186-1191.
27. Sahani R. "Nutritional and Health Status of the Jarawas: A Preliminary Report". *J. Anthropol. Survey of India* 52 (2003): 47-65.
28. Shetty PS and James WT. "Report of the Food and Agricultural Organization: Body Mass Index: It's Relationship to Basal Metabolic Rates and Energy Requirements". *Eur. J. Clin. Nutr* 48.Suppl 3 (1994): S28-S37.
29. Topal YS and Samal PK. "Causes for Variation in Social and Economic Condition among Tribes of Indian Central Himalaya: A Comparative Study". *Man in India* 81 (2001): 87-88.
30. Ulijaszek SJ and Kerr DA. "Anthropometric Measurement Error and the Assessment of Nutritional Status". *Br. J. Nutr* 82 (1999): 165-177.
31. World Health Organization (WHO). *Physical Status: The Use and Interpretation of Anthropology*. Technical Report Series No. 854. Geneva: World Health Organization (1995).
32. Yadav YS, Singh P and Kumar A. "Nutritional Status of Tribals and Non-Tribals in Bihar". *Ind. J. Prev. Socl. Med* 30 (1999): 101-106.
33. Weiner JS and Lourie JA. *Human Biology: A Guide to Field Methods*. International Biological Programme, IBP No.9. Marylebone London NW (1981): 28-37.