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Nutritional status of Gadaba tribal children in Koraput, Odisha

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Abstract
Nutritional status is a major determinant of the health and well-being amongst children. Developing countries like India accounts for about 40% of the undernourished children in the world and are largely due to the result of dietary inadequacy in relation to their needs. More than half of the children in India are unable to grow to their full physical and mental potential owing to their malnutrition. Under nutrition is characterized by mental and physical starvation, low weight in relation to height or other skeletal indices, diminished skin fold, exaggerated and skeletal prominences and loss of elasticity of skin. The etiology of under nutrition is associated with several related consistent factors termed as poverty syndrome. This research study aims to determine the nutritional status of Gadaba tribal children in the remote district of Koraput, Odisha and make suggestion for their wellbeing.

Keywords: Nutrition, tribal children, deficiency, malnutrition, CED

Introduction
In India malnutrition remains a silent emergency, though the Govt. of India has made significant progress in the past several decades in improving the health and well-being of its people. According to the World Bank report in the last 40 yrs in India the mortality has declined by half and fertility by two fifths, but malnutrition has only come down by about one fifth. While under nutrition remains a major concern area for tribal people however tribal children are the most vulnerable segment for under nutrition and their nutritional status has been considered as an important indicator for progress in efforts to combat under nutrition and associated ill health for tribal (ICMR, 2013).

Nutritional status is a major determinant of the health and well-being amongst children. Developing countries like India accounts for about 40% of the undernourished children in the world and are largely due to the result of dietary inadequacy in relation to their needs. More than half of the children in India are unable to grow to their full physical and mental potential owing to their malnutrition. Under nutrition is characterized by mental and physical starvation, low weight in relation to height or other skeletal indices, diminished skin fold, exaggerated and skeletal prominences and loss of elasticity of skin. The etiology of under nutrition is associated with several related consistent factors termed as poverty syndrome.

Orissa, the most picturesque state in eastern India, occupies a unique place in the tribal map of the country having largest number of tribal communities (62 tribes including 13 primitive tribes) with a population of 8.15 million constituting 22.3% of state's population (Census, 2001). The primitive tribal communities have been identified by the Govt. of India in 15 states/union territories on the basis of (a) pre agricultural level of technology (b) extremely low level of literacy; and (c) small, stagnant or diminishing population (Basu, 1994).

Keeping this fact in view and realizing the importance of nutritional status of the population, more particularly of the children, the researcher has taken an attempt to study the nutritional study of the tribal children. As the state of Orissa has the higher number of tribal populations of eastern India, the study was designed and planned to be within the geographical limits of the state; and the research effort is entitled as: *"Nutritional Status of Tribal Children: A Study in the District of Koraput"*

Objectives of the Study
The objectives framed to undertake the research study is described below:

- To determine the anthropometric characteristics and prevalence of chronic energy deficiency based on body mass index (BMI) of Gadaba tribal children.

The plan and procedure for achieving the objectives of this study are designed in conformity with the methodology/ procedure adopted for a *'Normative Study'*. The details of the methodology are confined to the three basic principle of the normative study, viz.

a. Selection of Tools/Techniques
b. Selection of the Sample, and,
c. Collection and Analysis of Data

The interview schedule was designed in such a way that the hypothesis for the study could be tested and a near accurate result could be obtained. The schedule was also pretested within a small group of identical community in a nearby area and redesigned as per the results obtained thereof. Each aspect of the interview schedule was examined carefully and was finalized and used for the study purpose.
The sample villages of the selected block are divided into two categories, viz., Developed and Underdeveloped. The required secondary information to categorize the villages is collected from the secondary source and the indicators on the basis which the division is made are shown below:

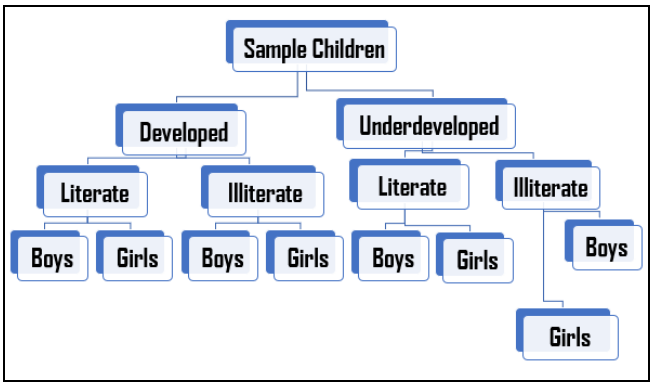

Fig 1: Organizational Chart Showing Different Strata Selected for the Study

A total number of 312 sample children of age 6 – 14 yrs are identified for the study and are regrouped into the following strata.

- **Developed and Underdeveloped:** This has been taken as a synonym for urban and rural. As discussed earlier the villages located within 4-5 kms. of the block headquarters are being identified as 'developed' and the villages beyond this limit are being considered as 'underdeveloped'.
- **Literate and Illiterate:** The standard norm for literate and illiterate (defined by the Government) is used to regroup the children who live in the developed and underdeveloped villages.
- **Boys and Girls:** As usual to estimate and examine the difference in the nutritional status of the boys and girls both the categories are added into the strata.

The Pottangi Block of the Koraput district of Orissa has been selected as the sample block and as per our purpose some villages of the block are being identified. The villages of the block were divided into two categories, viz., Developed and Underdeveloped. Out of these strata some villages were selected from these two categories with the help of stratified sampling method. Thus the villages selected are; *Badliguda, Nilampadu and Chintaguda***,** which are considered as the developed villages and those villages are located within 4-5 kms of the Pottangi block. On the other hand, the villages, viz., *Podapadar, Mulaguda*, *Sisaguda* and *Ghodaghati*, which are located beyond the above limit and located within a distance of 15-17 kms from the block head quarter are taken up for our research purpose as the underdeveloped villages.

Nutritional Status of the Sample Children
Furthermore, as per the methodology described earlier in this chapter –among various available methods the following two methods were preferred to be used;

a) Anthropometric Measurements and b) Dietary Assessment for the purpose of estimation of the related data collected through the questionnaire. It is also mentioned above –in detail- that the 'Anthropometric Measurement is based on the height-for age and the weight-for age, and the Dietary Assessment is based on the comparison of the Recommended Dietary Allowance (RDA) and the observed food intake of the Gadaba children. All those data, estimation and corresponding analysis are being presented in the sections below.

a. Anthropometric Measurement.
In developing countries like India anthropometry measurement is used for assessing nutritional status in the community (Ghosh *et al*, 2001 and Khongsdier *et al*, 2005). The Body Mass Index (BMI) is widely accepted as one of the best indicators of nutritional status (James, 1988; Ferro-Luzzi, 1992 and Shetty, 1994). Thus, the use of BMI as an anthropometric indicator of nutritional status may be more appropriate in a country with diverse ethnic groups like India (Naidu and Rao, 1994; Bailey and Ferro-Luzzi, 2005).
Under this type of method, it was attempted to measure the nutritional status, mainly using the Body Mass Index (BMI). The Ratio of weight (in kg)/Height (m)2 is referred as Body Mass Index (BMI). Nutritional status was evaluated according to internationally accepted BMI guidelines (Khonsgdier, 2001). Chronic energy deficiency Grades III, II and I were defined as per BMI values as per the following: a) Normal (18.5-24.9), b) Chronic Energy Deficiency (CED-I) (BMI 17.0-18.4), c) CED-II (BMI 16.0-16.9) and d) CED-III (BMI less than 16.0). The figures in parenthesis indicate BMI scores estimated on various nutritional parameters.

Table 1: Nutritional Status of 6 Year Children using BMI Classification

Sl. No.	Indicator	Literacy Level	Sex	Observed BMI	Standard BMI	BMI Classification According to WHO							
						Normal		CED-I		CED-II		CED-III	
						Boys (15.36)	Girls (14.74)	Boys (14.17)	Girls (13.56)	Boys (13.19)	Girls (12.60)	Boys (<13.19)	Girls (< 12.60)
1	Developed	Literate	Boys	14.30	15.36			14..30					
			Girls	14.12	14.74				14.12			12.60	
		Illiterate	Boys	13.72	15.36			13.72					

			Girls	13.29	14.74				13.29				
2	Under Developed	Literate	Boys	12.67	15.36							12.67	
			Girls	12.22	14.74								12.22
		Illiterate	Boys	12.40	15.36							12.4	
			Girls	11.99	14.74								11.99

Note: CED indicates Chronic Energy Deficiency

Here the BMI for the children of 6 years of age was estimated and the average BMI of all those children were calculated which is termed observed BMI. This BMI for were compared with the standard BMI to find out any deviations if exists. Also, the Table reflects the BMI classification for this age group of Gadaba children and the category of children is determined as per their BMI scores.

An examination of the figures provided in Chart indicates BMI of all the eight categories of Gadaba children (studied by us) are below their standard BMI. But a very close scrutiny of the data reveals the fact that the BMI of the developed category of children are slightly higher than the children of the underdeveloped category, which proves the fact that 'development plays a positive role in determining the nutritional status of the Gadaba children in this age group.

Further, the fact that-among this age group of six years of children- the literate boys and girls as well as those illiterate ones who reside in the developed area are coming under the CED-I group. On the other hand, all the other categories of the sample children are within the CED-III category. This fact reflects the existence of a very poor nutritional status among the 6year old Gadaba children, which is only be due to the availability of poor dietary intakes but also may be a direct outcome of not-so-good rearing practices adopted by those Gadaba mother during the childhood period of the sample children.

Table 2: Nutritional Status of 7 Year Children using BMI Classification

Sl. No.	Indicator	Literacy Level	Sex	Observed BMI	Standard BMI	BMI Classification According to WHO							
						Normal		CED-I		CED-II		CED-III	
						Boys (15.46)	Girls (15.14)	Boys (14.21)	Girls (13.91)	Boys (13.57)	Girls (13.09)	Boys (<13.57)	Girls (< 13.09)
1	Developed	Literate	Boys	14.44	15.46			14.44					
			Girls	14.29	15.14				14.29				
		Illiterate	Boys	14.11	15.46					14.11			
			Girls	13.84	15.14						13.84		
2	Under Developed	Literate	Boys	13.60	15.46					13.6			
			Girls	12.30	15.14							12.3	
		Illiterate	Boys	13.32	15.46							13.32	
			Girls	12.21	15.14								12.21

Note: 1-CED-Chronic Energy Deficiency

The above Table reflects the BMI classification for the children of 7year age group who belongs to the various categories selected by us for the study.

An examination of the figures provided in the table and the corresponding Chart-reflects that the observed BMI of all the eight categories of the sample Gadaba children (of 7year age group) are below their standard BMI estimated as per the ICMR norms. But a very close scrutiny of the data indicates the same trend (as of the children of 6-year age group) that the observed or actual BMI of the developed category of children are slightly higher than the children of the underdeveloped category.

An analysis of the above Table indicate the fact that-among this age group of Seven years of children, no category of Gadaba children comes in the normal health or energy standard. Moreover, the literate boys and girls of the developed area are within the CED-I category, illiterate boys and girls of the developed area and the literate boys of the underdeveloped area comes within the CED-II category and the rest three categories of sample Gadaba children of 7 years comes within the CED-III category.

Table 3: Nutritional Status of 8 Year Children using BMI Classification

Sl.No.	Indicator	Literacy Level	Sex	Observed BMI	Standard BMI	BMI Classification According to WHO							
						Normal		CED-I		CED-II		CED-III	
						Boys (15.69)	Girls (15.62)	Boys (14.42)	Girls (14.35)	Boys (13.57)	Girls (13.51)	Boys (<13.57)	Girls (<13.51)
1	Developed	Literate	Boys	15.45	15.69			15.45					
			Girls	14.79	15.62				14.79				
		Illiterate	Boys	15.40	15.69			15.4					
			Girls	14.78	15.62				14.78				
2	Under Developed	Literate	Boys	14.41	15.69					14.41			
			Girls	14.24	15.62						14.24		
		Illiterate	Boys	14.25	15.69							13.56	
			Girls	14.18	15.62								13.49

Note: 1-CED-Chronic Energy Deficiency

A critical analysis of the figures provided in the table for the eight years age group of the Gadaba children and the corresponding reflects that the observed BMI of all the eight categories of the sample are below their standard BMI estimated as per the ICMR norms. Even if not a single group of the children comes within the normal category. Moreover, the trend graph, which reflects the calculated BMI, as per the actual data and the standard BMI (ICMR) indicates a huge difference between the two. Further, it can be observed that except for the sample literate and the illiterate boys of both the developed as well as the underdeveloped area no other group of children comes closer to the ICMR standard of nutrition. This factor needs a close attention of everybody who is associated with the child and children's nutrition and health aspects.

A close and critical analysis of the above chart and the corresponding figures in the Table of the corresponding figures of the BMI classification for the Eighth year Gadaba children indicates that no category among them have a normal BMI as per the ICMR classification. On the other hand, all the sample children who belongs to the developed area comes within the CED-I category and all the children who resides in the underdeveloped area, irrespective of their literacy level, comes within the CED-II and CED III category. This fact also signifies the importance of socio-economic development on the health and nutritional status of the Gadaba children of Pottangi block in Koraput district.

In tune with our norms and principles, the BMI of the Gadaba children of 9-year-old was also estimated for each sample group and compared with the standard BMI. All those data are presented in form of tables for further analysis.

Table 4: Nutritional Status of 9 Year Children using BMI Classification

Sl. No.	Indicator	Literacy Level	Sex	Observed BMI	Standard BMI	BMI Classification According to WHO							
						Normal		CED-I		CED-II		CED-III	
						Boys (14.87)	Girls (16.36)	Boys (13.66)	Girls (15.03)	Boys (12.86)	Girls (14.15)	Boys (<12.86)	Girls (< 14.15)
1	Developed	Literate	Boys	14.85	14.87			14.85					
			Girls	16.35	16.36				16.35				
		Illiterate	Boys	14.81.	14.87			14.81					
			Girls	14.99	16.36						14.99		
2	Under Developed	Literate	Boys	14.82	14.87			14.28					
			Girls	14.78	16.36				14.78				
		Illiterate	Boys	14.74	14.87			14.74					
			Girls	14.75	16.36						14.75		

Note: 1-CED-Chronic Energy Deficiency

A critical analysis of the figures provided in the table for the nine years age group of the Gadaba children and the corresponding Chart reflects that the observed BMI of boys of all categories are very near to standard BMI though they are categorized under CED I. The observed BMI of the literate as well as the illiterate girl child (within this age group) of the developed and underdeveloped area are found to be under CED II.

The other two sample girl child are within the CED-I category of BMI classification. Taking a closer look at the table it can be inferred that the illiterate girls irrespective of the nature of their locality haven't had sufficient growth which clearly reflects in their BMI. Further this can be attributed to lack of attention towards girl child. This fact is represented in a pictorial form for a very clear understanding in Chart below.

In addition to the above analysis, the BMI of the 10-year sample Gadaba children were also estimated and as per the designed methodology compared with the standard BMI and also categories under various CED groups. All those data/information are being presented below for further examination and analysis.

Table 5: Nutritional Status of 10 Year Children using BMI Classification

Sl. No.	Indicator	Literacy Level	Sex	Observed BMI	Standard BMI	BMI Classification According to WHO							
						Normal		CED-I		CED-II		CED-III	
						Boys (16.61)	Girls (17.07)	Boys (15.26)	Girls (15.69)	Boys (14.37)	Girls (14.76)	Boys (<14.37)	Girls (<14.76)
1	Developed	Literate	Boys	16.57	16.61			16.57					
			Girls	17.04	17.07				17.04				
		Illiterate	Boys	16.54	16.61			16.54					
			Girls	15.61	17.07						15.61		
2	Under Developed	Literate	Boys	16.55	16.61			16.55					
			Girls	15.52	17.07						15.52		
		Illiterate	Boys	15.22	16.61					15.22			
			Girls	15.48	17.07						15.48		

Note: 1-CED-Chronic Energy Deficiency

A critical analysis of the figures provided in the table for the Ten years age group of the Gadaba children and the corresponding Chart reflects that the observed BMI of the sample differs from the standard according to the locality they belong i.e. developed and underdeveloped. Further it can be deduced that developmental factors play a vital role in determining the nutritional status of children.

Moreover, by using the same techniques the BMI of the 11-year-old children is also estimated and compared with the ICMR standard.

Table 6: Nutritional Status of 11 Year Children using BMI Classification

Sl. No.	Indicator	Literacy Level	Sex	Observed BMI	Standard BMI	BMI Classification According to WHO							
						Normal		CED-I		CED-II		CED-II	
						Boys (16.43)	Girls (16.71)	Boys (15.10)	Girls (15.36)	Boys (14.21)	Girls (14.45)	Boys (<14.21)	Girls (< 14.45)
1	Developed	Literate	Boys	16.41	16.43			16.41					
			Girls	16.67	16.71				16.67				
		Illiterate	Boys	16.38	16.43			16.38					
			Girls	16.64	16.71				16.64				
2	Under Developed	Literate	Boys	15.08	16.43					15.08			
			Girls	15.31	16.71						15.31		
		Illiterate	Boys	15.06	16.43					15.06			
			Girls	14.42	16.71								14.42

Note: 1-CED-Chronic Energy Deficiency

The evaluated BMI of the sample children when observed thoroughly with reference to the nature of locality shows an interesting trend. From this we can infer that the children who belong to the developed areas come under CED I and the rest sample of the underdeveloped category comes under CED II and CED III as shown in Chart below. This clearly shows that socio economic developmental factors play an important role in the growth pattern.

Again, analyzing the underdeveloped category, it has been found that illiterate girls of this locality are the most vulnerable group who comes under CED III and needs serious attention.

Furthermore, by using the same techniques the BMI of the 12-year-old children are also estimated and compared with the ICMR standard. All those data, graphs and analyses are provided below for further references and analysis.

Table 7: Nutritional Status of 12 Year Children using BMI Classification

Sl. No.	Indicator	Literacy Level	Sex	Observed BMI	Standard BMI	BMI Classification According to WHO							
						Normal		CED-I		CED-II		CED-III	
						Boys (17.13)	Girls (17.67)	Boys (15.74)	Girls (16.24)	Boys (14.82)	Girls (15.28)	Boys (<14.82)	Girls (<15.28)
1	Developed	Literate	Boys	17.11	17.13			17.11					
			Girls	17.65	17.67				17.65				
		Illiterate	Boys	17.08	17.13			17.08					
			Girls	16.21	17.67						16.21		
2	Under Developed	Literate	Boys	15.72	17.13					15.72			
			Girls	16.18	17.67						16.18		
		Illiterate	Boys	14.81	17.13							14.81	
			Girls	14.78	17.67								14.78

Note: 1-CED-Chronic Energy Deficiency

The observed BMI status provided in the table indicates that all sample from developed area comes under CED I category except illiterate girl children who comes under CED II as per Table below.

It can be inferred that impact of education has played an important role in the improved BMI samples of the literate. Literate children of underdeveloped area come under CED II and children who are educationally backward falls under CED II category

The facts and figures of the 13 Yrs age group are presented below in tabular format.

Table 8: Nutritional Status of 13 Year Children using BMI Classification

Sl. No.	Indicator	Literacy Level	Sex	Observed BMI	Standard BMI	BMI Classification According to WHO							
						Normal		CED-I		CED-II		CED-III	
						Boys (17.48)	Girls (19.56)	Boys (16.06)	Girls (17.97)	Boys (15.12)	Girls (16.92)	Boys (<15.12)	Girls (< 16.92)
1	Developed	Literate	Boys	17.41	17.48			17.41					
			Girls	18.41	19.56				18.41				
		Illiterate	Boys	17.38	17.48			17.38					
			Girls	17.96	19.56						17.96		
2	Under Developed	Literate	Boys	17.34	17.48					17.34			
			Girls	17.89	19.56						17.89		
		Illiterate	Boys	15.11	17.48							15.11	
			Girls	16.9	19.56								16.9

Note: 1-CED-Chronic Energy Deficiency

An examination of the figures provided in, and their corresponding graphs reveals that BMI of the underdeveloped illiterate boys and girls are very low and fall under CED III classification as compared to the other categories.

Furthermore, CED II and CED III are the two classified zones where majority of the sample children falls. From this it can be inferred that the sample children are suffering from severe under nutrition and need regular attention and monitoring.

In addition to all these analyses, BMI for the fourteen-year sample children were also estimated and presented below.

Table 9: Nutritional Status of 14 Year Children using BMI Classification

Sl. No.	Indicator	Literacy Level	Sex	Observed BMI	Standard BMI	BMI Classification According to WHO							
						Normal		CED-I		CED-II		CED-III	
						Boys (18.36)	Girls (19.98)	Boys (16.87)	Girls (18.36)	Boys (15.88)	Girls (17.28)	Boys (<15.88)	Girls (<17.28)
1	Developed	Literate	Boys	18.33	18.36			18.33					
			Girls	19.68	19.98				19.68				
		Illiterate	Boys	16.85	18.36					16.85			
			Girls	18.36	19.98						18.36		
2	Under Developed	Literate	Boys	16.72	18.36					16.72			
			Girls	18.31	19.98						18.31		
		Illiterate	Boys	15.83	18.36							15.83	
			Girls	17.26	19.98								17.26

Note: 1-CED-Chronic Energy Deficiency

This age group is very crucial from the point of view that the children normally attain the adolescence and moves ahead towards the adulthood from this age onwards. More particularly, in the tribal communities this age is virtually taken up as the last stage of childhood and the girls are quite vulnerable to it. Hence, the estimation of BMI of the sample children of this age group and the comparison with the standard BMI assumes utmost importance.

An examination of the figures provided in Table and charts reveals that majority of the sample children fall under CED II and CED III irrespective to the locality they belong except literate boys and girls who are under CED I. As this is the adolescent period it can be inferred that their growth pattern is very low, and alarming be due to the inadequate diet intake and less absorption of micronutrients in their body. Various reasons can be attributed to this cause viz. income, socio economic factors, food habits etc.

The overall CED classification for sample children from 6-14 yrs is shown below in the chart.

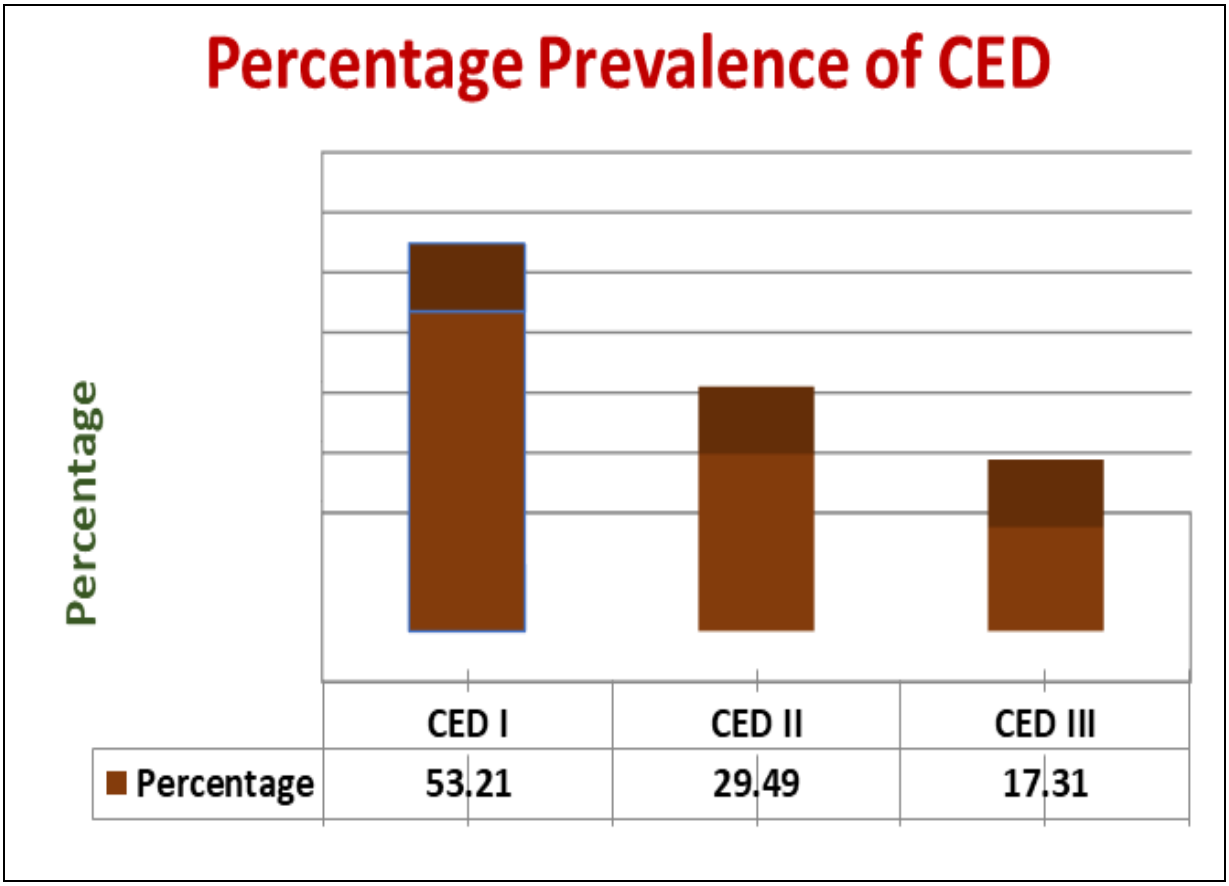

Fig 2: Classification of BMI (CED) for children of 6-14 Yrs age

An examination of the Chart reveals that not a single Gadaba child was under normal category. The entire sample Gadaba children from 6-14 Yrs age irrespective of their sex, locality and literacy fall under some form of chronic energy deficiency syndrome. The percentage prevalence of CED was calculated as: CED I (53.21%), CED II (29.49%) and CED III (17.31%).

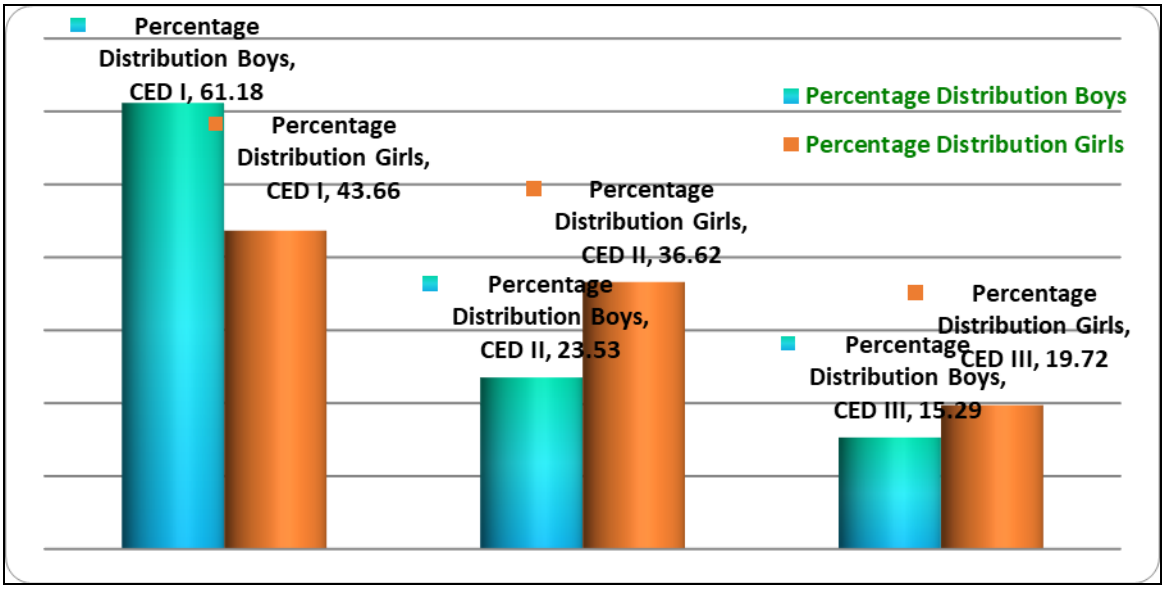

Fig 3: Percentage Distributions of Boys and Girls as per CED

Further segregation of the data for boys and girls reveals that the prevalence of CED I is more among boys (61.18%) and in girls (43.66%). Majority girls (36.62%) come under CED II as compared to boys (25.53%). CED II is more prominent among the girls (19.72%) as compared to boys (15.29%). The girl children need severe nutritional attention as evident from the above chart. The prevalence of CED presents the fact that the Gadaba tribal children are facing severe nutritional stress. Their situation is critical, demanding implementation of immediate nutritional intervention programs.

Besides these age-wise analyses of Chronic Energy Deficiency (CED) –as per the WHO standard the health and nutritional status of the sample children was calculated based on the formula devised by the Indian Academy of Pediatrician (IAP). The IAP classification is based on weight only and currently used by the Integrated Child Development Scheme (ICDS) sponsored by the Govt. of India for selecting beneficiaries and growth monitoring. According to this classification if a child's weight is greater than equal to 80% or more of NCHS standard weight then he/she as classified as normal weight. If it is between 70% - 79.9% then it's classified as Grade I under nutrition, similarly 60% - 69.9% as Grade II under nutrition, 50% - 59.9% Grade III under nutrition, and < 50% as Grade IV under nutrition. (IGNOU, 2004)

Conclusion

Efforts to reduce under nutrition depend on reducing poverty, eradication of illiteracy, providing better sanitation, increasing access to clean drinking water, maternal and child health services. Such programs would be beneficial in not only reducing the rates of CED, but also it helps reducing morbidity and mortality.

This study demonstrated that the nutritional status of the Gadaba children, especially during the 6 – 14 yrs age is very critical. There is an immediate requirement for appropriate steps to be taken to improve nutritional status of this ethnic group. Moreover, it must be mentioned here that similar studies should be undertaken among children of other tribal populations of not only Orissa but also in other parts of India. Since various tribal groups constitute a sizeable portion of India's population, improvement of their nutritional status is of paramount importance from the national public health perspective.

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