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ASSESSMENT OF NUTRITIONAL STATUS OF SCHOOL CHILDREN IN RURAL AND URBAN AREAS OF BANKURA, WEST BENGAL

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ABSTRACT: The health and nutritional status of school children is an index of national investment in the development of its future manpower. Malnutrition affects the child's physical and cognitive growth and increases the susceptibility to infections while having an adverse impact on economic growth of the country indirectly. The objective of this study is to assess the nutritional status of rural and urban school going children (16 - 18 years) of Bankura district, West Bengal. A total of 80 school children [rural school children (Group 1; n = 40) and urban school children (Group 2; n = 40)] belonging to the age group of 16 to 18 years and the study were conducted from the month of September 2015 to February 2016. The important clinical signs like pallor, hair changes, eye changes, teeth changes, skeletal changes, goitre, skin changes and bones *etc.*, were found significantly higher for Group 1. Mean height, weight and body mass index were significantly higher in the Group 2 school children compared to Group 1. The prevalence of underweight was significantly higher in Group 1 School children compared to Group 2 according to their BMI, WC and WHR. The overall prevalence of underweight was 65%. The present study highlights that the rural school going children of Bankura district belonging to the lower socioeconomic classes and are suffering from different grades of malnutrition than their counterparts. These high levels of malnutrition in the present study underline the great need for nutritional intervention.

INTRODUCTION: Children and adolescent are considered to be the most important natural resources and biggest human investment for development in every community. The health and nutritional status of children is an index of national investment in the development of its future manpower. Nutritional status is an important index for measuring quality of life especially in children.

In this respect, understanding the nutritional status of children has far reaching implications on better development of future generations¹ as well as future development of humanity². Health problems due to poor nutritional status in primary school - age children are among the most common causes of low school enrolment, high absenteeism, early dropout and unsatisfactory classroom performance. Schools are considered as perfect settings for health promotion among children and school staffs³⁻⁴. School age is a dynamic period of physical growth as well as of mental development of the child. The nutritional status of school - aged children impacts their health, cognition and subsequently their educational achievement.

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Although the World Bank has included school health as one component of its essential public health package for cost effective health program. The nutritional and health status of school aged children in the developing world has received a little attention⁵. WHO in 1997, developed 10 recommendations for school health, and initiated a global school health initiative in ten countries, of which 8 were developing countries⁶. Despite such initiatives, school health has not been focused in India for many years and donor initiated school health projects have come and gone sporadically over the decades.

According to UNICEF data, 90% of developing world's undernourished children lives in Asia and Africa while 40% of the world's malnourished lives in India⁷. The 2013 Global Hunger Index Report ranked India 16th, which represents the serious hunger situation. The National Family Health Survey (NFHS) data indicates that 43% of children fewer than 5 - years of age are underweight and 2% of them are overweight. Approximately 20% of the population in every country constitute school age children 5 - 15 years. About 200 million children belong to this group and majority of them reside in underprivileged areas in the rural India⁸.

In India, we face a double jeopardy of malnutrition *i.e.*, children from urban areas are affected with problems of over - nutrition while those from rural area suffer from effects of under - nutrition. The long term consequences of malnutrition none a child - turned - adult are issues of deep concern. Under-nutrition impairs the child's immune system and weakens the defences against other diseases. Whereas over - nutrition contributes to childhood obesity and leads to the early onset of hypertension, Diabetes mellitus, coronary heart diseases, orthopaedic disorder and other respiratory diseases.

According to modern concepts, school health service is an economical and powerful means of raising community health and more important in future generations. By simply doing periodic medical examination and daily morning inspection of students, we can detect many more problems and treat accordingly. The health problems of student's vary country to country. The most prevalent health problems are malnutrition, infectious disease,

intestinal parasites, and diseases of skin, eye, ear and dental caries. The foundations of good health and sound mind are laid during the school age period⁹.

MATERIALS AND METHODS: A school based observational cross sectional study was carried out in the Department of Physiology, Bankura Christian College, Bankura¹⁰⁻¹¹.

Sample Size: A total of 80 - children [rural school children (Group 1; n = 40) and urban school children (Group 2; n = 40)] were included and belonging to the age group 16 to 18 years were selected for this study. The study was conducted from month of September 2015 to February 2016.

Inclusion Criteria: Children of 16 - 18 year were included in this study.

Exclusion Criteria: Children who were seriously ill, too agitated and unwilling for anthropometric measurements were excluded from the study.

The methodology comprised of interview and physical examination. Socio-economic status (SES) was determined by using Modified Prasad's scale¹². The information was collected on pre - designed and pretested proforma.

Assessment of Important Sign: The important signs looked for during clinical examination are general appearance, hair changes (loss of lustre, discoloured and dry and sparse and brittle), eye discharge (absent, watery and mucopurulent), lips (normal, angular stomatitis mild and angular stomatitis marked), gums (normal, bleeding, pyorrhoea and retracted), teeth changes (absent, chalky teeth, pitting of teeth and discoloured), skin changes (normal, loss of lustre, dry and rough and hyperkeratosis) and bone (normal and rickets).

Assessment of Malnutrition: Nutritional status of the children was assessed by anthropometric measurements. Anthropometric classification was used for the assessment of malnutrition (**Table 1**). Based on the age, body weight and height, a number of indices such as weight - for - age, height - for - age and BMI - for - age have been suggested¹³. Under nutrition that is Wasting and stunting were defined according to Water low's classification¹².

Data on children's growth status was obtained by measuring weight and height. Information on age of the child, socio - demographic characteristics, birth interval, history of infectious diseases and diet history was collected from the mother of the selected students using a structured questionnaire. The children are classified using three categories: 'underweight' (low weight - for - age), 'stunting' (low height - for - age) or 'thinning' (low BMI - for - age). Low anthropometric values are those more than 2 - SD away from the CDC 2000 (Centres for Disease Control and Prevention) standards¹²⁻¹⁵.

Questionnaire Includes Demographic Information (gender and age), food habits, medical history (hypertension, diabetes, coronary heart disease, chronic renal disease, chronic respiratory diseases, etc.) behaviour and personal habits (e.g., smoking) and family history.

Anthropological Parameters: Each subject following parameters were measured like height, weight, circumferences at waist and hip, and skin fold thickness at biceps, triceps, suprailiac and subscapular. Anthropometric measurements were taken by using standard protocols given by Weiner and Lourie. Stature was taken with the help of anthropometry in the standard arm hanging position

TABLE 2: MUAC CUT - OFFS TO CLASSIFY NUTRITIONAL STATUS IN CHILDREN 14 YEARS TO 18 YEARS OF AGE

	Severe acute malnutrition (SAM)	Moderate malnutrition	Normal
10 - 14 years	< 160 mm	≥ 160 to < 185 mm	≥ 185 mm
14 years-adults	< 190 mm	≥ 190 to < 220 mm	≥ 220 mm

Waist circumference (WC) was measured with a non-stretchable anthropometric tape (Mabis) at the mid-point between the last rib and the iliac crest, and we consider the average of both measures. The waist - to - height ratio (WHtR) was determined by dividing waist circumference (cm) by height (cm).

Measurement of Blood Pressure: Blood pressure was checked by auscultation, using a mercury sphygmomanometer (Mukherjee) with appropriate cuff or the arm circumference, after the student remained five minutes at rest and sitting. Reading was taken in sitting posture and on the right hand of the participants. Three readings of the BP of each subject were taken, maintaining an interval of 2 min between each reading. The mean of three

body weight was measured by using spring balance with minimum clothing.

TABLE 1: CATEGORY OF MALNUTRITION ACCORDING TO BMI VALUE AS PER WHO CUT-OFFS

BMI (kg/m ²)	Nutritional status
< 16.0	Severe malnutrition
≥ 16.0 to < 17.0	Moderate malnutrition
≥ 17.0 to < 18.5	Mild malnutrition
≥ 18.5 to < 25.0	Normal nutritional status

(Source: WHO 1999. Management of Severe Malnutrition: A Manual for Physicians and Other Senior Health Workers. Geneva: WHO).

Middle Upper Arm Circumference (MUAC): (MUAC) was measured in centimetre with a non-stretched measuring tape with the right arm hanging relaxed. MUAC is the circumference of the left upper arm, measured at the mid-point between the tip of the shoulder and the tip of the elbow (olecranon process and the acromium).

In children, MUAC is useful for the assessment of nutritional status¹⁸⁻²³. It is good at predicting mortality and in some studies, MUAC alone²⁴⁻²⁶ or MUAC for age 10, predicted death in children better than any other anthropometric indicator. This advantage of MUAC was greatest when the period of follow-up was short²⁷ (**Table 2**).

readings will be reported, in accordance with the JNC 7 recommended standard.

Statistical Analysis: The data was analysed statistically by using appropriate statistical tools such as mean, standard deviation and percentage. Coefficient of correlation and was also performed and the level of significance was also tested.

RESULTS: **Table 3**, shows the percentage distribution of the nutritional deficiency signs amongst rural and urban students. The description of the rural children is as follows - General Appearance: A majority of the rural respondents (74%) were classified as good and fair, (26%) were poor level whereas the urban students (96%) were classified as fair, (4%) poor.

Hair: 55% of rural children had normal hair. However, 45% had dull hair or hair without lustre. Whereas 96% students in urban has normal hair and remaining 4% were without lustre. So, there is a significant difference in hair condition, it may assume that it is due to the deficiency of nutritional.

Eyes: There is no significant differences are observed.

Lips: In rural students only 6% of the students were observed to suffer mild to marked angular stomatitis, whereas in urban 3% students only suffered from mild angular stomatitis.

Gums: Gums were observed normal in 98% of the rural respondents and 100% among the urban

respondents, while 2% of rural children had bleeding gums.

Teeth: 21% of the rural children had chalky teeth confirming the deficiency of Calcium, 11% had discoloured teeth which could be a result of poor dental care.

Skin Appearance: Skin Appearance was normal in 58% per cent, dull in lustre in 25% and dry and rough was 17% in rural children whereas 97% were normal and only 3% were dry and rough in urban children.

Bones: Bones were found normal in both rural and urban children. None of the children had Rickets or any other visible orthopedic problem.

TABLE 3: COMPARATIVE STUDY OF ASSESSMENT OF IMPORTANT PHYSICAL SIGN AT DIFFERENT PORTION OF THE BODY RURAL SCHOOL CHILDREN (GROUP 1; n = 40) AND URBAN SCHOOL CHILDREN (GROUP 2; n = 40)

Sl. No.	Clinical Sign (General appearance)	Category	Group 1	Group 2
1	General appearance	Good	26%	79%
		Fair	48%	17%
		Poor	22%	4%
		Very poor	4%	-
2	Hair	Normal	55%	96%
		Loss of Lustre	34%	4%
		Discoloured and Dry	11%	-
		Sparse and Brittle	-	-
3	Eye discharge	Absent	99%	100%
		Watery	1%	-
		Mucopurulent	-	-
4	Lips	Normal	94%	97%
		Angular Stomatitis Mild	4%	3%
		Angular Stomatitis Marked	2%	-
5	Gums	Normal	98%	100%
		Bleeding	2%	-
		Pyorrhoea	-	-
		Retracted	-	-
6	Teeth	Absent	68%	91%
		Chalky Teeth	21%	-
		Pitting of Teeth	4%	-
		Discoloured	7%	9%
		Normal	58%	97%
7	Skin	Loss of Luster	25%	-
		Dry and Rough	17%	3%
		Hyperkeratosis	-	-
		Normal	100%	100%
8	Bones	Rickets	-	-

The study group consisted of 80 children, out of which equal number of male and female students from both rural and urban area with a mean age of 14.4 ± 0.91 years for urban school children and for rural school was 14.87 ± 1.11 years were included in this study. **Table 4** and **Fig. 1** summarises the

comparison of participants' general anthropometric information in terms of age, height and weight, body mass index and body surface area and also determine the number of obese subject according to the WHO guideline. The mean BMI was significantly lower ($p < 0.001$).

TABLE 4: COMPARATIVE STUDIES OF HEIGHT, WEIGHT AND BMI

Subject	Age ± S.D.	Height ± S.D.	Weight ± S.D.	BMI ± S.D.	BSA ± S.D.
Group 1	14.87 ± 1.11	152.57 ± 5.34	48.02 ± 10.79	18.20 ± 2.87	1.47 ± 0.21
Group 2	14.4 ± 0.91	160.31 ± 5.86	52.92 ± 8.04	20.88 ± 3.47	1.52 ± 0.14

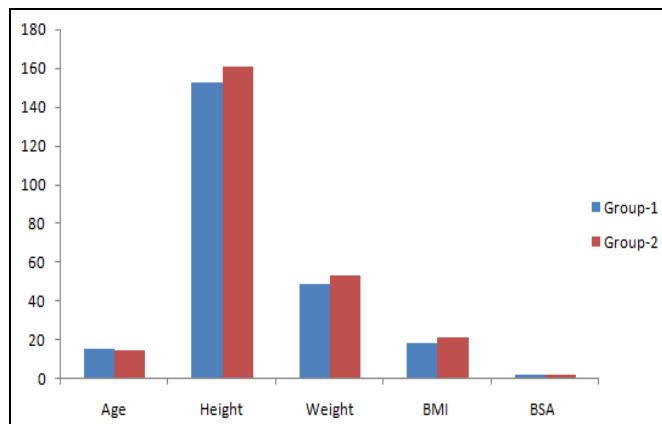


FIG. 1: GRAPHICAL REPRESENTATION OF BODY HEIGHT, WEIGHT, BMI AMONG RURAL AND URBAN SCHOOL CHILDREN

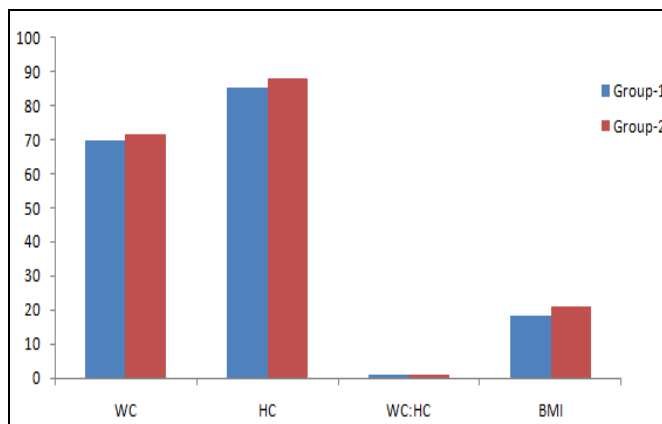


FIG. 2: GRAPHICAL REPRESENTATION OF COMPARATIVE STUDIES OF WAIST HIP RATIO AND BMI AMONG RURAL AND URBAN SCHOOL CHILDREN

Table 5 shows comparison between WHR and BMI among both rural and urban school children. In Group 1, WHR was 0.78 ± 0.07 with BMI 18.2 ± 2.87 . Group 2 had WHR 0.80 ± 0.04 and BMI 20.88 ± 3.04 . Statistically significant relation at ($r =$

0.83), ($r = 0.81$) was found between WHR and BMI in both the groups. Comparison also revealed a linear positive correlation graphically in all groups between WHR and BMI (**Fig. 2**).

TABLE 5: COMPARATIVE STUDIES OF WAIST HIP RATIO AND BMI AMONG RURAL AND URBAN SCHOOL CHILDREN

Sl. No.	Parameter	Group 1	Group 2
1	Waist circumference (cm)	69.93 ± 8.78	71.56 ± 7.97
2	Hip circumference (cm)	85.49 ± 8.83	87.95 ± 8.02
3	Waist Hip ratio (WHR)	0.78 ± 0.07	0.80 ± 0.04
4	BMI	18.2 ± 2.87	20.88 ± 3.04

MUAC is an appropriate indicator for the assessment of acute adult under - nutrition. The indicator is useful for both screening acute adult under - nutrition and for estimating prevalence of under - nutrition at a population level. **Table 6** shows the result of mid- upper circumference (MUAC). For the rural school children (Group 1) those MUAC values were above 13.5 to 16, their percentage was 5% and they were severe acute malnutrition.

Those rural children MUAC values ranges between 16 - 18.5cm and their percentage was 22.5%, they were moderate malnutrition and MUAC values above 18.5cm were 72.5% they were normal. On the other hand the urban school children (Group 2) those MUAC values ranges between 16 - 18.5cm and their percentage was 2.5%, they were moderate malnutrition and MUAC values above 18.5cm were 97.5% they were normal.

TABLE 6: MIDDLE UPPER ARM CIRCUMFERENCES (MUAC) FOR BOTH RURAL AND URBAN SCHOOL CHILDREN

Sl. No.	Variable	Group 1		Group 2	
		Frequency	Percentage (%)	Frequency	Percentage (%)
1.	11.5 - 13.5	0	0	0	0
2.	13.5 - 16	2	5%	0	0
3.	16 - 18.5	9	22.5%	1	2.5%
4.	18.5>	29	72.5%	39	97.5%

Table 7 shows the percentage of different grades of nutritional status according to their BMI, WC and WHR. According to this three anthropometric

variables majority of rural school children suffer from under - weigh whereas less urban children suffers from under-weight (**Fig. 3**).

TABLE 7: COMPARISON OF PERCENTAGE OF NUTRITIONAL STATUS ACCORDING TO THEIR BMI, WC AND WHR

Nutritional category	Group 1			Group 2		
	BMI n (%)	WC n (%)	WHR n (%)	BMI n (%)	WC n (%)	WHR n (%)
Under Weight	26 (65%)	30 (75%)	28 (70%)	18 (45%)	22 (55%)	21 (52.5%)
Normal	12 (30%)	8 (20%)	7 (10%)	17 (42.5%)	16 (40%)	16 (40%)
Over weight	2 (5%)	2 (5%)	5 (17.5%)	5 (12.5%)	2 (5%)	2 (5%)
Obese	0	0	0	0	0	1 (2.5%)

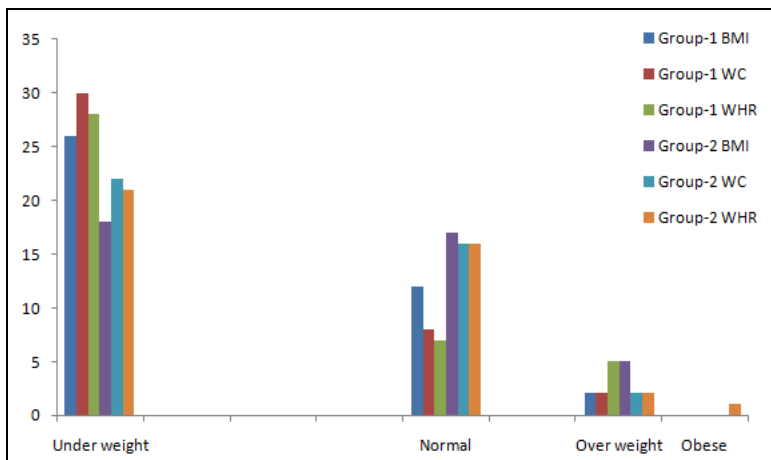


FIG. 3: GRAPHICAL REPRESENTATION OF NUTRITIONAL STATUS ACCORDING TO THEIR BMI, WC AND WHR

DISCUSSION: The socio economic characteristics of the rural children revealed that the majority (60.2%) of the head of the household were farmer and civil servants and remaining of them earn less than Rs 1,20,000/- year. Such a relatively low income will most likely affect the nutritional status of subjects in such homes considering the cost of living in the Bankura. The income of the household head therefore, appears to be a major factor in determining the nutritional status of mothers and children in the household. The high levels of malnutrition in the present study underline the great need for nutritional intervention.

A healthy child becomes a healthy adult. Of the various factors which determine the health of the child, nutrition plays the most vital role. Low body weight is unhealthy and harmful in the way it has dire consequences on both physical and psychological well - being of a child. Decreased level of thinking, impaired concentration, irritable mood and heightened obsessiveness, while contributing to the psychological effects of malnutrition, undermines the academic performance of a child and leads to the development of a socially withdrawn child.

On the other hand, malnutrition has a profound impact on immune system by weakening the defences and aggravating the effects of infections. Infections contribute to malnutrition by a variety of mechanisms including anorexia and impaired absorption of nutrients. This shows that enteric infection begets malnutrition and malnutrition begets more infections.

The mean height of rural children in the 14 - 16 years age group was 1.52m which was differing from the mean height of urban children in same age group. The mean weight of urban school children was 52.92 kg which was higher than the mean weight of rural school children. The mean BMI among the rural children were 18.2 kg/m² which were less than the mean BMI of urban school children. According to WHO, BMI score for rural school children shows they were suffering from mild malnutrition, whereas the urban school children having normal nutritional status.

The mean waist circumference and hip circumference among urban school children were 71.56 and 87.95cm which was higher than the mean WC and HC of rural school children were

69.93 and 85.49cm respectively. So, the mean waist hip ratio (WHR) of rural school children was less than the mean WHR of urban school. The frequency (%) of MUAC among urban school children which was differ from the frequency (%) of MUAC of rural school children. The percentage of obesity as per BMI, WC, WHR among rural school children was differing from the percentage of obesity as per BMI, WC, WHR of urban school children.

CONCLUSION: Our study highlights that children from rural areas and belonging to lower socio - economic classes are more nutritionally deprived than their counterparts. This difference highlights the necessity of a differential approach in combating malnutrition. The present study also shows reveals that the rural school going children of Bankura district are suffering from different grades of malnutrition. The clinical sign (General appearance) observations also supported the result of anthropometric status of children. It was revealed that the majority of rural school children suffer from under - nutrition compared to the urban school children according to their BMI score, waist circumference and waist - hip ratio.

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CONFLICT OF INTERESTS: The authors declare that they have no conflict of interests.

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