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Assessment of Nutritional Status of Adolescent Girls by Mid-Upper Arm Circumferences of Paschim Medinipur, India

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Introduction

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 status. It is good at predicting mortality by iMUAC alone or MUAC for age; it also predicted death in children better than any other anthropometric indicator. Measurements of adult MUAC have long been known to reflect changes in adult body weight [1]. This advantage of MUAC was greatest when the period of follow-up was short. Ferro-Luzzi and James have proposed MUAC cut-off points for use in screening acute adult under nutrition. They are based on extrapolation from more normally nourished populations in developing countries, Under nutrition is outcome of in sufficient food intake and repeated infected disease, among total adolescent population 88% belong to developing country [2,3]. Adolescent of developing countries are at greater risk of undesirable consequences of under nutrition. In this study MUAc act as tool to study malnutrition. Roc curve in this study helps to determine malnutrition by MUAC.

Methodology

This is cross-sectional study done on 10-19 years adolescent girls of rural area; this study is done on 1009 girls. Some socio-economic data were taken by different anthropometry. Measurements are taken like Height by anthropometric rod and weight through weighing machine [4].

MUAc measurement help in calculate arm fat area and arm muscle circumference ,arm muscle area, MUAc is measure by inextensible scale after marking midpoint of upper arm between olecranon and acronomium process, height is measured by anthropometric rod nearest 0.5 cm, Technical error of measurement is done to standardize data [5].

In this study table represents in that population mean is MUAc 21.71 (2.85), ANOVA shows that age wise increase in MUAC and they statistically significant (F-193.45) BMI are correlated with MUAC (r=0.350, p=0.000) (Figure 1).
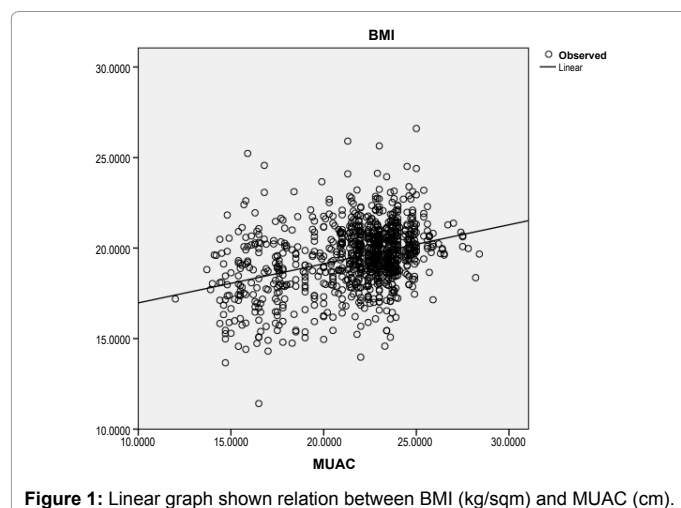

Figure 1: Linear graph shown relation between BMI (kg/sqm) and MUAC (cm).

Overall study represents that 404 among study population CED is below 5th percentile, adolescent girls of 10 years age are all underweight on basis on MUAc (Tables 1-3). 76 girls of 11 years are suffering from under nutrient (Table 4). Table 4 had shown that mean MUAc 21.71 (2.58), mean BMI is 19.50 kg/sqm (3.09) [6,7].

Mean		21.714
Median		22.60
Std. Deviation		2.85
Percentiles	50	22.60
	75	23.60
	95	24.90

Table 1: Mean SD of MuAc of study population.

Types of CED	Frequency	Percent	Valid Percent	Cumulative Percent
1.00	404	40.0	40.0	40.0
2.00	605	60.0	60.0	100.0
Total	1009	100.0	100.0	

Table 2: Frequency of CED of adolescent girls.

Age (years)	MUAc (cm)		Total
	1	2	
10	100	0	100
11	76	24	100
12	61	39	100
13	53	47	100
14	35	65	100
15	25	75	100
16	17	83	100
17	17	83	100
18	17	83	100
19	3	106	109

Table 3: Age wise comparison of MUAc.

	MUAc (cm)	BMI (kg/sqm)
Total no.	1009	1009
Mean	21.71	19.50
Std. Deviation	2.85	1.75
Variance	8.13	3.09

Table 4: Mean, SD of BMI, MUAc of adolescent girls.

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BMI is decreased significantly (F=243.0; p<0.001) from the highest MUAC group (22.5 kg/m^2) to the lowest one (17.1 kg/m^2). Overall prevalence of CED (BMI<18.5 kg/m^2). MUAc is a measure of both energy deficiency in adult and children, and is a useful index of the efficacy of the nutritional therapy in PEM and obesity. The measurement of MUAC can be regarded as a screening method for underweight, normally assessed from BMI to identify the preferential loss of peripheral tissue stores of fat and protein [8]. The MUAc value of a well-nourished child is above 13.5 cm, between 12 cm and 13.5 cm indicates malnutrition and below 12 indicates more severe malnutrition (WHO, 1995). Out of 50 subjects, 76% (38) were having MUAC value <23 cm, which shows an inverse relation between MUAC and clinical staging (Table 5). The mean age of patients with MUAC value <23 cm was 36.5 years, CED based on BMI in criteria <18.52 shows 94.03 specificity npv is 90 PPV is 9.7 represented in Table 5. Receiver operating curve characteristic Table 6 represents that area under the ROC curve is 0.604 which is significant at <0.05 in CED analysis based on BMI (Tables 6-8). Table 7 shows results of receiver operating analysis

curve characteristic of criteria <22.9 MUAc sensitivity 53.4 specificity PPV 79.9 and PPV is 80 and NPV 53.6. Table 6 represents that <18.64 is best indicator for analysis CED based on MUAC where specificity and sensitivity is highest.

Discussion

In this study, it shows in respect to MUAc present study population is under nutrient, MUAc have correlation with BMI that means higher MUAC have this present study represents that 40% girls are under nutrient, 24% girls are under nutrient is respect to BMI. MUAc and BMI relation show it significant regression relation.

References

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Criterion	Sensitivity	95% CI	Specificity	95% CI	+PV	95% CI	-PV
≤ 18.5225	5.77	1.2-15.9	94.03	85.4-98.3	9.7	0.06-52.7	90
≤ 18.5348	7.69	2.1-18.5	94.03	85.4-98.3	12.5	0.2-54.9	90.2
≤ 18.6214	9.62	3.2-21.0	94.03	85.4-98.3	15.2	0.6-57.0	90.4
≤ 18.6412	11.54	4.4-23.4	94.03	85.4-98.3	17.7	1.1-58.8	90.5
≤ 18.6558	11.54	4.4-23.4	92.54	83.4-97.5	14.7	0.9-51.3	90.4

Table 5: Results of receiver operating curve characteristic of CED.

Area under the ROC curve (AUC)	0.604
Standard Error [a]	0.0523
95% Confidence interval [b]	0.510 to 0.692
z statistic	1.988
Significance level P (Area=0.5)	0.0468

Table 6: Area under the ROC curve (AUC).

Criterion	Sensitivity	95%CI	Specificity		+PV	95%	-PV
>22.9	53.64	49.6-57.7	79.95	75.7-83.7	80	75.8-83.8	53.6
>23	47.52	43.5-51.6	83.42	79.4-86.9	81.1	76.6-85.0	51.5
>23.1	46.85	42.8-50.9	83.42	79.4-86.9	80.9	76.3-84.8	51.2
>23.2	46.03	42.0-50.1	83.42	79.4-86.9	80.6	76.0-84.6	50.8
>23.3	45.36	41.3-49.4	84.41	80.5-87.8	81.3	76.7-85.3	50.8
>23.4	41.23	37.3-45.3	87.13	83.5-90.2	82.7	78.0-86.8	49.8
>23.5	37.25	33.4-41.2	88.12	84.6-91.1	82.4	77.4-86.7	48.4
>23.6	34.44	30.6-38.4	90.1	86.8-92.8	83.9	78.7-88.2	47.9
>23.7	29.64	26.0-33.5	91.34	88.2-93.9	83.6	78.0-88.3	46.5
>23.8	26.82	23.3-30.5	91.83	88.7-94.3	83.1	77.1-88.1	45.6
>23.9	21.85	18.6-25.4	93.32	90.4-95.5	83	76.3-88.5	44.4

Table 7: Results of receiver operating curve characteristic of MUAC.

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	14.816	0.399		37.126	.000	14.033	15.599
	MUAC	0.216	0.018	0.350	11.839	.000	0.180	0.251
a. Dependent Variable: BMI								

Table 8: Linear regression show relation of BMI and MUAc.