



Correlation of BMI and MUAC with anemia among Sindh University Students, Jamshoro, Pakistan

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Abstract: Anemia remains the problem of concern world wide, particularly in the developing countries. Anemia is prevalent in all age groups, being more common in female adolescents, and young adults. Number of studies suggests higher prevalence of anemia in University Going students, however, little is known about prevalence of anemia in university students of Pakistan. This cross sectional study was carried out at University of Sindh from January 2016 to December 2016. Total 391 students both male and female students participated in the study. Data was obtained through structured questionnaire. Hematological parameters were assessed using blood analyzer. Overall prevalence of anemia in both male and female students was 53%. The prevalence of anemia was higher in female (80.37%) students than in male students (33.77%). Further, we have found very strong correlation of BMI with MUAC both in male ($r=0.83$) and female students ($r=0.86$). We have also found the significant correlation of BMI ($r = 0.38$, $P < 0.05$) and MUAC ($r = 0.14$, < 0.05) with hemoglobin in female students. However, no significant correlation of BMI and MUAC with hemoglobin was observed in male students.

In conclusion, higher prevalence of anemia was found in female students, and significant correlation of BMI and MUAC with hemoglobin was found in female students.

Keywords: BMI, (Body Mass Index) MUAC, (Mid-upper Arm Circumference) Correlation, Anemia Structure.

1. INTRODUCTION

Anemia is the major health problem across world wide, particularly in the developing countries where number of factors including malnutrition causes an increase in prevalence of anemia (McLean, *et al.* 2009). Anemia is prevalent in all age groups, but it mainly affects pregnant women and female adolescents (Toteja, Singh *et al.* 2006, Baig-Ansari, *et al.* 2008, Anjum, *et al.* 2015). University students mostly comprise of young adults with the age ranging from 18 to 24 years (Al-Sayes, *et al.* 2011). Number of studies have been reported about the prevalence of anemia in young adults particularly university students (Sultan 2007, Baig-Ansari, *et al.* 2008, Khan, Akhtar *et al.* 2010, Al-Sayes, *et al.* 2011). The published data also suggest that female students have significantly higher prevalence of anemia in comparison with male students (Sultan 2007, McLean, *et al.* 2009). Most of the reports suggest that higher prevalence in female might be due to menstrual disturbances in female (Peuranpää, *et al.* 2014, Cooke, *et al.* 2016). However, malnutrition and bad eating habits are also the factors anemia in both male and female students (Campillo, *et al.* 2004). Number of recently published studies suggests an association of malnutrition with anemia (Mitrache, *et al.* 2001). BMI has been used as indicator for measuring the malnutrition and find the association of BMI with anemia (Campillo, *et al.* 2004, Dars, Sayedet *al.* 2014).

However Middle upper arm circumference is also used as an indicator for measuring malnutrition in children and adolescents (Tang, *et al.* 2013, Laghari, *et al.* 2015). Association of anemia with MUAC has not been extensively studied.

The purpose of this study was to find the prevalence of anemia in Sindh University Students. Sindh University is located in the Jamshoro district with more than 30 thousand students comprising the age from 18 to 24. We have carried out the detailed study on prevalence of anemia; the other purpose was to find out whether BMI and MUAC are correlated with prevalence of anemia.

2. MATERIAL AND METHODS

Study Setting and Sampling

The data was collected from January 2016 to December 2016, a total of 391 students ranging from 18 to 24 years were selected randomly from various faculties of University of Sindh, Jamshoro. Out of 391 students 163 were female students and 228 were male students. 4 to 5 mls of venous blood samples was drawn, ethylenediamine tetra-acetic acid (EDTA) was added to stop clotting. Blood samples were used for the analyses of hemoglobin, Red Cell Count (RBC), Packed Cell Volume PCV, Mean Corpuscular Volume (MCV), Mean Corpuscular Hemoglobin (MCH). Mean Corpuscular Hemoglobin Concentration MCHC.

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Data collection

Data was collected using structured interview based questionnaire comprising various sections and elements. These elements included information on demographic data, age, height, weight, social habits, and symptoms, dietary and nutritional habits. Anthropometric measurement was carried out using standards Body mass index BMI formula and Middle Upper Arm Circumference (MUAC) was obtained to the nearest 0.1 cm. BMI is a simple index of weight-for-height and it is commonly used to classify underweight, normal weight, overweight and obese in adults. It is defined as the weight in kilograms divided by the square of the height in meters Kg/m². Body mass index was calculated as follows: body weight (Kg)/height (m²). WHO BMI values were taken as reference values for measuring underweight, normal weight, over weight and obese. Hemoglobin less than <13 g/dl was considered anemic for male students and hemoglobin level <12 g/dl was considered as anemic for female students.

Statistical Analysis

(SPSS) Version 16 was used for statistical analysis. Pearson correlation coefficient was used for measuring the correlation between variables. *P* values for

significance were set at 0. < 0.5 and, < 0.01. The verbal and written consent was obtained before collection of data.

3.

RESULTS

Over all prevalence of anemia in both male and female students were 53. 19% (n=208). The mean age of male students was 21.25±1.79 and the mean hemoglobin level was (13.30±1.27). Out of 228 male students 33.77% (n=77) were anemic (<13gm/dl) and 66.23% (n=151) were non anemic (≥13gm/dl). The grading of anemia showed 0.88% (n=2) had severe anemia (<8 gm/dl), 3.95% (n=9) had moderate anemia (8-10.9 gm/dl) and 28.95% (n=66) had mild anemia (11-12.9 gm/dl).

The mean age of female students was 20.9±1.8 and the mean hemoglobin value was (10.83± 1.40 gm/dl). Out of 163, 80.37% (n=131) were anemic (<12 gm/dl) and 19.63% (n=32) were non anemic (≥12 gm/dl). Further categorization showed that 38.04% (n=62) female students had mild anemia (11-11.9 gm/dl), 36.81% (n=60) had moderate anemia (8-10.9 gm/dl), 5.5% (n=9) had severe anemia (<8 gm/dl).

Table 1 Correlation of BMI and MUAC with various hematological indices in male students (n=228)

	BMI	MUAC	RBC	HB	HCT	MCV	MCHC	MCH
BMI	Pearson correlation	1						
	Sig. (2 Tailed)							
		.830**	.215*	.117	.131	-.104	.029	-.082
		.000	.018	.201	.153	.255	.749	.372
MUAC	Pearson Correlation	1						
	Sig. (2 Tailed)							
		.830**	.206*	.124	.155	-.086	.029	-.079
		.000	.023	.174	.089	.347	.755	.389

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Table 2 Correlation of BMI and MUAC with various hematological indices in female students (n=163)

	BMI	MUAC	RBC	HB	HCT	MCV	MCHC	MCH
BMI	Pearson correlation	1						
	Sig. (2 Tailed)							
		.861**	.275*	.249*	.197	-.091	-.012	-.044
		.000	.020	.038	.096	.448	.922	.714
MUAC	Pearson Correlation	1						
	Sig. (2 Tailed)							
		.861**	.260*	.289*	.248*	-.046	.087	.030
		.000	.028	.014	.036	.700	.467	.805

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Table 1 shows the strong correlation (r= 0.83) of anemia with BMI and MUAC, which is statistically extremely significant (P <.0001). This strong correlation indicates that MUAC can also be used as indicator for measuring the under-nutrition and over-nutrition of adults. No correlation of BMI and MUAC with

hemoglobin level was found however, we have found the positive correlation of BMI (r= 0.215, P <. 05) and MUAC (r= 0.206, P <. 05) with RBC numbers. Table 2 indicate strong correlation of BMI with MUAC in female students (r= 0.861, P <. 0001). We have found the significantly positive correlation of BMI

($r = 0.275$, $P < .05$) and MUAC ($r = 0.260$, $P < .05$) with RBC numbers, similarly, both BMI ($r = 0.249$, $P < .05$) and MUAC ($r = 0.289$, $P < .05$) were also correlated with hemoglobin level in female students.

We have found no significant correlation of BMI and MUAC with HCT, MCV, MCHC and MCH both in males and females (Table 1 and Table 2).

4. DISCUSSION

BMI has been used an indicator for measurement of underweight and obesity however, quite recently MUAC has also been used; the study carried out in India and Bangladesh fixed the cut off values for both male and female adults (Dasgupta, *et al.* 2010, Sultana, Karim *et al.* 2015). We have found strong positive correlation of BMI with MUAC which indicate that prevalence of anemia in male students is nearly same as reported earlier (Hafeez, *et al.* 2016), however, the data we have collected clearly suggest the higher prevalence of anemia in female than in male, these results are consistent with already published results, and however, the prevalence rate of anemia in female students is much higher than previously published studies (Goswami, Sachdeva *et al.* 2014, Habib, Black *et al.* 2016). The studies carried out in Kingdom of Saudi Arabia in King Abdul-Aziz University (Al-Sayes, *et al.* 2011), University of Sharjah (Sultan 2007), University of Peshawar Pakistan (Khan, *et al.* 2010) and hostel students of the University of Sri Jayewardenepura, Sri Lanka (Chathuranga, *et al.* 2014) indicate the prevalence of anemia in female from 23 to 27%, however, our study indicate the much higher prevalence of anemia in female University students than these studies. The prevalence of anemia in female students was even higher than previously reported in Bangladesh (Shill, *et al.* 2014). This higher prevalence in female might be due to malnutrition and menstrual problems as reported in several other studies (Al-Sayes, *et al.* 2011, Chandra, *et al.* 2016). MUAC can alternatively be used as parameters. However, we are not able this stage to fix the cut off values of MUAC for male and female adults.

We have also observed the positive correlation of both BMI and MUAC with hemoglobin and red blood cells, these results are in agreement with previously published studies (Kavthekar, *et al.* 2016), however, Over weight and obesity has also been reported to be correlated with iron deficiency anemia (Pinhas-Hamiel, *et al.* 2003).

5. CONCLUSION

We have found the strong positive correlation of BMI with MUAC. MUAC can alternatively been used as the parameter instead of BMI. Both MUAC and BMI were positively correlated with increasing concentration

of hemoglobin only in female students. However future study is required to further investigate it.

Conflict of interest

All authors fully disclose that there is no financial or ethical conflict of interest regarding this publication.

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