

## Correlation between Body Mass Index and Fasting Blood Glucose Level in a Selected Group of Teenagers in Bangladesh

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### Abstract

The trend of increasing overweight and obesity is not related to genetic factors only; rather majority of this burden is attributable to the environmental factors. The aim of the study was to observe the correlation between body mass index (BMI) and fasting blood glucose (FBG) level in a selected group of teenagers of Bangladesh. A cross sectional study was conducted involving 39 male and 41 female MBBS students of Faridpur Medical College during 06-04-2014 to 22-05-2014 by purposive sampling. Data were collected using a questionnaire & check list. Out of 80 students 48.8% male, 51.2% female, 12.5% underweight, 67.5% normal, 16.2% overweight & 3.8% was obese. Mean age of the students was 18.99, BMI 21.99, SBP 121.12, DBP 79.19 and FBG 4.53. Most of students were normotensive (SBP 88.8%; DBP 96.2%) & a few students (SBP 8.8% & DBP 3.8%) were hypertensive.

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Majority of students (66.2%) were normoglycemic and rest of the students were hypoglycemic. Correlation between BMI and FBG ( $P=0.65$ ) was not significant but correlation between BMI and systolic blood pressure (SBP) ( $p<0.0001$ ); BMI & diastolic blood pressure (DBP) ( $p<0.05$ ) was significant. Comparison of SBP between male and female students showed ( $p<0.001$ ) was significant. BP and family history of hypertension showed ( $\chi^2=5.85$ ),  $p=0.05$  level of significance. BMI and FBG showed no significant correlation. BMI and BP showed positive correlation. Male has higher BP than female. Students with family history of hypertension are prone to develop hypertension.

Keywords: Body Mass Index, Fasting Blood Glucose, Teenagers, Bangladesh.

Number of Tables: 06

Number of References: 14

Number of Correspondences: 06

### Introduction

The world health organization (WHO) regards a BMI of less than 18.5 as underweight and may indicate malnutrition, an eating disorder, or other health problems, while a BMI greater than 25 is considered over weight and more than 30 is considered as obese<sup>1</sup>. The trend of increasing overweight and obesity cannot be attributed to the genetic factors only; rather majority of this burden is attributable to the environmental factors, the "Obesogenic environment"<sup>2</sup>. This implies a massive chronic disease burden, resulting in an economic burden in the next 10 to 20 years if nothing is done to prevent it. In low income countries the people from the high socioeconomic status and urban areas are more likely to be obese<sup>3</sup>.

In recent times, there have been a lot of critical biochemical investigations into the inter-relationship between body mass index (BMI) and blood pressure<sup>4</sup>. It is not unexpected for increase in blood glucose to induce increase in BMI; as increase in blood glucose level have associated with increase in lipid biosynthesis (lipogenesis) and hence, an increase in weight<sup>5</sup>. A strong correlation has been established between a high BMI and the

development of type-2 diabetes mellitus from a study of more than 7000 British men (mean follow up of 12 years)<sup>6</sup>. It is therefore, expected that BMI should correlate with blood glucose levels but this is not however always the case because a Scottish study has shown no significant statistical correlation between the random blood sugar level and Body Mass Index (BMI)<sup>7</sup>.

Rasul et. al. found the prevalence of overweight and obesity among the medical students was 27.16% (Male 39% and female 22%). 58% of the respondents had positive family history of overweight/obesity and around 70% of them had positive family history of Type 2 Diabetes and Hypertension<sup>8</sup>. Gopalakrishnan et. al. found that overweight was encountered for 15.9% of the total (18.3% in male and 13.8%) study subjects and they also showed that 5.2% of study subjects were obese, 14.8% were found to be underweight (12.2% in male and 17.0% in female)<sup>9</sup>. Chaudhry et. al. found that the prevalence of overweight was 8.2% and that of obesity was 2.4%. Overall 18.6% of males and 7.4% of females were found to be overweight or obese<sup>10</sup>. It is expected that BMI should correlate with blood glucose levels but this is not always proved because Lohitashwa et. al. & Erasmus et. al. has shown no significant statistical correlation between the blood sugar level and body mass index (BMI)<sup>11,12</sup>.

There is no sufficient data about overweight and obesity and its correlation with blood glucose level among teenage population especially medical students in public medical colleges of Bangladesh. So far our knowledge goes there is no such study showing correlation between overweight, obesity and Fasting blood glucose level in a selected teenage population like medical students of Bangladesh. So assessment of correlation between BMI and FBG in young generation of our country especially medical students will provide valuable information's about health status of future health service providers of Bangladesh.

#### Materials and Methods

A descriptive cross sectional observational study was conducted from 06-04-2014 to 22-05-2014 in the Department of Biochemistry, Faridpur Medical College, Faridpur. To obtain the selected group of teen agers, 1<sup>st</sup> year (F-23, session 2013- 2014) MBBS students of Faridpur Medical College, Faridpur was taken as sample. Calculated sample size was 233. Number of 1<sup>st</sup> year MBBS student in Faridpur Medical College was 113. Due to limited time, 80 students (male 39, female 41) were taken as sample purposively. All students of 1<sup>st</sup> year (F-23, session 2013- 2014) MBBS students of Faridpur Medical College, Faridpur willing to be volunteers of the study was included. Students taking steroid and seriously ill students due to any disease were excluded.

BMI 18.5-24.99 was considered as normal, 25.00 - 29.99 was considered as overweight, 30 - 39.99 was considered as obese. SBP <100 mm of Hg was considered as low, 100 - 139 mm

of Hg was considered as normal & >139 mm of Hg was considered as hypertensive. DBP <60 mm of Hg was considered as low, 60 - 89 mm of Hg was considered as normal & >89 mm of Hg was considered as hypertensive. FBG <4.4 mmol/L was considered as low, 4.4-6.0 mmol/L was considered as normal & >6.1 was considered as high Data were collected in a questionnaire & check list. FBG was estimated by semi-automated analyzer- Evolution 3000.

The questionnaire was pre-tested before finalization. Data were collected after giving ethical clearance from the ethical review committee of Faridpur Medical College, Faridpur. Data was checked and edited, if needed. Statistical analysis was done by using SPSS (version 16.0 for windows). Mean value of the findings were compared between sexes by unpaired students, t test. Categorical variables were analyzed by  $\chi^2$  test. Correlation between variables was determined by Pearson's correlation coefficient test. For all the statistical analysis, 2- tailed p value < 0.05 was considered as level of significant.

#### Results

Mean age of the students was  $18.99 \pm 0.75$ , BMI was  $21.99 \pm 3.55$ , SBP was  $121.12 \pm 9.74$ , DBP was  $79.19 \pm 7.79$ , and FBG was  $4.53 \pm 0.54$ . Out of 80 students 48.8% was male, 51.2% was female, 12.5% was under weight, 67.5% was normal, 16.2% was overweight & 3.8% was obese. Majority of students were normotensive (SBP 88.8%, DBP 96.2%) & few students (SBP 8.8% & DBP 3.8%) were hypertensive. Majority of students (66.2%) were normoglycemic and rest of the students were hypoglycemic, no students were hyperglycemic. Distribution of students showed no significant difference between sex & BMI; between sex & FBG. Distribution of students showed significant difference between sex & BP (SBP;  $p = 0.001$  & DBP;  $p = 0.06$ ). Significant difference ( $\chi^2 = 5.85$ ;  $p = 0.05$ ) between BP and family history of hypertension. Showed highly significant positive correlation ( $p = 0.000$ ) between BMI and SBP of students. Showed significant positive correlation ( $p = 0.04$ ) between BMI and DBP of students showed no significant correlation between BMI and FBG of students.

Table-I: Characteristics of the students by sex and category.

Variables	Mean±SD	Category	No. of student	Frequency			
Sex		Male	39	(48.8)			
		Female	41	(51.2)			
Age	Male 19.08±0.77	Female 18.90±0.73	Total 18.99±0.75				
BMI	Male 22.12±3.22	Under wt.	10	(12.5)			
		Normal	54	(67.5)			
		Female	Over wt.	13	(16.2)		
		Obese	3	(3.8)			
		Total	21.99±3.55				

SBP	Male	Low	1	(1.2)
		Normal	72	(88.8)
	Female	High	7	(8.8)
				117.68±8.66
				Total
				121.12±9.74
DBP	Male	Low	1	(1.2)
		Normal	76	(96.2)
	Female	High	3	(3.8)
				7.56±7.67
				Total
				79.19±7.97
FBG	Male	Low	27	(33.8)
		Normal	53	(66.2)
	Female			
				4.46±0.60
				Total
				4.53±0.54
Total			80	(100)

Table-II: Distribution of students by sex.

Variables	Sex	Frequency	Mean±SD	T value	P value
BMI	Male	39(48.8%)	22.12±3.22	0.304	0.76 <sup>ns</sup>
	Female	41(51.2)	21.88±3.88		
FBG	Male	39(48.8%)	4.61±0.47	1.23	0.22 <sup>ns</sup>
	Female	41(51.2)	4.46±0.60		
SBP	Male	39(48.8%)	80.90±8.02	3.45	0.001 <sup>**</sup>
	Female	41(51.2)	77.56±7.67		
DBP	Male	39(48.8%)	80.90±8.02	1.87	0.06 <sup>ns</sup>
	Female	41(51.2)	77.56±7.67		

ns = Not significant. \*\*= significant

Table-III: Comparison of BP of students with and without a Family History of hypertension.

Family H/O	BP category			Total Frequency	X <sup>2</sup> value	P value
	Low:(SBP<100 or DBP<60) Frequency	Normal:(SBP: 100-139 or DBP: 60-89) Frequency	High:(SBP: 140 or above or DBP:90 or above) Frequency			
Present	0(0%)	33(41.2%)	7(8.8%)	40(50%)	5.85	0.05 <sup>ns</sup>
Absent	1(1.2%)	38(47.5%)	1(1.2%)	40(50%)		
Total	1(1.2%)	71(88.8%)	8(10.0%)	80(100%)		

ns = Not significant

Table-IV: Correlation between BMI and SBP of students.

Variables	N	R	P
BMI	80		
SBP	80	0.382	0.000 <sup>***</sup>

\*\*\*=significant at 0.0001 level

Table-V: Correlation between BMI and DBP of students.

Variables	N	r value	P
BMI	80		
SBP	80	0.227	0.04 <sup>*</sup>

\*=significant at 0.05 level

Table-VI: Correlation between BMI &amp; FBG of the students.

Variables	N	r- value	p value
BMI	80		
FBG	80	-0.18	0.65 <sup>ns</sup>

ns = Not significant

## Discussion

Obesity is a global problem affecting both the developed and developing countries. It is a leading preventable cause of morbidity and mortality associated with non-communicable disease. World health organization (WHO) showed mean BMI 20.32, male 21.00 and female 19.63 in 2011 in Bangladesh.

In the present study, age (Mean±SD) of the students was 18.99±0.75 (years), BMI (Mean±SD) was 21.99±3.55 (Kg/m<sup>2</sup>), SBP (Mean±SD) was 121.12±9.74 (mm of Hg), DBP (Mean±SD) was 79.19±7.79 (mm of Hg), and FBG (Mean±SD) was 4.53±0.54 (mmol/L). Out of 80 students, 48.8% was male, 51.2% was female, 12.5% was under weight, 67.5% was normal weight, 16.2% was overweight & 3.8% was obese. Most of the students were normotensive (SBP 88.8%; DBP 96.2%) & few students (SBP 8.8% & DBP 3.8%) were hypertensive. Majority of students (66.2%) were normoglycemic and rest of the students were hypoglycemic. None students were hyperglycemic.

Comparison ( $\chi^2=0.23$ ;  $p=0.97$ ) and correlation ( $r=-0.18$ ,  $p=0.65$ ) between BMI & FBG showed no significant difference or correlation. No significant difference was found in BMI between sexes ( $\chi^2=1.06$ ;  $p=0.79$ ). No significant difference was found between BMI & BP ( $\chi^2=4.42$ ;  $p=0.62$ ) of the students. There was no statistical significant difference between BP and family history of hypertension ( $\chi^2=5.85$ ;  $p=0.05$ ) but may be significant in near future. Distribution of SBP shows significant difference between male & female ( $t=3.45$ ;  $p=0.001$ ). Though DBP did not show significant difference between male & female ( $t=1.87$ ;  $p=0.06$ ) which may be significant in future. Significant positive correlation ( $p=0.000$ ) between BMI and SBP of students was found. Also significant positive correlation was found between BMI and DBP of students ( $p=0.04$ ).

World Health Organization (2011) showed mean (total) BMI 20.32, male 21.00 and female 19.63 in Bangladesh. In this study mean BMI was 21.99, male 22.12 and female was 21.88 which is near to WHO finding.

Study conducted by Rasul et. al. found 27. 16% (Male 39% and female 22%) was overweight & obese, 58% of the respondents had positive family history of overweight/obesity and around 70% of them had positive family history of Type 2 Diabetes and Hypertension. Similar type of study conducted by Gopalakrishnan et. al. found 14.8% respondent were underweight (12.2% in male and 17.0% in female), 15.9% (18.3% in male and 13.8%) was overweight and 5.2% of study subjects were obese. Chaudhry et. al. found 8.2% medical students were overweight and that of obesity was 2.4%. Overall 18.6% of males and 7.4% of females were found to be overweight or obese and Lohitashwa et. al. found obese I in 17.7% of subjects and obese II was in 6.7% of subjects. The present study showed 12.5% of students was under weight, 67.5% was normal, 16.2% was overweight & 3.8% was obese. This study also showed 50% students have positive family

history of hypertension & 38.8% students have positive family history of DM. So the findings of this study are somewhat similar to other study mentioned above.

No significant difference ( $\chi^2=0.23$ ;  $p=0.97$ ) was found between BMI and FBG of the students. It is expected that BMI should correlate with blood glucose levels but this is not always proved because Lohitashwa et. al. & Erasmus et. al. has shown no significant statistical correlation between the blood sugar level and body mass index (BMI). So this study is in the line of other study.

Distribution SBP shows significant difference between male & female ( $t= 3.45$ ;  $p =0.001$ ). Highly significant positive correlation ( $p=0.000$ ) between BMI and SBP of students. Significant positive correlation ( $p=0.04$ ) between BMI and DBP of students was found which is agreed with Ravisankar et. al. & Adediran et. al.<sup>13,14</sup>.

#### Conclusion

BMI and FBG of students showed no significant correlation. BMI and BP showed positive correlation. Male has higher BP than female. Students with family history of hypertension are prone to develop hypertension.

#### Acknowledgment

Thanks to Almighty Allah for giving me the opportunity & providing me with sufficient energy and patience to carry on this study. I would like to express my greatest gratitude & whole hearted respect to Prof. Dr. Nasimul Haque, Head of the Department of Biochemistry, FMC, Faridpur for his inspiring guidance, constant supervision, constructive criticism, valuable advice and encouragement in carry out this study. I would like to thank Principal of Faridpur Medical College, Faridpur & my heartfelt thanks to all the respondents who helped us by providing their valuable opinion and unconditional time in this study. Finally and most importantly, to my family and friends, I appreciate their support and standing by my side always.

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