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Physiology

An Association between Fasting Blood Glucose level and BMI in BICH Young Adult Students: A study in a Tertiary Care Hospital, Dhaka, Bangladesh

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Abstract   Original Research Article

Background: Non-communicable disease like diabetes is becoming a public health problem that it is already present in most middle-low income countries. The increased risk of associated with high BMI levels in middle-aged group has been clearly established but young adult age group yet not known. So, the aim of this study was to determine the relationship between body mass index (BMI) and fasting blood glucose level in young adult age group. *Objectives:* To observe fasting blood glucose level in young adult students of Bangladesh institute of child health (BICH) & its association with BMI. *Materials & Method*: This cross sectional study was carried out on 127 young adult students aged 18-32 years in the department of physiology, Bangladesh institute of Child health (BICH) from January 2018 to January 2019. *Methods*: Fasting blood glucose of the study subjects were measured by using blood glucometer (using blood glucose test strip). BMI was calculated as weight (kg)/height (m2). *Results:* The study result found that 14.96 % of the participants are underwweight group, 26.77% are overweight group and 16.54% are obese group. Mean glucose level 5.411 ±0.4806 in underweight group (BMI<18.5), Within the overweight group (BMI 23-24.99) mean glucose level is 5.597±0.6548. The obese group (BMI ≥25) mean glucose level is 5.638±0.6756. Though mean glucose level are within normal range but positive correlation (p-value=0.324) between BMI and blood glucose levels were found. The mean plot in Anova analysis shows that there is a substantial change of the mean in glucose level within the underweight and the overweight and obese group. Ordinal regression analysis further shows that the difference is significant (p value=0.004). *Conclusion:* Positive correlation were found between BMI and fasting glucose level. BMI which is non-invasive is recommended as a screening tool for developing diabetes risk and recommending early measure to control the glucose level.
Keywords: Body Mass Index (BMI), Blood Glucose Level (BGL).

INTRODUCTION

The body mass index (BMI) is used to categorize adults into different groups based on anthropometric height/weight characteristics. BMI represents an index of an individual's fatness. BMI is generally used as an indication for the development of or prevalence of numerous health problems [1]. One of the most common health hazards worldwide is diabetes, which is the presence of excessive sugar in the blood. Diabetes can lead to several health complications in the long run. Diabetes is a non-communicable disease which has caused substantial mortality and morbidity worldwide and significant economic impact [2, 3]. BMI is a widely used risk factor for diabetes. ADA recommends "BMI Cut Points to Identify At-Risk Asian Americans for Type 2 Diabetes Screening" (32,33) suggest that the BMI cut point should be lower for the Asian American population. The BMI cut points fall consistently between 23 and 24 kg/m2 (sensitivity of 80%) for nearly all Asian American subgroups (with levels slightly lower for Japanese Americans). This makes a rounded cut point of 23 kg/m2 practical" [4]. According to WHO 422 million people worldwide had diabetes, with a major concentration in the developing countries and 80% of diabetes death take place in low and middle-income countries. Diabetes is gradually becoming a common health issue in Bangladesh. In Bangladesh, with it's growing population, a recent meta-analysis showed that there is a significant increase in diabetes among adults. It has sharply increased from 4% in 1995 to 2000 and 5 % from 200 to 2005 to 9% in 2006 to 2010.5. The prevalence will be 13% by 2030 According to the International Diabetes Federation [5, 6].

In addition to the issue of diabetes, another study shows the increasing problem of underweight and overweight/obesity in Bangladesh among older adults($\geq$35). However, underweight remains the major public health issue for both female and males($\geq$35) which include 30% of the population. Both conditions are related to the increased danger of morbidity and mortality with the risk of developing non-communicable diseases. [7]In our study, we present the prevalence and socio-demographic determinants of underweight, overweight and obesity among the young-adult population aged $\leq$32 years.

OBJECTIVES

To evaluate the blood glucose level of young adult students in Bangladesh institute of child health (BICH) & its association with BMI.

MATERIALS AND METHODS

The study was carried out on 127 young adult students aged 18-32 years in the department of physiology, Bangladesh institute of Child health (BICH) from January 2018 to January 2019. One hundred and twenty seven(127) healthy young consenting adults between the ages of 16 and 32 years were selected for the study.

Measurement of fasting blood glucose level

Fasting early morning blood glucose of the study subjects were measured using blood glucometer (using blood glucose test strip). For the test a small volume of blood samples were collected by piercing finger tips of the study subjects using sterile lancet .

Blood Glucose Determination

Fasting plasma glucose level range was based on the recommendation of WHO.

Body Mass Index (Bmi) Estimation

Weights were taken to the nearest lb and height to the nearest feet from which BMI was calculated as weight (kg)/height (m2).

Statistics

The researcher used simple statistical tools to analyze the data. The association between Glucose level and BMI among the groups was checked through p-values using SPSS version 24. For analytical tests, a 95% confidence limit ($p < 0.05$) was taken as the level of significance. We also performed a regression analysis.

RESULTS

The study result found that 14.96 %(n=19) of the participants are underweight (BMI<18.5), 26.77% (N=34) of the participants are overweight (BMI 23-24.99) and 16.54% (n=21) of the participants are obese (BMI >25). (Table-2) Among the groups, the underweight (BMI<18.5) mean glucose level is, 5.411 $\pm$0.4806, normal-weight group (BMI 18.5-22.9) mean glucose level is 5.421$\pm$.5333. Within the overweight group (BMI 23-24.99) mean glucose level is 5.597$\pm$0.6548. The obese group (BMI $\geq$25) mean glucose level is 5.638$\pm$0.6756. 45.40% (n=44) of non-diabetic participants (5.6) belongs to the normal BMI group, 29.60% (n=8) pre-diabetic (5.6-6.99) participants belong to normal and overweight BMI group equally and 33.33% (n=1) diabetic participants ($\geq$7) belong to normal, overweight and obese BMI group equally. (Table-3). There is a positive correlation (p-value=0.324) between BMI and blood glucose levels. (Figure-1) The mean plot in Anova analysis shows that there is a substantial change of the mean in glucose level within the first category(non-diabetes) and the second category(prediabetes and diabetes). (Figure-2) Ordinal regression analysis further shows that the difference is significant (p value=0.004)

Table-1: Demographic Distribution of the study participnts (n=127)

Age	Number (%)	Min, Max	Mean±SD
16-20	45 (35.4)		
21-25	79(62.2)	18, 32	21.48±2.218
>26	3(2.4)		
Sex			
Male	63(49.6)		
Female	64(50.4)		

Table-2: Blood Glucose level within BMI group (n=127)

BMI	N(%)	Mean	SD	Min.	Max.
Underweight	19(14.96)	5.411	.4806	4.1	6.1
Normal	53(41.73)	5.421	.5333	4.2	7.5
Overweight	34 (26.77)	5.597	.6548	4.8	7.9
Obese	21(16.54)	5.638	.6756	4.8	7.2
Total	127 (100)	5.502	.5871	4.1	7.9

Table-3: Diabetes Status in BMI Class (n=127)

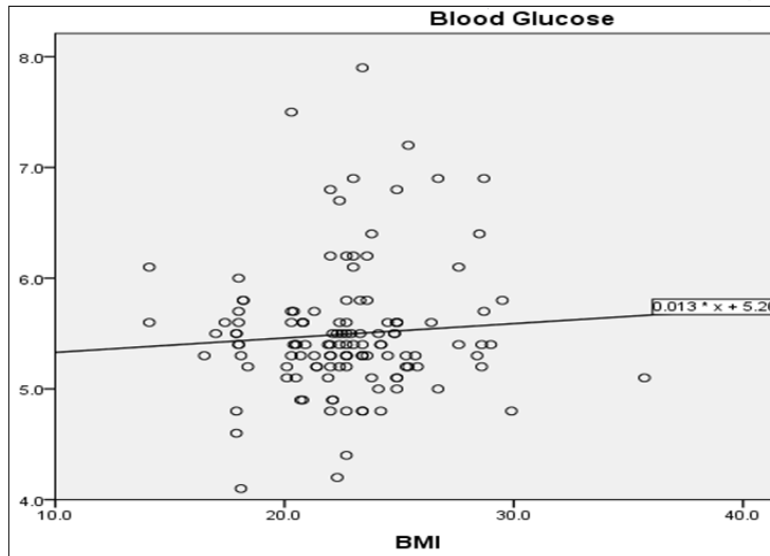| BMI	BGL	Diabetes	Pre-diabetes	Non-Diabetes
Underweight	N (%)	0	5(18.50)	14(14.40)
Normal	N(%)	1(33.30)	8(29.60)	44(45.40)
Overweight	N(%)	1(33.30)	8(29.60)	25(25.80)
Obese	N(%)	1(33.30)	6(22.20)	14(14.40)
Total	N	3	27	97

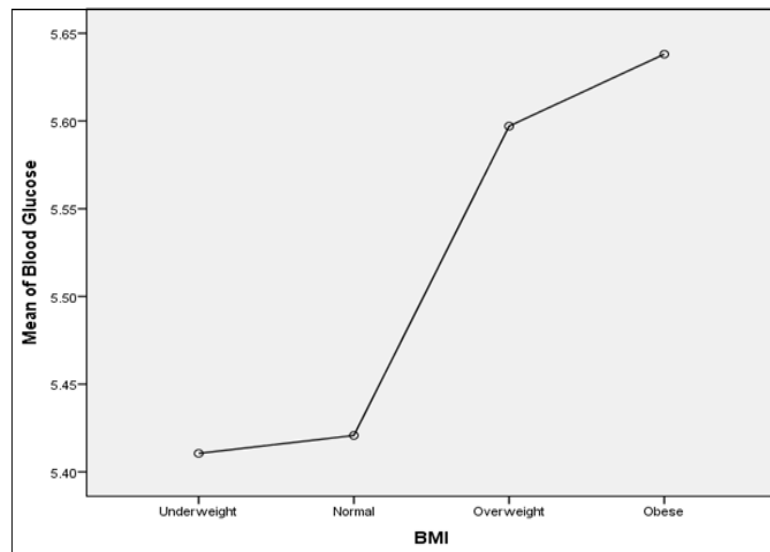**Fig-1: Correlation between BMI and Blood Glucose**

Fig-2: Mean plot of Blood Glucose (Ordinal regression analysis shows a p value=0.004)

DISCUSSION

It has been observed that Bengali young adults are highly prone to diabetes even with only modestly overweight, central obesity, which is observable in other studies based on Asian participants [8, 9]. Our study revealed that a small number of participants were diabetic but a substantial percentage of subjects were pre-diabetic. For the study, all of our subjects were healthy young-adults within the age range 18-32. These findings correspond well with another cross sectional study on university graduates of Bangladesh public university [10]. In our study we found the mean glucose level drastically changes between the underweight-normal group and overweight-obese group (p value<.005) [11-13]. The positive but weak correlation between BGL and BMI is supported by other studies although, it found a stronger correlation between the two [14]. On the contrary, a recent study has found the mean BMI in those without diabetes was 26.8. In those with diabetes, the BMI was 29.1; that is, it was higher as generally expected. However, the percent of lean body mass was the same; that is, the increased BMI in those with diabetes was not due only to an excessive

accumulation of fat [15]. Other factors that can contribute to developing overweight and obesity could be eating speed [16, 17]. A study conducted on Chinese college students suggests that health education programs should be executed to help young-adults control their eating speed [18]. An increasing number of obese people among young adults can also result from lifestyle change such as leaving home, going to university/college, starting work, developing relationships, possibly cohabiting or marrying, potentially experiencing pregnancy and child-rearing [19-21]. Unhealthy lifestyle among young adults due to stress and sociological factors can make vulnerable [22, 23]. The finding on higher BMI is similar to other studies that found elevated BMI was related to greater rates of conversion to diabetes [24]. Participants in the underweights BMI group, possibly showing lower glucose levels, may have reduced secretion of glucagon and epinephrine, causing inadequate hepatic glucose production throughout iatrogenic hypoglycemia. Additionally, the result of glucagon may be compromised in people with insufficient glycogen since this hormone increases blood glucose level through hepatic glycogenolysis [25, 26].

LIMITATIONS OF THE STUDY

The study has a limited sample size and preferable it considers only the same group of people who particularly studies in BICH.

CONCLUSION AND RECOMMENDATIONS

According to our information, a high prevalence of glucose level was ascertained among young adult students. It considers that overweight and obesity were considerably related to prehypertension and high blood pressure among young students in BICH. This study showed that the impact of BMI on the fasting glucose level is negligible or too small to be clinically significant. Future studies should explore the other possible reason that can lead to the development of pre-diabetes among young adults. The study disclosed to focus on our body mass index and daily lifestyle.

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