

Association between body mass index and blood glucose levels in baghpat district women

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Abstract

Introduction: Obesity is the leading factor in the pathogenesis of health disorders such as hypertension and type-2 diabetes mellitus. Since BMI is the associated with obesity, the present study has been carried out to evaluate the association between diabetes and BMI.

Material and Methods: A study has been carried including 2000 females between (21-60 years) were enrolled in the study, For the study 2000 women age between 21 to 60 years were selected. All 2000 subjects were from four age groups and these age groups were 21 to 30 years (group1), (group 2)31 to 40 years, 41 to 50 years (group 3) and 51-60 years (group 4). Sample selection was done in such way so that each category should have 500 samples for making even sample distribution in all groups. Statistical calculation was done using SPSS.

Results: The association between BMI and diabetes was significant with increasing BMI at both the level ($p < 0.05$, $P < 0.01$).

Conclusion: BMI and FBG are associated and subjects are therefore at risk of Obesity and its related conditions.

Keywords: blood pressure, body mass index, obesity, fasting blood sugar, diabetes

Introduction

According to the recent estimates of the WHO, the prevalence obesity has become more than doubled in the world since 1980. More than 1,400 million adults (20 years or older) are overweight, more than 200 million men and nearly 300 million women are obese. The WHO predicts that overweight and obesity will soon be primary cause of illness and it will replace the usual public health problems, such as nutrition and communicable disease. This forecast has become necessary because, starting in 2005, the WHO estimates that at least 400 million adults (9.8%) were obese, rate was higher among women than men (WHO, 2004) [1]. Obesity has become a serious and widespread condition that represents an economic burden in developed countries and is gradually increasing in developing countries. Obesity is a condition in which excess fat has accumulated in the body to the extent that health can be pessimistically exaggerated. Obesity is generally defined as a body mass index (BMI) of 30 kg / m² or more Overweight and obesity are associated with various diseases, particularly diabetes mellitus (type 2), cardiovascular diseases, osteoarthritis, some types of cancer and obstructive sleep apnea (Poobalan *et al*, 2016) [2].

The incidence and prevalence of diabetes and cardiovascular disease in India increasing and is a result of dietary habits and life style. In adults the prevalence of diabetes is 2-3 folds greater in urban than in rural population. National surveys showed that there has been a marked decrease in under nutrition and significant increase in the prevalence of overweight and obesity, more specifically among the urban populations of India (Singh *et al*, 1995) [4].

Glucose synthesizes fatty acid that constitute body fat content.

An increase in blood glucose level will result in increase in BMI causing increased lipid biosynthesis and hence body weight. Insulin which is secreted from beta cells of islets of langerhans from pancreas act through specific cell receptor of insulin sensitive cells which results in enhanced glucose uptake into the cell. Since body weight is associated with BMI, it may be expected that BMI should correlate with blood glucose levels (Nelson and Cox, 2005) [5].

Material and methods

The present study was conducted in the Baghpat district. Baghpat is a town of NCR and a Municipal board in Baghpat district in western Uttar Pradesh, India. The sample was taken from urban areas of Baghpat and Baraut.

For the study 2000 women age between 21 to 60 years were selected. All 2000 subjects were from four age groups and these age groups were 21 to 30 years (group1), (group 2)31 to 40 years, 41 to 50 years (group 3) and 51-60 years (group 4). Sample selection was done in such way so that each category should have 500 samples for making even sample distribution in all groups.

Inclusion Criteria

Subjects of either gender between 20-60 years and not taking any antidiabetic drugs.

Exclusion Criteria

Patients suffering from diseases like liver disease, renal disease, cardiac disease, respiratory disease or any other acute or chronic diseases as well as patients suffering from AIDS, thyroid disorder, psychiatric illness or on insulin therapy were

also excluded. Pregnant women are also not included in the study.

For the collection of blood sample, tourniquet was applied in the arm and blood was taken from antecubital vein of the patient. The collected blood was allowed to clot for 30 minutes. Serum was separated from cells and collected in a separate labeled aliquot vial. Fasting blood glucose measurement was done in morning after 12-hour fast using laboratory kits. A fasting blood sugar level above 126 mg/dl was confirmed as diabetic. Weight was recorded to nearest 0.5 kg and height was recorded to nearest 0.5 cm. Height was measured in standard standing position without shoes by using a tape meter, while keeping shoulders in erect position. Body mass index (BMI) was calculated by the formula weight (kg)/height² (meter²). Subjects with a BMI of 18- 24.5 kg/m² were classified as normal weight, ≥ 25 Kg/m² were classified as overweight and those with a BMI >25 Kg/m² were defined as obese.

Statistical analysis

ANNOVA and cross tabulation was used to perform statistical calculation using SPSS. P value less than 0.05 was considered significant. The data were expressed as mean \pm SD. Chi square test was used to perform statistical calculation using

SPSS.

Results

Out of total women in the age group I (21-30) years, 51.8% women were non diabetic and having normal body mass index and 5.2% women were normal and diabetic. 10% women were found to overweight and non-diabetic, 4.2% women were underweight and non-diabetic. 10% of diabetic women were overweight and diabetic and 19.6% of the diabetic patients were obese. Age group II (31-40) years was found that 44.2% women were found to have normal BMI and non-diabetic, 4.6% women were underweight and non-diabetic. 14.6% of diabetic women were overweight and diabetic and 22.8% of the diabetic women were obese. Age group III (41-50) years was found that 39.8% women were found to have normal BMI and non-diabetic, 4.8% women were underweight and non-diabetic. 14.6% of diabetic women were overweight and diabetic and 24% of the diabetic women were obese. Group IV (51-60) years was found that 19.2% of diabetic women were overweight and diabetic and 23% of the diabetic women were obese. 35.8% women were found to have normal BMI and non-diabetic, 4% women were underweight and non-diabetic. 30% women had normal body mass index and diabetes.

Table 4.10.2: Categories of fasting blood glucose level in females of various age groups

	Group I (21-30 years)	Group II (31-40 years)	Group III (41-50 years)	Group IV (51-60 years)
60-100 (mg/dL) Normal	91.2% (456)	36% (180)	54% (270)	44% (220)
>100-126 (mg/dL) pre diabetic	8.4% (42)	49.4% (247)	30.8% (134)	28.8% (144)
>126 (mg/dL) diabetic	0.4% (2)	14.6% (73)	19.2% (96)	27.2% (136)

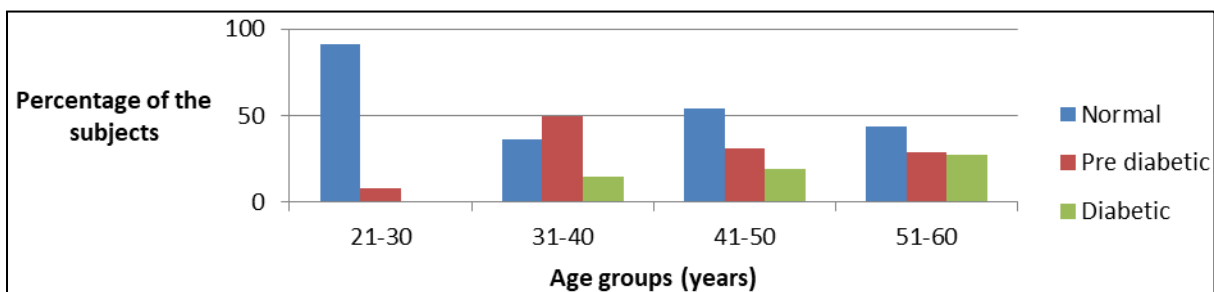


Fig 4.10.1: Categories of fasting blood glucose level in females of various age groups

In age group I (21-30 years) it was found that most of the females (91.2%) having normal fasting blood glucose only 8.8% were having diabetes. Group II (31-40 years), there was 49.4% females were having pre diabetes and 14.6% females were diabetic. In group III (41-50 years) there were 54%

females having normal fasting blood glucose and 30.8% female were pre diabetic and 19.2% were diabetic while group IV (51-60 years) had 28.8% of the females were pre diabetic and 27.2% had diabetes.

Table: Mean Fasting blood glucose and BMI of females in various age groups

		Age groups			
		Group I (21-30 years)	Group II (31-40 years)	Group III (41-50 years)	Group IV (51-60 years)
Fasting blood glucose (mg/dL)	(Mean \pm SD)	85.22 \pm 29.8	92.08 \pm 23.5	99.10 \pm 21.9	95.51 \pm 25.0
Body Mass Index (wt/ht ²)	(Mean \pm SD)	22 \pm 3.43	25.85 \pm 3.25	26.00 \pm 3.62	25.59 \pm 3.47

Table 1: Diabetes mellitus in (body mass index) BMI classes with different age groups

Age group		Pre diabetes or diabetes % (no.)	Normal % (no.)	Chi square test
Group I (21-30 years)	Under weight (<18.50)	4.2 (21)	4.2 (21)	269.90**
	Normal (18.50-24.99)	5.2 (26)	51.8 (259)	
	Overweight (≥25.00)	10 (50)	3 (15)	
	Obesity (≥30.00)	19.6 (98)	2 (10)	
Group II (31-40 years)	Under weight (<18.50)	4 (22)	4.6 (23)	258.14**
	Normal (18.50-24.99)	4.8 (24)	44.2 (221)	
	Overweight (≥25.00)	14.6 (73)	2.4 (12)	
	Obesity (≥30.00)	22.8 (114)	2.2 (11)	
Group III (41-50 years)	Under weight (<18.50)	4 (20)	4.8 (24)	232.40**
	Normal (18.50-24.99)	5.8 (29)	39.8 (199)	
	Overweight (≥25.00)	16 (80)	3.2 (16)	
	Obesity (≥30.00)	24 (120)	2.4 (12)	
Group IV (51-60 years)	Under weight (<18.50)	5 (25)	4 (20)	232.40**
	Normal (18.50-24.99)	6 (30)	35.8 (179)	
	Overweight (≥25.00)	19.2 (96)	4 (20)	
	Obesity (≥30.00)	23 (115)	3 (15)	

*Significant at $p \leq 0.05$, **Significant at $p \leq 0.01$

When association between BMI and diabetes was checked it was found that BMI was associated with diabetes in females of all four age groups. In group I (21-30 year age) obese females had 29.6% of females which had diabetes and high BMI. Group II (31-40 years age) 37.4% females had obese and diabetes. In group III (41-50 years age) obese subgroups

had 40% females who had diabetes and high BMI; in group IV (51-60 years age) 42.2% females had high BMI and diabetes. As the age increased the numbers of diabetic females also increased. After applying Chi square test we found significantly difference at both level ($p \leq 0.01$, $p < 0.05$) in all four age groups

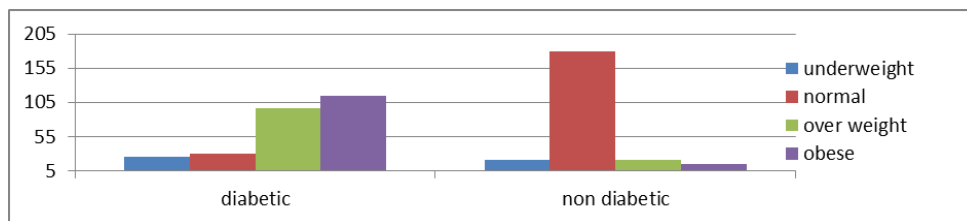


Fig 1: Diabetes status in BMI classes age group 21-30 years

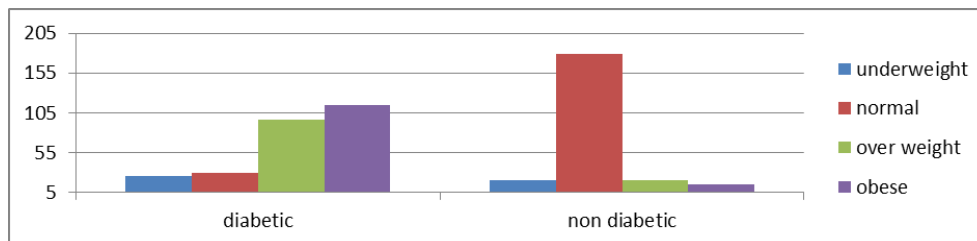


Fig 2: Diabetes status in BMI classes age group 31-40 years

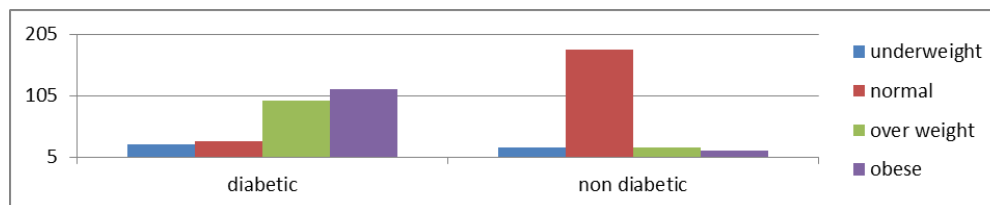


Fig 3: Diabetes status in BMI classes age group 41-50 years

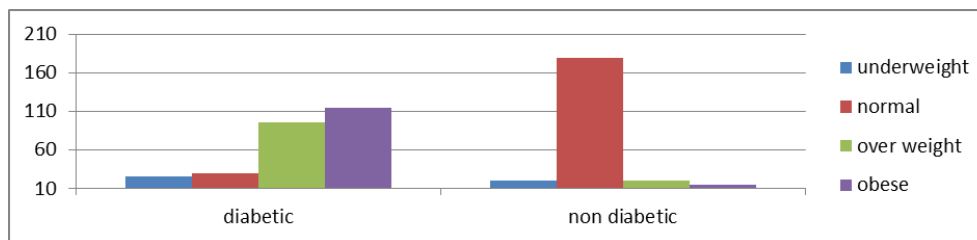


Fig 4: Diabetes status in BMI classes age group 51-60 years

Discussion

It has been observed that Indians are highly susceptible to diabetes cardiovascular risk even with only modest overweight, central obesity and decrease in physical activity.^{6, 10.} As per World Health Organization (WHO) expert group, Asians have different associations between body mass indexes, the percentage of body fat and the health risk of type 2 diabetes as compared to the other populations (Singh *et al*, 2005)^[4]. Chen *et al* (2018) was showed that obesity is the major risk factor for diabetes development as age increased body weight increased and it was highly associated with increasing diabetes in females with age. Hartemink *et al* (2006) conducted meta-analyses that detected a dose-response relationship between BMI and type 2 diabetes. It was shown that per kg/m² increase in BMI, the risk of diabetes increased and accounting for the heterogeneity among studies. Ganz *et al* (2014) was found that the risk of developing T2D for individuals who were overweight or obese was about 1.5–5 times higher than for individuals with normal BMI. Bertin *et al* (2000) found that the association between degree of obesity, body fats distribution and weight gain and diabetes. Increased BMI is an independent risk factor for the development of the risk of Type II diabetes. Shah *et al* (2006) was showed that BMI increases with age and BMI of diabetic subjects is positively correlated with age more than that in non-diabetic subjects. BMI of the diabetic subjects was found to higher than non-diabetic subjects. Ramachandran (2001)^[3] in his study showed that diabetes has a positive and independent association with age and BMI. Hossain (2017) was showed that diabetes was found to be associated with hypertension. In his study also showed that blood glucose levels in hypertensive subjects were higher than the normotensive counterpart.

Conclusion

In the present study, we have found a significant difference at both level ($p < 0.05$, $p < 0.01$) between diabetes and BMI. Food habits, intensive lifestyle modifications and regular exercise may prevent new-onset of diabetes, especially in patients with high BMI and high glucose level. This may help in prompt treatment or preventive measures to avoid future complications.

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