Research Article

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CORRELATION BETWEEN BLOOD GLUCOSE AND BODY MASS INDEX (BMI) AMONG TYPE 2 DIABETICS

Sasi Kumar S.^{1*}, Fathima latheef²

¹PhD (Nursing) Scholar in Saveetha University, Chennai, India & Professor, Vydehi Institute of Nursing Sciences, Bangalore, Karnataka, India

²Principal, Colombia College of nursing, Bangalore, Karnataka, India

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***Corresponding author**

E-mail: sashwya@rediffmail.com

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ABSTRACT

Diabetes mellitus is becoming a major health care challenge in India as well as in this world. Type 2 diabetes is related with obesity, physical inactivity, and dietary changes which lead to metabolic syndrome susceptibility. The presence of metabolic syndrome in diabetics can be predicted by assessment of anthropometric parameters and blood glucose. The present study was done to find a correlation between blood glucose and body mass index among type 2 diabetics residing in a selected rural community village, Bengaluru. Purposive sampling technique was used to select 138 type 2 diabetics. Body weight, height and blood glucose were measured. Data gathered were analyzed and interpreted using both descriptive and inferential statistics. The study results showed there was a significant positive correlation between blood glucose and body mass index ($r=0.554$, $p<0.001$) in type 2 diabetics.

Keywords: body mass index, blood glucose, type 2 diabetics

INTRODUCTION

India is in a process of rapid economic development and modernization with changing life style factors and it has an increasing trend of diabetes¹. Obesity is a frequent co-morbid condition and major potentially modifiable risk factor for type 2 diabetes²⁻³. Obesity has reached epidemic proportions globally with more than 1 billion adults are overweight and 300 million adults are clinically obese⁴. The mechanism of obesity that induces insulin resistance is poorly understood. But adipocytes secrete several biological products such as leptin, TNF- α , free fatty acids, resistin, and adiponectin that modulate insulin secretion, insulin action and body weight and may contribute to insulin resistance⁵. Obesity, classified as body mass index ≥ 30 kg/m², is a known predictor of type 2 diabetes⁶. Body mass index (BMI) is the most useful epidemiological measure of obesity. A person can be categorized as underweight if his/her BMI is ≤ 18.5 , as normal weight if his/her BMI is in the range of 18.5–24.9, as overweight if his/her BMI is between 25 to 29.9 and as obese if his/her BMI is ≥ 30 (WHO)⁷⁻⁸.

MATERIALS AND METHODS

The present study adopted, descriptive research with correlational design to determine the relationship between blood glucose and body mass index in type 2 diabetics. The study was conducted in selected villages in Kannamangala rural community, Bengaluru. After obtaining permission from the institutional ethical committee of Saveetha University (008/01/2015/IEC/SU) and Vydehi Institute of Medical Sciences (VIEC/2015/APP/098) the data collection was carried out. 138 type 2 diabetics were selected who met inclusion criteria by purposive sampling methods. The study inclusion criteria were (a) both male and female aged between 30-65 years diagnosed

with type 2 diabetes (c) willing to participate in the study (d) available at the time of data collection and (e) who can read and understand Kannada. Semi-structured interview schedule was used to collect the baseline information which includes age, gender, religion, educational profile, occupation, family type, dietary pattern, habits of addiction and associated health problems. Standard weighing machine and measuring tape were used to assess the weight and height respectively. Bio-physiological measures such as, measuring tape, weighing machine were calibrated. Reliability of the tools was established. Hence the tools were found to be reliable. The survey was done to select the participant's eligibility criteria. A total of 162 participants with type 2 diabetes were identified. Out of which 138 subjects who met study criteria were included. Following consent process participants were completed demographic profile. In this study, Type 2 diabetes is defined to include all diagnosed type 2 diabetics based on self-reported response and health records. Participants' height was recorded to nearest 0.05 cm and weight was recorded to nearest 0.5 kg and BMI was computed from height and weight (kg/m²) measured using standard methods. Later each participant was made to sit comfortably and 2ml of venepuncture blood was collected and delivered to the laboratory for estimation of glycated HbA1c blood glucose. There were 9 dropouts in the study; finally, 127 were included for statistical analysis.

Statistical analysis

Chi-square and Yates correction was used to find the association and Pearson r test was used to find the correlation between blood glucose and BMI. P value < 0.05 was considered as significant. All the analysis is carried out by using SPSS 16.0 version.

Table 1: frequency and percentage distribution of the participants according to the demographic data.

Sl.No	Demographic Variable	Frequency (f)	Percentage (%)
1.	Age (in years)		
	35-39	8	6.30
	40-44	50	39.37
	45-49	40	31.49
	50-54	18	14.17
	55-59	11	8.66
2.	Gender		
	Male	55	43.31
	Female	72	56.69
3.	Religion		
	Hindu	95	74.80
	Muslim	18	14.17
	Christian	14	11.02
4.	Educational profile		
	Primary	40	31.5
	Secondary	74	58.27
	Higher Secondary	11	8.66
	Undergraduate	02	1.57
5.	Occupation		
	Farmer/coolie	86	67.72
	Private employee	22	17.32
	Homemaker	19	14.96
6.	Type of family		
	Joint family	15	11.81
	Nuclear family	112	88.19
7.	Dietary pattern		
	Vegetarian	16	12.60
	Pure vegetarian	4	3.15
	Mixed diet	107	84.25
8.	Habits of addiction		
	a.Smoking status		
	Non-Smoker	83	65.35
	Smoker	26	20.47
	Ex-smoker	18	14.17
9.	b. Alcohol status		
	No	111	87.40
	Yes	16	12.60
10.	c. Use of Tobacco		
	No	101	79.53
	Yes	26	20.47
11.	Associated health problems		
	Nil	80	62.99
	Glaucoma and HT	07	5.51
	Cataract and HT	06	4.72
	Hypertension (HT)	34	26.77
12.	Body Mass Index		
	Under weight	07	05.51
	Normal weight	33	25.98
	Over weight	79	62.20
	Obese	08	06.30

Table 2: Association of Body Mass Index with selected demographic variables in type 2 diabetics

S.No	Demographic Variable	Body Mass Index				Chi-square (yates)	P value
		Under weight	Normal weight	Over weight	Obese		
1.	Age (in years)					19.087	0.086 NS
	35-39	00	02	03	03		
	40-44	02	11	35	02		
	45-49	02	09	28	01		
	50-54	01	04	11	02		
	55-59	02	07	02	00		
2.	Gender					8.441	0.037 S
	Male	02	07	41	05		
	Female	05	26	38	03		
3.	Religion					15.89	0.014 S
	Hindu	05	25	64	01		
	Muslim	00	04	09	05		
	Christian	02	04	06	02		

4.	Educational profile						
	Primary	03	11	22	04		
	Secondary	04	16	51	03	7.662	0.568
	Higher Secondary	00	06	04	01		NS
	Undergraduate	00	00	02	00		
5.	Occupation						
	Farmer/coolie	05	18	61	02		
	Private employee	01	12	05	04	17.932	0.006
	Homemaker	01	03	13	02		S
6.	Type of family						
	Joint family	04	05	03	03	16.94	0.001
	Nuclear family	03	28	76	05		S
7.	Dietary pattern						
	Vegetarian	04	08	04	00		
	Pure vegetarian	00	04	00	00	25.152	0.001
	Mixed diet	03	21	75	08		S
8.	Habits of addiction						
	a.Smoking status						
	Non-Smoker	05	27	48	03		
	Smoker	02	05	17	04	7.403	0.285
	Ex-smoker	00	01	14	01		NS
9.	b. Alcohol status						
	No	07	31	67	06	1.495	0.683
	Yes	00	02	12	02		NS
10.	c. Use of Tobacco						
	No	04	21	73	03	18.752	0.001
	Yes	03	12	06	05		S
11.	Associated health problems						
	Nil	02	19	58	01		
	Glaucoma and HT	02	03	02	00	32.35	0.001
	Cataract and HT	03	02	00	01		NS
	Hypertension (HT)	00	09	19	06		
S-Significant ; NS-Non significant							

Table3: Association between blood glucose and demographic variables among type 2 diabetics

S. No	Demographic Variable	HbA1c level (Mean=8.82)		Chi-square	P value
		Below mean (66)	Above mean (61)		
1.	Age (in years)				
	35-39	06	02		
	40-44	18	32		
	45-49	24	16	10.492	0.003
	50-54	14	04		S
	55-59	04	07		
2.	Gender				
	Male	27	28	0.57	0.322
	Female	39	33		NS
3.	Religion				
	Hindu	51	44		
	Muslim	06	12	3.467	0.177
	Christian	09	05		NS
4.	Educational profile				
	Primary	17	23		
	Secondary	41	33	1.751	0.626
	Higher Secondary	06	05		NS
	Undergraduate	02	00		
5.	Occupation				
	Farmer/coolie	51	35	5.741	0.057
	Private employee	08	14		NS
	Homemaker	07	12		
6.	Type of family				
	Joint family	09	06	0.441	0.51
	Nuclear family	57	55		NS
7.	Dietary pattern				
	Vegetarian	11	05		
	Pure vegetarian	03	01	1.734	0.42
	Mixed diet	52	55		NS
8.	Habits of addiction				
	a.Smoking status				
	Non-Smoker	52	31		
	Smoker	11	15	11.633	0.003
	Ex-smoker	03	15		S

9.	b. Alcohol status				
	No	60	51	0.215	1.535
	Yes	06	10		NS
10.	c. Use of Tobacco				
	No	49	52	0.125	2.357
	Yes	17	09		NS
11.	Associated health problems				
	Nil	39	41		
	Glaucoma and HT	02	05	2.783	0.426
	Cataract and HT	03	03	0.426	NS
	Hypertension (HT)	22	12		
S-Significant, NS-Non significant					

Table 4: Correlation coefficient of HbA1c with Body Mass Index

Parameter	Pearson correlation coefficient	P value
BMI	0.554	<0.001

RESULTS

Subject demographic characteristics

The data presented in Table 1 shows that frequency of participants based on their demographic data. Out of 127 subjects, 72(56.69%) were female and 55 (43.31%) were male. With regards to age majority of them 50 (39.37%) were belongs to 40-44 years. Majority of them i.e. 95(74.8%) were belongs to Hindu religion. With regards to education 74 of them (58.27%) had secondary education. 67.72 percent of them were working as a farmer/coolie and most of them i.e. 85.04% were employed. With regards to type of family majority of 112 (88.19%) were belongs to nuclear family. Most of them followed mixed diet (84.25%), non-smoker (65.35%), and no alcohol drinking habits (87.40%). Most of them (79.53%) were not using tobacco. With regards to associated health problems majority 80(62.99%) of the participants don't had any other associated diseases and 47(37%) of them had hypertension. With regards to body mass index majority of them were overweight 79 (62.20%) followed by normal weight 33 (25.98%), obese 8(6.3) and underweight 7 (5.51%).

Table 2 shows that association of body mass index with demographic data. There was significant association of body mass index with gender, religion, occupation, type of family, dietary pattern, tobacco use and associated health problems. Meanwhile there was no significant association of Body Mass Index with age, education profile, financial status, and smoking and alcohol habits. Data presented in Table 3 shows that there was significant association of blood glucose with age, habits of addiction and there was no significant association with other demographic variables. Table 4 shows that there was a positive correlation between BMI and HbA1c ($r=0.554$) ($p<0.001$).

DISCUSSION

Individual with impaired fasting glucose and prone to develop overt diabetes tend to gain visceral fat more selectively than subcutaneous fat, compared with those who remained non-diabetic. This could be sustained by defects in adipogenesis or specificities in adipose tissue morphology, independently of body fat level and obesity plays a causal part in the pathogenesis of type 2 diabetes⁹. The demographic findings of the present were supported by Sujatha PH et al¹⁰. The present study reveals that there was a significant positive correlation between BMI, and blood glucose. These findings are consistent with other study done by Adamuet al¹¹ which support a strong relationship between BMI and blood glucose. The studies conducted on different population groups are also shown there was a positive relation between BMI and diabetes¹²⁻¹⁴. In conclusion gaining weight related to fasting glucose has higher incidence of

metabolic abnormalities. Unfortunately, majority of individual with diabetes are not aware these changes brought about by diabetes mellitus. Health professionals should create awareness among type 2 diabetics about reason for increasing body weight, changes in blood glucose level, and risk for the development of metabolic syndrome. Since the results of the present study also clearly show that increase in blood glucose level is more likely to relate with body mass index. Therefore, early screening with early intervention is most importance to reduce metabolic risk factors. Interventions like relaxation therapy, mindfulness meditation are necessary to manage body weight and control diabetes and its related complication. Further, the present study was recommended that interventional study can be done on reduction of blood glucose, and among type 2 diabetics.

CONCLUSION

The study finding shows that there was positive correlation between blood glucose and body mass index. In conclusion increase blood glucose associated with increasing weight gain among diabetics and prone to develop metabolic syndrome as it can lead to enormous health cost. So, the concerted effort must take to control blood glucose level and reduce weight gain. It also can be done through the complementary therapies such as walking, aerobic exercises, yoga and mindfulness exercise/training programme which is cost effective and no side effect.

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