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MICROVASCULAR AND MACROVASCULAR PROBLEMS IN INDIVIDUALS WITH TYPE 2 DIABETES MELLITUS WHO ARE OVERWEIGHT AND NORMAL

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ABSTRACT

Background: Along with type 2 diabetes mellitus, obesity and overweight are regarded as significant independent risk factors for cardiovascular illnesses. However, there is a dearth of information on obesity and diabetic consequences.

Aim: The purpose of this study was to evaluate the macrovascular and microvascular consequences in individuals with type 2 diabetes mellitus who were overweight and non-obese as well as those who were overweight and obese.

Methods: 168 individuals with type 2 diabetes mellitus who visited the Institute during the study period were evaluated in this study. Following WHO guidelines for Asian participants, each subject's BMI was evaluated and they were split into two groups: obese/overweight and non-obese/overweight. The subjects' duration of diabetes and level of control were evaluated. In accordance with American Diabetes Association recommendations, each participant's macrovascular and microvascular problems were evaluated. Obese/overweight diabetics and individuals with normal BMI were evaluated for complications.

Results: Of the 168 study participants evaluated, 90 (or 53.57%) were female. 66.6% (n=112) of the participants were overweight or obese. 10.71% of diabetics with a normal BMI and 26.79% of those who were overweight or obese developed retinopathy. With a p-value of less than 0.05, Ischemic Heart Disease (IHD) was observed in 28.57% (n=16) and 46.42% (n=52) of participants with normal BMI and those who were overweight or obese, respectively.

Conclusion: According to the current study, individuals with type 2 diabetes mellitus who are overweight or obese are at a higher risk of developing complications, including ischemic heart disease and retinopathy. Additionally, diabetes people who are overweight or obese have poor glycemic control. Microvascular problems arise early in people with diabetes who are overweight or obese.

Keywords: type 2 diabetes, obesity, and complications from macrovascular disease Retinopathy and microvascular complications

INTRODUCTION

Obesity is characterized by an excessive or aberrant buildup of fat in the body's adipose tissues to the point that it may be harmful to one's health. Obesity has been shown to raise the chance of developing a number of illnesses and other health issues. Nearly 30-65% of adult Indian urban residents are overweight or obese, making obesity a major worldwide health pandemic. Obesity and type 2 diabetes mellitus have been found to be closely related.

According to statistics from the literature, type 2 diabetes mellitus and obesity are both independent risk factors for cardiovascular diseases, making them significant contributors to the mortality and morbidities brought on by atherogenic microvascular and macrovascular disorders.[2]

However, not every individual with type 2 diabetes mellitus is overweight or obese. Body mass index, or BMI, offers the most practical indicators of obesity. High body mass index has also been linked to increased endothelial dysfunction, which is a key contributor to the development of thrombosis and atheroma plaque.[3] There is little

information currently available in the literature regarding the association between obesity and microvascular complications of diabetes.[4]

Therefore, evaluating macrovascular and microvascular consequences in individuals with type 2 diabetes mellitus who were overweight and non-obese as well as overweight and obese was the goal of the current investigation.

MATERIALS AND METHODS

Assessing macrovascular and microvascular problems in overweight and non-obese individuals as well as overweight and obese individuals with type 2 diabetes mellitus was the goal of the current observational cross-sectional investigation. The study participants came from the Institute's medicine department. Prior to participation, all individuals gave their written and verbal informed consent.

According to American Diabetes Association (ADA) guidelines5, the study evaluated participants who were 20 years of age or older, attended the Institute during the designated study period, and had a verified diagnosis of type 2 diabetes mellitus. Subjects under the age of 20 who refused to participate in the study were excluded.

Following the study participants' final inclusion, information was collected using a structured proforma, including each subject's height and weight, which was then used to determine their body mass index, or BMI. A typical stadiometer was used to measure height in centimeters while standing upright with the back straight, feet near to one another, and arms at the side. In contrast, a standard analogue weighing machine was used to measure weight in kilograms when standing.

A person's BMI was calculated by dividing their weight in kilograms by their height in meters squared (kg/m2). In individuals over 20, normal, overweight, and obese people have BMIs of 18–22.9 kg/m2, 23-24.9 kg/m2, and >25 kg/m2. The glycemic control status of each participant was evaluated. ADA criteria for diabetic control were 80–130 mg/dL, postprandial glucose <180 mg/dL, and HbA1C <7.0.

In accordance with ADA standards, microvascular and macrovascular problems were also evaluated. Autonomic, motor, and sensory neuropathy were the three types of neuropathy evaluated in microvascular complications. Eye conditions such as retinopathy and macular edema were evaluated by specialists in the field of ophthalmology.

With a thorough history, distal symmetric sensory polyneuropathy was evaluated using the following methods: vibration perception and 10-g monofilament for large-fiber function evaluation, temperature and pinprick sensation for small-fiber function evaluation, and 10-g monofilament for protective sensation evaluation. When monofilament failed to detect four out of ten stimulations over the bilateral soles, it was interpreted as positive. Sudomotor dysfunction with increased or decreased sweating, neurogenic bladder, erectile dysfunction, fecal incontinence, constipation, gastroparesis, orthostatic hypotension, resting tachycardia, and hypoglycemia unawareness were all indicators of diabetic autonomic neuropathy.

A lower estimated glomerular filtration rate (eGFR) and/or the presence of albuminuria without indications of other major causes of kidney impairment were used to diagnose nephropathy. With the aid of a mobile application, eGFR was computed using the CKD-EPI creatinine equation (2021) based on plasma creatinine, age, gender, and race. 6 Using completely and semi-autoanalyzer ERBA TransAsia machines with corresponding kits based on the spectrophotometric technique principle, serum creatinine and blood sugar levels were measured.

Cerebrovascular disorders were evaluated using non-contrast computed tomography brain, clinical evaluation, and history for macrovascular complications, while changes in electrocardiograms (ECGs), clinical evaluation, and history were used to evaluate coronary heart diseases.

The collected data was statistically evaluated using the Student t-test, ANOVA (analysis of variance), Turkey post hoc analysis, Chi-square test, and SPSS (Statistical Package for the Social Sciences) software version 24.0 (IBM Corp., Armonk, NY, USA) for evaluating descriptive measures. To evaluate correlation across different factors, the Pearson correlation coefficient was employed. The findings were presented as frequency, percentages, mean, and standard deviation. A p-value of less than 0.05 was taken into account.

RESULTS

Assessing macrovascular and microvascular problems in overweight and non-obese individuals as well as overweight and obese individuals with type 2 diabetes mellitus was the goal of the current observational cross-sectional investigation. 168 individuals with type 2 diabetes mellitus who visited the Institute during the study period were evaluated in this study. The current study included 90 females and 78 males. The majority of the 78 male respondents (53.8%) were between the ages of 40 and 60, with 12.82% of the participants being older than 60. The bulk of the 90 female participants in the study were over 60, with 35.6% of them being between 40 and 60.

Eleven percent of females under 40 years old had diabetes. In terms of macrovascular and microvascular problems, out of the 168 patients evaluated in the study, 33.3% (n=56) were non-obese and 66.6% (n=112) were overweight and obese/overweight. With a 0.03 difference, it was statistically significant. Both non-obesity and obese overweight study participants had similar mean ages (p=0.04). Males made up 53.57% (n=30) and 42.86% (n=48) of the non-obese overweight and obese overweight subjects (p=0.07), while 46.43% (n=26) and 57.14% (n=64) of the obese overweight and obese overweight subjects (p=0.08) (Table 2).

According to the study's findings, the mean creatinine levels of non-obese overweight participants were considerably lower than those of obese overweight participants (1.2 and 2.10, respectively, with p=0.001). Both non-obese overweight and obese overweight participants had statistically similar levels of retinopathy, mean GFR, nephropathy, neuropathy, CVA, and ischemic heart disease (p=0.06, 0.06, 0.2, 0.6, 0.5, and 0.05).

For both non-obesity overweight and obese overweight participants, the mean duration of microvascular problems was 5.54 and 5.72 years, respectively. This difference was not statistically significant (p=0.4). Table 2 shows that the mean duration of macrovascular problems was 8.54 years for non-obesity overweight participants and 6.46 years for obese overweight subjects, with p=0.04.

Macrovascular problems were observed in 74% of non-obese overweight patients and 60% of obese/overweight subjects with type 2 diabetes mellitus when glycemic control was evaluated. 72% of non-obese overweight patients and 65% of obese/overweight subjects experienced microvascular problems (Table 2).

DISCUSSION

168 individuals with type 2 diabetes mellitus who visited the Institute during the study period were evaluated in this study. The current study included 90 females and 78 males. The majority of the 78 male respondents (53.8%) were between the ages of 40 and 60, with 12.82% of the participants being older than 60. The bulk of the 90 female participants in the study were over 60, with 35.6% of them being between 40 and 60. Eleven percent of females under 40 years old had diabetes. These findings were similar to those of earlier research by Poirier P et al. (2006) and Tomic M et al. (2003), in which the authors evaluated participants with demographic information similar to the current study in their study participants who had diabetes and were overweight.

Out of the 168 patients evaluated, 33.3% (n=56) were non-obese and 66.6% (n=112) were overweight, according to the study's findings on macrovascular and microvascular problems in obese/overweight and non-obese overweight subjects. With a 0.03 difference, it was statistically significant. Both non-obesity and obese overweight study participants had similar mean ages (p=0.04). Males made up 53.57% (n=30) and 42.86% (n=48) of the non-obese overweight and obese overweight subjects (p=0.07), while in the obese overweight and obese overweight individuals, there were 46.43% (n=26) and 57.14% (n=64) (p=0.08).

These findings were in line with research by De Block CE et al. (2005) and Nag T et al. (2013), who also reported macrovascular and microvascular complications in obese/overweight and non-obese overweight subjects that were comparable to the current study.

Compared to obese overweight patients, the mean creatinine levels of non-obese overweight subjects were considerably lower (1.2 and 2.10, respectively; p=0.001). Both non-obese overweight and obese overweight participants had statistically similar levels of retinopathy, mean GFR, nephropathy, neuropathy, CVA, and ischemic heart disease (p=0.06, 0.06, 0.2, 0.6, 0.5, and 0.05). For both non-obesity overweight and obese overweight participants, the mean duration of microvascular problems was 5.54 and 5.72 years, respectively. This difference was not statistically significant (p=0.4).

Both the non-obese overweight and obese overweight participants experienced macrovascular problems for an average of 8.54 and 6.46 years, respectively, with a p-value of 0.04. These results were consistent with those of Agarwal AK et al. (2011) in 2013 and Agarwal AK et al. (2012) in 2009, where the authors likewise noted non-significant variations between the laboratory parameters of overweight diabetics who were obese and those who were not.

According to the evaluation of glycemic control in research participants with type 2 diabetes mellitus, 74% of non-obese overweight patients and 60% of obese/overweight persons experienced macrovascular problems. 72% of non-obese overweight patients and 65% of obese/overweight subjects experienced microvascular problems.

These findings were consistent with those of Duby JJ et al. (2013) and Chawla A et al. (2013), who also reported similar results to the current study in their investigations on the relationship between microvascular and macrovascular complications and glycemic control in study participants with type 2 diabetes mellitus.

CONCLUSION

Considering its limitations, the present study concludes that being overweight and obese are linked to an increased risk of complications in subjects with type 2 diabetes mellitus, particularly ischemic heart disease, and retinopathy. Also, there is poor glycemic control in obese/overweight diabetic subjects. There is an early appearance of microvascular complications in overweight/obese diabetics.

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S. No	Category	Non-obese overweight		Obese overweight		Total	p-value
		n	%	n	%		
1.	**Total n (%)**	56	33.3	112	66.6	168	**0.03**
2.	**Mean age**	54.62		57.21		-	0.4
3.	**Gender**						
a)	Males	30	53.57	48	42.86	78	0.07
b)	Females	26	46.43	64	57.14	90	0.08

4.	**Mean creatinine**	1.2		2.10		-	**0.001**
5.	**Retinopathy**	6	10.71	30	26.79	36	0.06
6.	**Mean GFR**	69.55		57.89		-	0.06
7.	**Nephropathy**	20	35.71	52	46.43	72	0.2
8.	**Neuropathy**	30	53.27	58	51.79	88	0.6
9.	**CVA**	8	14.28	14	12.5	22	0.5
10	**Ischemic heart disease**	16	28.57	52	46.42	68	0.05
11	**Microvascular complications mean duration**	5.54		5.72		-	0.4
12	**Macrovascular complications mean duration**	8.54		6.46		-	0.04

Table 1: Microvascular and macrovascular complications in obese/overweight and non-obese overweight subjects in the study

S. No	Poor glycemic control in diabetics with complications	Obese/overweight	Non-obese/overweight
1.	**Macrovascular complications**	60%	74%
2.	**Microvascular complications**	65%	72%

Table 2: Glycemic control in study subjects with type 2 diabetes mellitus