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Original Research Article

Study and Correlation of Anthropometric Indices & Lipid Profile in 300 Patients of Type 2 Diabetes Mellitus with Obesity at Tertiary Care Hospital

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Abstract

Background: Diabetes is globally a fast-growing public health concern with its effect on individuals, healthcare system and economy of nations. Central or abdominal obesity is associated with metabolic disorders.

Aims and Objective: To correlation of BMI, WHR & lipid profile in obese type 2 Diabetic patients.

Methods: Cross-sectional observational study, comprised 300 confirmed cases of type 2 diabetes obese were assessed clinically from November 2017 to October 2019 for BMI and WHR and investigated for Total Cholesterol, Triglyceride and LDL.

Results: Out of 300 patients of Type 2 diabetic and obese, 174 were male and 126 were female. Most commonly affected age group in male patients were 5th decade of life (35%) and in female patients' 4th decade of life (33%). 179 out of 205 class1 obese patient in which 96(32%) were male and83(27.7%) female patients,65 out of 75class 2 obese patient in which 45(15%) were male and 20(6.67%) were female patients and 18 out of 20 class 3 obese patient in which 12(4%) were male and 6(2%) were females; have abnormal WHR. There is statistically positive correlation between abnormal levels of Total cholesterol, TG, LDL and WHR in all class obesity patients.

Conclusion: Dyslipidemia is quite prevalent in type 2 diabetic obese patients. This study showed that the atherogenic markers such as increased LDL-c and Triglycerides correlated more strongly and significantly with WHR than with BMI. So WHR can be good anthropometric indices than BMI to predict cardio metabolic risk in type 2 Diabetic obese patients.

Keywords: Body mass Index, Waist hip ratio, Diabetes Mellitus, Lipid profile.

Introduction

Diabetes is globally a fast growing public health concern[1]. In line with the latest information from the International Diabetes Federation, 451 million adults worldwide have diabetes; this number is predicted to touch the 693 million figure by 2045[2]. India accounted for nearly one sixth of global diabetes burden in 2011 with about 62 million of people affected by diabetes which is projected to rise to 101 million by 2030[1,2]. Asian countries have the highest number of people with diabetes. Because of genetic variation and high vulnerability to environmental factors, classified via a low Body Mass Index, central obesity, excessive body fat proportion and a high degree of insulin resistance, the population of Asian Subcontinent faces higher risk for diabetes and its complications[3,4]. BMI is frequently used to categorize individuals as underweight, normal, overweight and obese[5] and obese patient further classified on basis of BMI AS CLASS 1 OBESITY (30-34.9), CLASS 2 OBESITY(35-35.9) & CLASS 3 OBESITY (>40).

High BMI (Body mass Index) has a 2 times greater risk of developing Type2 DM compared to low BMI. The results showed that general obesity had risk of 2.24 times while abdominal obesity had risk of 2.44 times for occurrence of Type2 DM[6]. In Type2 Diabetic patients' abnormalities of lipid metabolism can be found in the form of dyslipidemia. Dyslipidemia is a disorder of lipid metabolism characterized by an increase or decrease in lipid fraction in the plasma. The main lipid fraction abnormalities include increase in total cholesterol, triglycerides, low density lipoprotein and decrease high density lipoprotein. Dyslipidemia caused by Type2 DM is secondary dyslipidemia[7]. Type 2 DM is characterized by impaired insulin secretion, insulin resistance, excessive hepatic glucose production, and abnormal fat metabolism[8]. Obesity, particularly visceral or central (as evidenced by the waist hip ratio), is very common in type 2 DM (80% or more are obese).

Insulin resistance, the decreased ability of insulin to act effectively on target tissues (especially muscle, liver, and fat), is a prominent feature of type 2 DM and results from a combination of genetic susceptibility and obesity[9]. The influence of obesity on type 2 diabetes mellitus is determined not only by the degree of obesity but also by where fat accumulates. Increased upper body fat including central obesity, as reflected in increased abdominal girth or waist-to-hip ratio, is associated with the metabolic syndrome, type 2 diabetes, and cardiovascular diseases[10].

Aims and Objectives

The objective of our study was:

1. To evaluate BMI and WHR of Type2 Diabetic obese patient.
2. To analyze lipid parameters in patients with type 2 diabetic obese patient.
3. To correlate BODY MASS INDEX, Waist Hip ratio and serum Lipid profile in type 2 diabetic Obese patient.

Materials and Method

This observational cross-sectional study includes 300 Type 2 diabetic obese patients who satisfied the inclusion criteria, and this study was carried out in Department of General Medicine. AMCMET MEDICAL College, Ahmedabad from November 2017to January 2019. Informed written consent was obtained from every participant and the study was approved by the institutional ethics review committee. The confirmed cases will be finally analyzed and assessed clinically and by appropriate lab investigations. BMI was calculated as weight in kilograms divided by the square of height in meters. BMI = Weight(kg)/height (m2). We had taken patient who set in the criteria for obesity in which BMI >_30KG/M2 and classified

into: Class 1(30.0-34.9kg/m2), Class 2 (35.0-39.9kg/m2), Class 3 (more than 40 kg/m2). We measured waist circumference according to The WHO STEP wise Approach to Surveillance (STEPS) which provides a simple standardized protocol for measuring waist circumference which instructs that the measurement to be taken at the approximate midpoint between the lower margin of the last palpable rib and the top of the iliac crest (WHO, 2008b).

Hip circumference was measured around the widest portion of the buttocks. The ratio of the waist circumference and hip circumference was used to calculate WHR. The threshold cut-off values adopted for WHR ≥0.90 for males and ≥0.85 for females in obesity. Venous blood samples were collected after an overnight fasting in the patients for lipid profile. Value is calculated according to Fried Ewald equation=Total cholesterol-(HDL-TG/5). The cut-off values taken for dyslipidemia according to National Cholesterol Education Program Adult Treatment Panel III criteria: Total cholesterol (TC)≥ 200mg/dl,Low density lipoprotein (LDL-C)≥ 100mg/dl, Triglycerides (TG)≥ 150mg/dl, High density lipoprotein (HDL-C)< 40mg/dl male &<50mg/dl in female.

Statistical Analysis

Data entry was done in MS Excel 2010 and analysis of data was done using SPSS. Continuous variables were reported as mean and standard deviation. Categorial variables were reported as number and percentages. p-values <0.05 were considered statically significant.

Results

A study was carried out to analyze the correlation of BMI, waist Hip ratio & Serum Lipid profile in 300 patients having type 2 diabetes and obesity in AMC MET MEDICAL College. In our study 174(58%) patients were Male and 126 (42%) patients were Female. So, more no. of patients was of Male gender. Among them most commonly affected age group in male patients were 5th (51 -60) decade of life (35%) and in female patients' 4th (41 -50) decade of life (33%). In malesClass1 and class2 obesity is found most frequently in 51-60 years of age & class 3(Morbid) obesity is most commonly seen in 41 -50 (2%) years and 61-70 (2%) years of age group. In females, Class 1 obesity is found most frequently in 41-50years of age, while class 2 obesity most commonly seen in 51-60 years &class 3(Morbid) obesity is most commonly seen in 31-40 (1%) years and 61-70(1%) years of age group.

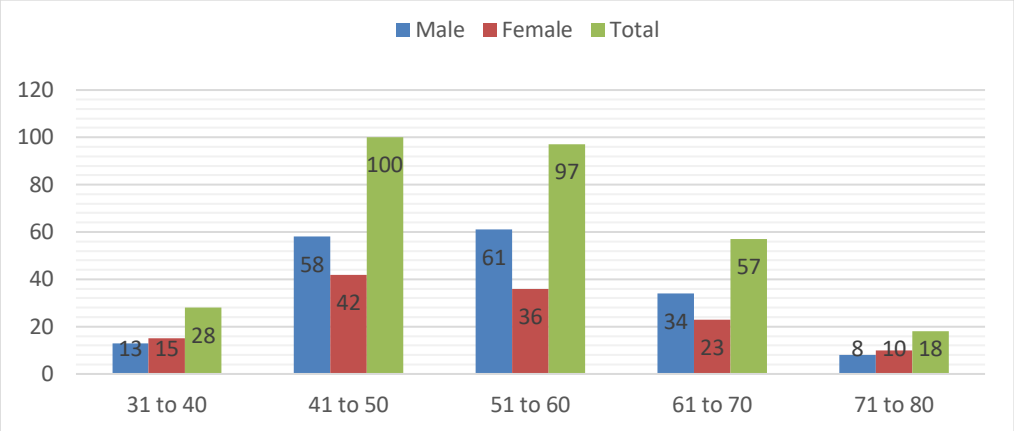

Figure 1: Age wise distribution with gender

Most commonly affected age groups in male were 5th decade and in female 4th decade of life.

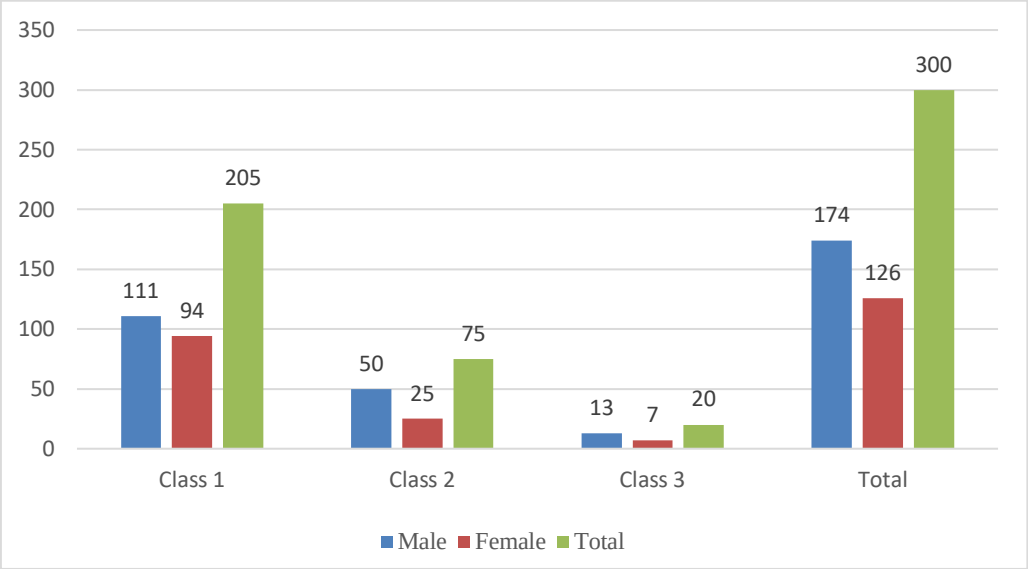

Figure 2: Distribution of patient according to obesity classes as per BMI

111 out of 205 male patients and 94 out of 205 female patients were under class 1 obesity.50 out of 75 male patients and 25 out of 75 were under class 2 obesity and 13 out of 20 male patients and 7 out of 20 female patients belonged to class 3 obesity.

Table 1: Distribution of Patient According to Obesity Classes as per BMI.

	Male	Female	Total
Class1	**111(37%)**	**94(30%)**	**205(67%)**
Class2	**50(17%)**	**25(10%)**	**75(27%)**
Class3	**13(4%)**	**7(2%)**	**20(6%)**
Total	**174(58%)**	**126(42%)**	**300**

Class 1 obesity were 67%, class 2 obesity were27 % and class 3 (morbid obesity) were 6%

Table 2: Correlation Between Waist Hip Ratio and BMI in Male & Female Patients.

BMI (34.22±3.14)	**ABNORMAL WHR**		**NORMAL WHR**	
	MALE (>0.9)	**FEMALE) (>0.85)**	**MALE (<0.9)**	**FEMALE (>0.85)**
CLASS 1	**96(32%)**	**83(27.7%)**	**15(5%)**	**11(3.7%)**
CLASS 2	**45(15%)**	**20(6.67%)**	**5(1.67%)**	**5(1.67%)**
CLASS 3	**12(4%)**	**6(2%)**	**1(0.33%)**	**1(0.33%)**
TOTAL	**153(51%)**	**109(36.3%)**	**21(7%)**	**17(5.7%)**

According to our study,179 out of 205 class1 obese patient in which 96(32%) were male and83(27.7%) female patients,65 out of 75class 2 obese patient in which 45(15%) were male and 20(6.67%) were female patients and 18 out of 20 class 3 obese patient in which 12(4%) were male and 6(2%) were females; have abnormal WHR.

Table 3: Correlation of BMI and Total Cholesterol, Triglyceride and LDL in total study patients.

Obesity classes according to BMI	TOTAL CHOLESTEROL (mg/dl) (258.67±50.3)			**TRIGLYCERIDE** (mg/dl) (248.98±77.96)			**LDL (mg/dl) (219.64±51.26)**		
	<200	>200	P value	<150	>150	P value	<100	>100	P value
Class 1	35 (11.7%)	170 (56.7%)	**0.046**	**24** (8%)	**181** (60.33 %	**0.631**	**28** (9.33 %	**177** (59%)	**0.030**
Class 2	7 (2.33%)	68 (22.7%)	**0.152**	**11** (3.7%)	**64** (21.3%)	**0.477**	**4** (1.33 %	**71** 23.6%	**0.070**
Class 3	1 (0.33%)	19 (6.3%)	**0.218**	**2** (0.7%)	**18** (6%)	**0.741**	**1** (0.33 %	**19 (6.3%)**	**0.373**
Total (300)	43 (14.3%)	257 (85.7%)		**37** (12.4%)	**263** (87.6%)		**33** (11%)	**267** (89%)	

There is statistically positive correlation between normal and abnormal cholesterol in all class 1 obesity patients while in class 2& class 3 obesity patients show statistically negative correlation between BMI and total cholesterol value. No statically significant correlation seen between normal and abnormal TG level in all class of obesity. But there is statically significant correlation seen between normal and abnormal LDL level in all class of obesity.

Table 4: Correlation of WHR and Total Cholesterol, Triglyceride and LDL in Total Study Patients.

Gender	**WHR (cm)**	**TOTAL CHOLESTEROL (mg/dl)** (258.67±50.3)		**TRIGLYCERIDE (mg/dl)** (248.98±77.96)		**LDL (mg/dl) (219.64±51.26)**	
		<200	**>200**	**<150**	**>150**	**<100**	**>100**
Male (n=174)	**<0.9**	**9 (5%).**	**12 (7%)**	**6 (3%)**	**15 (9%)**	**7 (4%)**	**14 (8%)**
	>0.9	**10 (6%)**	**143 (82%)**	**8 (5%)**	**145 (83%)**	**9 (5.2%)**	**144 (82.8%)**
Female (n=126)	**<0.85**	**6 (5%)**	**11 (9%)**	**8 (6%)**	**9 (7%)**	**1 (0.8%)**	**16 (12.7%)**
	>0.85	**18 (14%)**	**91 (72%)**	**15 (12%)**	**94 (75%)**	**16 (12.7%)**	**93 (73.8%)**
Total (n=300)		**43 (14%)**	**257 (86%)**	**37 (12%)**	**263 (88%)**	**33 (11%)**	**267 (89%)**

There is statistically positive correlation between abnormal levels of Total cholesterol, TG, LDL and WHR in all class obesity patients.

Discussion

Our study examined correlation between BMI, WHR and serum lipid profile in type 2 diabetic obese patient. The study subjects were divided into several groups based on age, gender, BMI, WHR below and above threshold cut off values, and with normal and abnormal lipid profiles. As per our study, we found that patient belonging to class 1 obesity were 67%, class 2 obesity were27 % and class 3 (morbid obesity) were 6% (table 1&chart 2) which also matching with Study at Bansal et al[11] shows 37.5% patient were obese under study population, among obese 78.4% patient had class1 obesity, 17.6%had class 2 obesity and 3.9 %had class 3 obesity (morbid obesity). Another study conducted by Biadgo et al[12] and S choi et al[13] positive correlations were seen between WHR and TC in type 2 diabetics which matches with findings of our study (table 2 & table 4).

There is statistically positive correlation (p value 0.046) in class 1 obesity patients while in class 2& class 3 obesity patients show statistically negative correlation between BMI and total cholesterol value. (Class 2 p value0.152) (class 3 0.124) (table 3). Another study conducted by Bansal et al[11] shows statistically in significant correlation between BMI and Total cholesterol. Another study conducted by Raminderpalsingh et al[14] shows statistically significant correlations were not seen between BMI and TC (p = 0.856) in the total population. So, BMI alone is not only tool to stratify patient for Dyslipidemia & BMI is not predictor for high serum cholesterol value.

In class 1 obesity (p value 0.631), class 2 obesity (p value 0.477), and 3 obesity (p value 0.7414) shows statistically negative correlations between BMI and TRIGLYCERIDES in our study, which is comparable to Study conducted by Bansal et al[11]. Another study conducted by Raminderpalsingh et al[14] shows statistically insignificant correlations between BMI and TG in the total population.

Our study shows class 1 obesity positive correlation (p value 0.03078) & class 2 obesity (p value 0.0703) & class 3 obesity (p value 0.373) negative correlations between LDL and BMI, which is comparable to another study done by Raminderpalsingh et al[14] which shows statistically insignificant correlations between BMI and LDL-C (p value 0.832) in the total population.

In our study, we found that 257(86%) out of 300 patients has altered TC value. Among them 143male patients & 91 female patients had altered (>200mg/dL) TC value and altered WHR.(m>0.9,f>0.85) so significant positive correlation was observed between WHR and TC in males(p value 0.00001) & insignificant correlation in female.(p value 0.0672) Which is compared to Study done by Raminderpal Singh Sibia et al[14] significant positive correlation was observed between WHR and TC in males(p value 0.002), while significant correlations was not seen between WHR and TC(p value 0.918) in females.

In our study, there is positive correlation was observed between WHR and TG in diabetic males (p= 0.0002),) and in diabetic females (0.0009) which is comparable to another study done by Raminderpal Singh Sibiaet al[14] shows positive correlation was observed between WHR and TG in males(p< 0.001) & insignificant

correlations found between WHR and TG(p=0.131)in female patient.

In our study we found positive correlation between WHR and LDL in male patient (<0.00001) and insignificant in female (p value 0.322) which is comparable to study conducted by Sandhu et al[15].

In present study, it was observed that dyslipidemia is quite prevalent in type 2 diabetic obese patients and the most commonly affected lipid parameter was LDLc followed by TG followed by total cholesterol, another study conducted by Bolre et al[16] and Pokharel et al[17] show elevated LDLc followed by hypertriglyceridemia.

Conclusion

In present study, it was observed that dyslipidemia is quite prevalent in type 2 diabetic obese patients. This study showed that the atherogenic markers such as increased LDL-c and Triglycerides correlated more strongly and significantly with WHR than with BMI. So WHR can be good anthropometric indices than BMI to predict cardio metabolic risk in type2 Diabetic obese patients. But the key limitations of a study were small sample size and there is lack of consistency between anthropometry and lipid profile in various studies.

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