

## Original Research Article

## Lipid Profile of Hypertensive Type 2 Diabetic over weight and Obese Patients in Bangladeshi Population

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**Abstract:** Diabetes mellitus, a major health concern throughout the world, is often coexisting with obesity, hypertension and dyslipidemia. Several studies have shown that dyslipidemia and hypertension are the major two contributing risk factors of CVD. But interplay among them still to be elucidated. So the present study was aimed to evaluate the lipid abnormalities among hypertensive-overweight to obese type 2 diabetic Bangladeshi population. Hypertension was defined as systolic blood pressure (SBP)  $\geq 140$  mmHg and/or diastolic (DBP)  $\geq 90$  mmHg. Obese and overweight was defined as BMI (30.0-34.9 and 25.0-29.9). Demographic and clinical data, body mass index (BMI) and fasting blood samples were taken to estimate the lipid profile. Serum glucose was estimated by glucose oxidase, Serum total cholesterol (T Chol), Serum high density lipoprotein-cholesterol (HDL-c), Serum triglycerides (TG) by enzymatic colorimeter test and serum low density lipoprotein-cholesterol (LDL-c) was determined by using Friedwald's formula. Appropriate statistical tools were used to calculate statistical difference using SPSS for windows Version 10. All the study subjects were aged matched. Body mass index (BMI) in all groups was significantly higher compared to the controls ( $P < 0.001$ ). Serum TG level were significantly higher in over weight hypertensive type 2 diabetics (HTDOW) and obese hypertensive type 2 diabetics (HTDOB) patients compared with their overweight and obese counterpart respectively ( $P < 0.001$ ,  $P = 0.007$ ). In over weight type 2 DM subjects, the mean TG level was higher ( $P = 0.041$ ) in hypertensive male and female as compared to their normotensive counterpart. On the other hand, in Obese DM subjects, Mean TG level was significantly higher only in hypertensive females as compared to normotensive females and males ( $P = 0.001$  and  $P = 0.049$  respectively). Serum Total cholesterol level didn't show any significant difference among the study subjects except obese-hypertensive type2 DM female subjects as compared to normotensive female counterpart ( $P = 0.008$ ). From the above study, it can be concluded that dyslipidemia especially hypertriglyceridemia exists in hypertensive overweight to obese type2 DM. Hypertriglyceridemia may be associated with hypertension.

**Keywords:** Diabetes mellitus, cholesterol, Hypertriglyceridemia

### INTRODUCTION

Diabetes mellitus, a major health concern throughout the world, contributing significantly to mortality and morbidity, thus adversely affect the quality and length of life. The incidence and prevalence of type 2 diabetes are increasing [1, 2], it is projected that the total number of people with diabetes will rise from 171 million in 2000 to 366 million by 2030 [1]. This life threatening disease is often coexisting with obesity, hypertension and dyslipidemia [3]. But interplay among them still to be elucidated.

The number of adults with hypertension is predicted to increase by 60% to a total of 1.56 billion people by 2025. It affects approximately 70% of patients with diabetes and is approximately twice as common in persons with diabetes as in that without [4]. The prevalence of coexistent hypertension and diabetes varies across different ethnic, racial, and social groups. Importantly, hypertension in patients with diabetes causes a significant increase in the risk of vascular complications in this population, and together both conditions predispose to chronic kidney disease [5, 6]. The overlap between hypertension and diabetes substantially increases the risk of ischemic

cerebrovascular disease, retinopathy, and sexual dysfunction [7]. Type2 DM is also associated with dyslipidemia [8]. Several studies have shown that dyslipidemia and hypertension are the major two contributing risk factors of CVD. Hypertension is also associated with obesity [9] which are characterized by dyslipidemia [10]. But the factors contributing the hypertension in overweight to obese subjects are not fully known. Moreover, life style and genetic factors contribute to both hypertension and diabetes [11]. Like other developing countries, in Bangladesh, the prevalence of obesity and type2 DM is increasing day by day due to urbanization. These further exaggerating the hypertensive condition. So the present study is designed to determine BMI and lipid abnormalities (T Cholesterol, HDL-c, LDL-c, and TG) in overweight to obese hypertensive type 2 DM in Bangladeshi population.

## SUBJECTS AND METHODS

### Materials and Methods:

#### Place of the study

The study was conducted in the biochemistry Laboratory, Chattagram Ma Shishu-O-General Hospital, Agrabad, Chittagong.

#### Study design

It was a Case control study. The subjects were selected on the availability in the hospital.

#### Types of study

This study was prospective which was based on current data. It is very reliable data. This data are stronger.

#### Study Subjects

Total 603 subjects were included in this study. There was no specific predilection for race, religion and socioeconomic status. The study subjects comprised of the following four groups: Overweight T2DM Hypertensive (HTDOW) 101 subjects, over weight T2DM with normal Blood pressure (NTDOW) 136, Obese T2DM Hypertensive (HTDOB) 46, Obese T2DM with normal Blood pressure (NTDOB) 97, Control 223 subjects

#### Collection of the subjects

Subjects were collected on every working day from 9 to 10am from the outdoor of the biochemistry Lab in the CMOSGH. Nature and method of the study were clearly detailed to the individual and also the close associate. All the planned information obtained and recorded.

#### Inclusion Criteria Cases:

Diabetes mellitus, Age 25 to 80years, Pressure  $\geq 140/90$ , over weight to Obese patient and for Control Healthy subjects, No diabetes, Age 25 to 80years, Pressure  $\leq 140/90$

#### Exclusion criteria

Subjects with serious co-morbid diseases (infection, stroke, myocardial infarction, major surgery, malabsorption etc.), pregnant or with history of using drugs significantly affecting glucose metabolism (glucocorticoids, oral contraceptives containing levonorgestrel or high-dose estrogen, phenytoin, high-dose thiazide diuretics etc.) were excluded.

#### Development of Questionnaire

A questionnaire was developed to obtain relevant information of demographic and socio-economic data such as age, educational status, and occupational status. The questionnaire also included anthropometric data, drug and medical history and clinical information. The questionnaire were coded and pre-tested before finalization. The questionnaire was both closed and open ended.

#### METHODS:

The importance of a health check-up and assessment of cardiovascular risk factors was explained. The volunteers had administered the structured questionnaires. After verifying the questionnaire, the doctors measured the height, weight (without heavy clothing and shoes), and blood pressure for each participant. All potential participants were requested not to eat anything after 20:00 h and to attend the clinic at Chittagong between 8:00 and 10:00 h on the following day. Venous blood samples (5 ml) were taken for blood analysis. All measurements were done in the laboratory of Chattagram Ma O Shishu General Hospital.

#### Measurement of blood lipids

Venous blood samples were drawn into ethylenediaminetetra-acetic acid containing vacuum tubes with minimum stasis. Plasma lipids were measured by enzymatic-colorimetric method: Plasma total cholesterol (CHOD-PAP), triglycerides (GPO-PAP) methods. The high density lipoprotein (HDL) cholesterol was measured by phosphotungstic-precipitation method. The low density lipoprotein (LDL) cholesterol was calculated by the Friedewald equation, given that none had TG level above 400 mg/dl.

#### STATISTICAL ANALYSIS

Values for the continuous variables are expressed as mean  $\pm$  SD. Comparisons of males and females with type 2 DM, and those with hypertension and type 2 DM against their non-diabetic and hypertensive non-diabetic counterparts were performed using unpaired students t tests for independent samples; a level of  $P < 0.05$  was considered as statistically significant. Statistics were computed using SPSS 11.5 (SPSS Inc., Chicago, IL, USA).

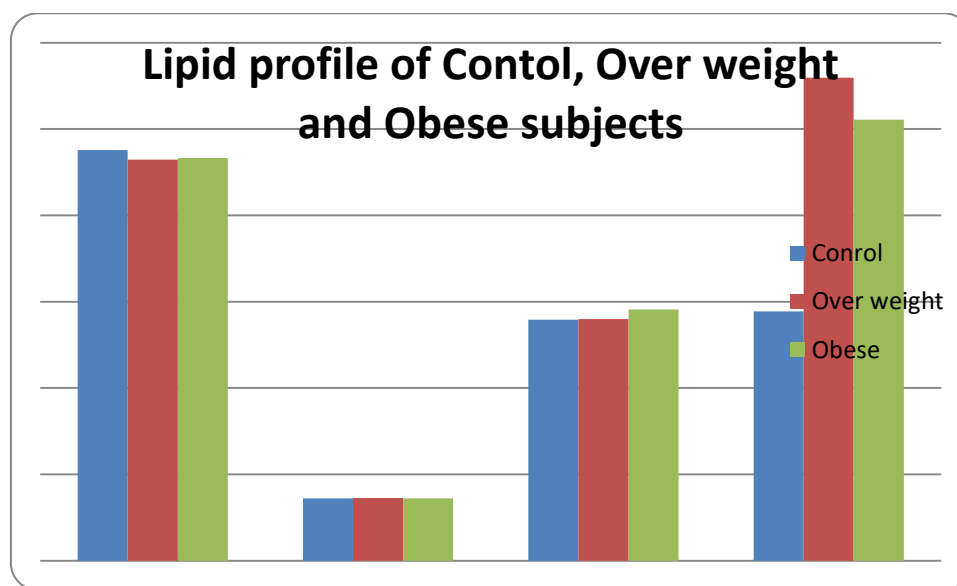
**OBSERVATION AND RESULTS**

Serum lipid levels of patients with overweight & obese type 2 diabetes mellitus having hypertension were evaluated and compared with that of other diabetic patients without hypertension. In this study, age matched 603 subjects were studied: 237 over weight type2 diabetic, 143 obese Type 2 diabetics and 223 non-diabetic subjects. 46 of the type obese 2 diabetics were hypertensive (HTDOB), of which 20 were females (%) and 26 were males (%). 101 of the overweight diabetic subjects were hypertensive (HTDOW), of which 45 were females (%) and 56 were males (%) [Table 1]. The mean TG concentrations were higher in over weight type 2 diabetics (HTDOW) and obese type 2 diabetics (HTDOB) with hypertension patients, compared with overweight and obese normotensive diabetic subjects, respectively ( $P < 0.001$ ,  $P = 0.007$ ) [Table 2]. Age, BMI, Fasting Blood Sugar (FBS) and blood sugar 2h after breakfast (ABF) were significantly higher in the hypertensive groups compared to normotensive groups.

In over weight DM subjects the mean TG concentration was higher ( $P = 0.041$ ) in hypertensive

females ( $311.84 \pm 50.24$  mg/dl) than in normotensive females ( $278.24 \pm 66$  mg/dl) [Table 5]. The mean TG concentration was also higher ( $P = 0.014$ ) in hypertensive males ( $309 \pm 50$  mg/dl) than in normotensive males ( $281 \pm 64$  mg/dl) in over weight DM subjects.

Mean TG concentration in hypertensive females ( $284.65 \pm 57$  mg/dl) was higher ( $P = 0.001$ ) than in normotensive females ( $253.67 \pm 56$  mg/dl) in Obese DM subjects [Table 6]. It was higher ( $P = 0.049$ ) in hypertensive males ( $280.60 \pm 60$  mg/dl) than in normotensive males ( $249 \pm 59$  mg/dl) in obese DM subjects. Total cholesterol in overweight, obese DM hypertensive groups showed no difference compared to the overweight, obese DM normotensive in both the male and female subjects. But TC was significantly higher ( $P = 0.008$ ) in obese DM hypertensive group than the obese DM normotensive female subjects (table 6). No significant difference was observed for HDL and LDL in any of the hypertensive group compared to the respective normotensive groups



**Fig: Lipid profile of Control, over weight and Obese subjects**

**Table 1: Characteristics of the Control, Obese and Overweight subjects**

Subjects		Age (year)	BMI ( $\text{Kg/m}^2$ )	FBS (mg/dl)	ABF (mg/dl)
Control 223		$50.35 \pm 12.36$	$22.02 \pm 1.76$	$5.23 \pm 0.78$	$6.71 \pm 0.79$
Diabetic Obese	HTN (46)	$52.43 \pm 9.85$	$32.55 \pm 2.12^{**}$	$10.19 \pm 3.12^{**}$	$14.82 \pm 3.74^{**}$
	NBP (97)	$49.86 \pm 12.22$	$27.34 \pm 1.24^{**}$	$9.14 \pm 2.99^{**}$	$13.19 \pm 3.99^{**}$
Diabetic over weight	HTN (101)	$49.76 \pm 9.46$	$27.42 \pm 1.26^{**}$	$9.40 \pm 2.97^{**}$	$13.39 \pm 3.92^{**}$
	NBP (136)	$49.83 \pm 9.54$	$32.22 \pm 1.67^{**}$	$9.38 \pm 2.69^{**}$	$13.96 \pm 3.53^{**}$

$^{**}P < 0.001$

**Table 2: Lipid profile of the Overweight and Obese DM subjects**

DM subjects		TChol (mg/dl)	HDL-c (mg/dl)	LDL-c (mg/dl)	TG (mg/dl)
Over weight	HTN (n=101)	237.83 ±33.9	36.16±5.43	139.49±28.78	310.92±50.01
	NBP (n=136)	232.24 ±38.10	36.21±5.37	139.91±33.59	279.75±65.10**
Obese	HTN (n=46)	242.88±39.99	36.71±5.18	148.59±39.40	285.51±62.32
	NBP (n=97)	233.25±39.08	36.10±4.93	145.57±38.21	255.35±61.83*

\*P&lt;0.05, \*\* P&lt;0.001

**Table 3: Characteristics of the Obese and Overweight hypertensive and normotensive DM male subjects**

Male	Control	Diabetic Obese		Diabetic over weight	
		Hypertensive 26	Normal BP 46	Hypertensive 45	Normal BP 59
Age(year)	52.74±12.38	57.61±8.68	52.11±10.17	53.6±9.64	53.6±10.35
BMI	22.76±1.22	32.20±2.18**	32.32±1.90**	27.68±1.25**	27.50±1.25**
FBS(mmol/l)	5.16±0.85	9.32±1.56**	9.14±1.94**	9.44±2.88**	8.97±2.59**
ABS(mmol/l)	6.62±0.82	13.77±2.79**	13.78±3.40**	13.83±3.99**	13.22±3.76**

**Table 4: Characteristics of the Obese and Overweight hypertensive and normotensive female subjects**

Female	Control	Diabetic Obese		Diabetic over weight	
		Hypertensive 20	Normal BP 51	Hypertensive 56	Normal BP 77
Age(year)	48.02±11.94	45.7±6.79	47.78±8.52	46.67±8.17	47±12.82
BMI	21.30±1.90	33.01±1.98**	32.14±1.43**	27.21±1.24**	27.21±1.23**
FBS(mmol/l)	5.29±0.74	11.32±4.18**	9.60±3.22**	9.38±3.06**	9.26±3.28**
ABS(mmol/l)	6.79±0.74	16.19±4.40**	14.12±3.67**	13.04±3.87**	13.16±4.18**

\*\* P&lt;0.001

**Table 5: Comparison of the mean lipid profile of overweight type 2 diabetic hypertensive and normotensive males and females**

Over weight DM subjects		T Chol (mg/dl)	HDL-c (mg/dl)	LDL-c (mg/dl)	TG(mg/dl)
Male	HTN (n=45)	236±32.62	36.20±5.15	139.38±27.62	309±50
	NBP (n=59)	231±35.64	36.51±5.63	139.16±31.11	281±64*
Female	HTN (n=56)	239.15±35.14	36.14±5.70	139.57±29.83	311.84±50.24
	NBP (n=77)	233.19±40.10	35.97±5.19	140.48±35.56	278.24±66.20**

\*P&lt;0.05, \*\*P&lt;0.001

**Table 6: Comparison of the mean lipid profile of obese type 2 diabetic hypertensive and normotensive males and females**

	Obese DM subjects	TChol (mg/dl)	HDL-c (mg/dl)	LDL-c (mg/dl)	TG (mg/dl)
Male	HTN (n=26)	229.71±43.42	36.16±4.27	135.49±41.56	280.18±60.28
	NBP (n=46)	228.75±40.16	35.73±4.74	140.68±40.58	249.21±59.32*
Female	HTN (n=20)	256.00±27.59	37.43±6.21	165.63±29.37	284.65±56.94
	NBP (n=51)	237.32±38.03	36.44±5.12	149.97±35.77	253.67±55.99*

\*P&lt;0.05, \*\*P&lt;0.001

## DISCUSSION

Type 2 DM, a major health concern throughout the world is often associated with cardiovascular morbidity and this may be explained by the abnormal lipid profile which is sometimes a feature of diabetes [3]. Diabetes is a risk factor of hypertension, also associated with Obesity [9]. But factors associated with hypertension in overweight to obese type2 DM are not fully elucidated. Moreover, dyslipidemia, an influencing risk factor of obesity [10], also has relationship with hypertension[12]. Debate still exists

among the interrelationships of these factors. Racial variation has found to influence various factors. Like other countries, In Bangladeshi population, prevalence of obesity and Type2 diabetes has been increasing in an alarming way. So the present study has been design, to get a better insight on the interplay between dyslipidemia and hypertension in overweight to obese with type2 diabetic subject.

A total 603 number of subjects have been recruited in this study. Among them 110 served as

control. Fasting serum glucose has been found significantly higher among the groups compared to control, supported by several studies [13]. Serum total cholesterol (TC), triglycerides (TG) and LDL level found to be significantly higher in all the groups compared to control. This confirms dyslipidemia in all the overweight and obese type2 diabetic groups, supported by several studies (130). Moreover, the findings of raised triglyceride level found to be significantly higher than some other study of Bangladeshi population by Shahadat *et al.* [14] and Saha *et al.* [15] are in good agreement with the prospective studies carried out in Stockholm [16]. In accordance with other studies; the most common recognized abnormality was hypertriglyceridaemia. However, type2 DM patient with overweight and obesity containing hypertension showed higher TG value than their diabetic counterpart. The findings of our study in type2 diabetes patients suffering from hypertension and other cases (diabetes patients with obese, diabetes patients with overweight) are consistent with several studies which found significantly higher concentration of serum triglyceride as compared with control [17]. The possible explanation for this is the dominance of overweight and obesity (both generalized and abdominal) among our patients. It was found that hypertriglyceridaemia was four times more in overweight and obese patients [13]. Some researchers associate the high triglyceride level to the poor glycaemic control of diabetes [18]. The increase in triglycerides in poorly controlled patients was related to the decrease of activities of adipose tissue and muscle lipoprotein lipase activity [13]. Elevated serum triglycerides in diabetic patients with hypertension may be the result of increased hepatic production of triglycerides and / or a reduction in their catabolism. In the presence of insulin resistance, inhibition of lipolysis is less pronounced in NIDDM. This results in hyperinsulinemia and increased TG from high levels of free fatty acids [19].

In our study, no significant difference was observed in HDL-C levels compared with control, supported by the study of O'Brien *et al.* [20] in different subjects but opposed by the Framingham study, where subjects are most often a heart attack with hypertriglyceridemia with decreased HDL

Both in over weight and obese type 2 DM subjects, the mean TG level were significantly higher in hypertensive male and female as compared to their normotensive counterpart. Serum Total cholesterol level didn't show any significant difference among the study subjects except obese –hypertensive type2 DM female subjects as compared to normotensive female counterpart (P=0.008).

## CONCLUSION

From the above study, it can be concluded that dyslipidemia especially hypertriglyceridemia exists in hypertensive overweight to obese type2 DM. Hypertriglyceridemia may be associated with hypertension in type 2 DM. To do this, it is necessary to take care of all the factors that may be associated with diabetes and hypertension for hope to overcome complications of atherosclerosis in essential hypertension-NIDDM association.

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