A COMPARISON OF ANTHROPOMETRIC MEASURES (BODY MASS INDEX) AND SERUM LIPIDS (CHOLESTEROL AND TRIGLYCERIDES) IN NORMOTENSIVE AND HYPERTENSIVE TYPE 2 DIABETICS.

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Abstract.
Aim: A study was undertaken at the Jos University Teaching Hospital, to determine the effect of hypertension on the lipids of type 2 diabetics.

Methods: Consecutive sex-marched and closely age-marched normotensive and hypertensive diabetics had their lipids and BMI compared.

Results: Sixty-two pairs of patients were evaluated; 37.1% of the hypertensive diabetics had high fasting serum triglycerides compared to 24.2% of normotensive diabetics. 46.8% of normotensive diabetics had high fasting serum total cholesterol compared to 38.7% of hypertensive diabetics. Overall, more hypertensive diabetics had lipid disorder than normotensive diabetics.

Hypertensive diabetics had a statistically significantly higher BMI than the normotensive diabetic patients.

Conclusion: From the study, hypertension seems to increase the presence of lipid abnormality in diabetics. Increased BMI and hypertriglyceridaemia in hypertensive diabetics may suggest the presence of the metabolic syndrome (Syndrome X) in the hypertensive diabetics.

Key words: Body mass index, Serum Lipid, Hypertension

Introduction:
Hypertension in diabetes mellitus can occur as a complication or it can coexist with the diabetes particularly in type 2 diabetic patients[1]. Diabetes mellitus and hypertension are disorders that may involve lipid disorder. Hypertension alone may be associated with hyperlipidaemia, while diabetes is either associated with hyperlipidaemia or dyslipidaemia, especially in poorly controlled cases. The lipid abnormalities can be of great concern among the interventional measures of either condition as these abnormalities can further worsen large vessel complication of type 2 diabetes[2]. It is a known fact that treatment of hypertensives with thiazides increases serum lipid levels and thiazides also inhibit pancreatic Islet-cell insulin release leading to abnormal glucose metabolism in form of glucose intolerance. This abnormal glucose metabolism may progress to diabetes in those without diabetes or it worsen the diabetes of those who are diabetic before starting thiazides. Diabetes on its own is associated with increased serum lipids[3]. The co-existence of the two conditions may be expected to worsen the disorder, if already present, as it is not all cases of hypertension or diabetes that have lipid abnormalities at presentation. A study was carried out at the Jos University Teaching Hospital to compare the lipid abnormalities of patients with poorly controlled type 2 diabetes and poorly controlled hypertensive type 2 diabetes at presentation. We also compared their body mass indices and also found out if there was any relationship between their body mass indices and lipid abnormalities and to find if there is

any contribution of the hypertension to the lipid abnormality in the diabetics.

Materials and methods:
The study was carried out on consecutive type 2 diabetic patients, attending the diabetes clinic of the Jos University Teaching Hospital from January to August 2000. It consisted of two groups of type 2 diabetic patients: one group consisting of normotensive diabetics while the second group were hypertensive diabetics. These were marched for sex and closely marched for age. The body mass index (BMI) was calculated and a BMI of less than 27kg/m^2 was considered acceptable. BMI between 27 and 29.9kg/m^2 was regarded as overweight and above 30kg/m^2 was regarded as obesity. The fasting serum cholesterol and triglycerides levels were estimated. Serum lipid disorder was present when the fasting serum total cholesterol level obtained was greater than or equal to 5.2mmol/l, and the fasting serum triglyceride level obtained was greater than or equal to 1.8 mmol/l. Hypercholesterolaemia and hypertriglyceridaemia were classified as mild, moderate and severe.

Statistical analysis:
Means were compared using the student's t-test. Relationships were tested using the simple moment correlation co-efficient. The level of significance was placed at $P<0.05$ of a two-tailed distribution table.

Results:
There were 124 consecutive type 2 diabetic patients seen during the study period: Sixty-two pairs for each group (normotensive and hypertensive). There were 34 male and 28 female patients for each group. The characteristics of these patients are summarized on Table 1. There was no statistically significant difference between the ages of the female hypertensive diabetics and that of the female normotensive diabetics. Also, there was no difference in the ages of the male hypertensive diabetics and the male normotensive diabetics. There was also no age difference between the male and the female patients in either group ($P>0.10$).

The hypertensive diabetics were heavier than the normotensive diabetics. The BMI of the normotensive and hypertensive male diabetics were similar; so also was that of the normotensive and hypertensive female diabetics ($P>0.10$). The hypertensive diabetic male patients had a similar BMI to that of the hypertensive diabetic female patients ($P>0.10$).

Total serum cholesterol and triglycerides were similar for both hypertensive and normotensive diabetics ($P>0.10$). There was no statistically significant difference between the normotensive male and female patients, and the hypertensive male and female patients ($P>0.10$).Seventy six percent (75.8%) of all the patients had fasting total serum cholesterol and triglyceride levels within the serum reference range of less than 5.2 mmol /l. Fourty seven percent (46.8%) of the normotensive and 38.7% of the hypertensive patients had hypercholesterolaemia. This is summarized on Table 2.

Mean BMI distribution per class of lipid is summarized on Table 3. The table shows an increase in BMI as one moves from one class of lipid abnormality to another, though there may be no marked change in the amount of lipid. There was, however, no statistically significant correlation between BMI and serum triglyceride levels in all classes of lipid abnormality except in the class of hypertensives with mild hyperglyceridaemia in which there was

a positive and statistically significantl correlation. This is shown in Table 4.

Table 1: Characteristic features of Patients.

Characteristic Feature	Mean(SD)		t-value	p-value
	Normotensive Diabetics(62)	**Hypertensive Diabetics(62)**		
Age (Years)	54.4(8.2)	54.2(8.1)	0.1085	p>0.10
BMI* (Kg/m^2)	25.7(5.9)	27.5(4.8)	1.9230	P<0.05
Cholesterol (mmol/l)	5.1(1.4)	5.2(1.6)	0.2939	p>0.10

* - Statistically significant.

Table 2: Distribution of patients according to lipid levels.

Lipid Level	Frequency (%)	
	Normotensives (n=62)	Hypertensives (n=62)
Triglycerides:		
Normal levels (<1.8mmol/l)	47 (5.8%)	39 (62.9%)
Mild hyperglyceridaemia (1.8 – 2.25mmol/l)	6 (9.7%)	8 (12.9%)
Moderate hyperglyceridaemia (2.26 – 3.39mmol/l)	6.9 (7%)	12 (19.4%)
Severe hyperglyceridaemia (>3.39mmol/l)	3 (4.8%)	3 (4.8%)
Cholesterol:		
Normal levels (<5.2mmol/l)	33 (53.2%)	38 (61.3%)
Mild hypercholesterolaemia (5.2 – 6.4mmol/l)	19 (30.7%)	15 (24.2%)
Moderate hypercholesterolaemia (6.5 – 7.8mmol/l)	9 (14.5%)	6 (9.7%)
Severe hypercholesterolaemia (>7.8mmol/l)	1 (1.6%)	3 (4.8%)

Table 3: Distribution of Patients' BMI according to lipid group.

Lipid group	Mean (SD) Lipid		*Mean (SD) BMI*	
	Normotensive Diabetics	**Hypertensive Diabetics**	**Normotensive Diabetics**	*Hypertensive* Diabetics
Triglycerides:				
Normal triglycerides	1.13 (0.30)	1.12 (0.35)	25.57 (6.39)	27.43 (4.87)
Mild hyperglyceridaemia	2.12 (0.12)	2.0 (0.12)	28.40 (4.84)	25.82 (4.35)
Moderate hyperglyceridaemia	2.92 (0.64)	2.72 (0.37)	23.65 (1.91)	28.06 (4.80)
Severe hyperglyceridaemia	7.23 (3.83)	5.64 (1.41)	25.65 (5.44)	31.57 (4.81)

Cholesterol:				
Normal cholesterol	4.09 (0.75)	4.25 (0.70)	24.48 (5.86)	26.40 (4.54)
Mild hypercholesterolaemia	5.60 (0.36)	5.67 (0.46)	27.03 (5.43)	29.46 (4.73)
Moderate hypercholesterolaemia	7.43 (0.55)	7.32 (0.43)	28.18 (5.40)	31.21 (6.12)
Severe hypercholesterolaemia	–	8.59 (0.48)	–	27.94 (4.43)

Table 4: Relationship between lipids and BMI in group of lipid.

Group of lipid	R – value	P – value
Normal cholesterol:		
Normotensive	0.295	p>0.05
Hypertensive	0.062	p>0.10
Mild hypercholesterolaemia:		
Normotensive	- 0.070	p>0.10
Hypertensive*	2.202	***P<0.001****
Moderate hypercholesterolaemia:		
Normotensive	0.145	p>0.10
Hypertensive	- 0.292	p>0.10
Severe hypercholesterolaemia:		
Normotensive	-	-
Hypertensive	- 0.367	p>0.10
Normal triglycerides:		
Normotensive	0.165	p>0.10
Hypertensive	- 0.166	p>0.10
Mild hyperglyceridaemia:		
Normotensive	0.135	p>0.10
Hypertensive	0.556	p>0.05
Moderate hyglyceridaemia:		

Normotensive	0.630	p>0.10
Hypertensive	0.055	p>0.10
Severe hyperglyceridaemia:		
Normotensive	0.879	p>0.10
Hypertensive	- 0.527	p>0.10

DISCUSSION:

Normotensive diabetic patients had a lower BMI than the hypertensive diabetic patients. This may probably be due to the fact that the hypertensive patients may be exhibiting the complication of obesity by being hypertensive and diabetic. The hypertensive patients also had a higher serum cholesterol value although not to a statistically significant level. This may be due to the fact that hypertension and diabetes are coexisting, each contributing to the lipid abnormality in the particular individual, thus making the level higher. The serum triglycerides were higher, though not so statistically in normotensive than hypertensive patients. Female (normotensive and hypertensive) patients had higher total serum cholesterol than male patients. The hypertensive female patients had higher serum triglycerides than their male counterparts, while the normotensive male patients had higher serum triglycerides than the normotensive female patients, but all these were similar statistically. This finding is similar to the finding by many workers[5, 6, 7] where women are said to have a higher lipid level than men.

Increasing BMI is a factor that increases the risk of diabetes and hypertension in the normal population, so it is the likely reason for the finding of a positively statistically significant correlation between BMI and serum lipids particularly in mild hypercholesterolaemia of hypertensive patients. There was no significant correlation in other classes. This may suggest indiscriminate dietary habits.

Diabetes and hypertension, though can be complication of obesity, can exist either alone or together. Hypertension, when it co-exists with diabetes mellitus, can fascilitate the progression of microvascular and macrovascular complications of diabetes, as hypertension may worsen the lipid abnormality of diabetes.(4,8 9)

Conclusion:

The BMI of hypertensive patients was higher than that of normotensive patients. The hypertensives had also a higher prevalence of serum triglycerides than the normotensive patients. Obesity was prevalent in hypertensives and was associated with hypertriglyceridaemia but not hypercholesterolaemia. Hypertension is thought to be associated with a high serum cholesterol, so hypertensives should have more patients with elevated cholesterol but it was different in this study. Hypertension, therefore, does not seem to worsen the hypercholesterolaemia of diabetes. However, syndrome X should be thought of in obese hypertensive diabetics as these have elevated serum triglycerides.

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