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THE ASSOCIATION BETWEEN LIPID PROFILE AND WAIST TO HIP RATIOS IN TYPE-1 AND TYPE-2 DIABETIC PATIENTS – A COMPARATIVE STUDY

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ABSTRACT: BACKGROUND: Diabetes is frequently associated with dyslipidemia and Obesity is one of the major risk factors. Anthropometrical measurements like BMI and WHR were used to rule out obesity and are more practical both in the clinical practice and epidemiological studies. Dyslipidemia remains largely under diagnosed and neglected in high risk populations in both Type-1 and Type-2 diabetes. To this purpose we have evaluated the lipid profiles in young diabetic patients (Type-1 and Type-2) to correlate them with their glycemic status, body mass index and waist-hip ratio in comparison with control subjects. **METHODS:** This comparative study was conducted in 65 diabetic and 30 non-diabetic patients, who had attended either as inpatients or outpatients to medicine or endocrinology departments of tertiary care hospital at Coastal Andhra Pradesh during the period from December 2006 to October 2008. Complete history was obtained from all these patients and a thorough physical examination was done. Their height, weight, waist and hip circumferences were measured and evaluated glycemic status and lipid profiles biochemically. The data was analyzed statistically and expressed results in mean, standard deviation, unpaired t test, chi-square test **RESULTS:** The total number of patients studied was 65 diabetics in which Type-1 DM were 15 and Type-2 DM was 50; controls were: 30 in number. In Type-1 BMI of <18.5 (mean=16.60±0.91), whereas in Type 2, 56% of patients had a BMI of ≥25 with a mean of 25.44±4.23. In Type-2 DM, among 22 patients with BMI <25, 17(77.27%) had dyslipidemia and among 28 patients with BMI >25, 28(100%) had dyslipidemia. In Type-2 DM, out of 50 patients 32 (64%) patients had high W/H ratio and 18(36%) patients had normal W/H ratio. In Type-2 DM TC, TG, LDL-C, were elevated and HDL-C was reduced in Type 2 compared to controls which were statistically significant. Out of 18 well controlled patients 13(72.22%) had dyslipidemia and among 32 poorly controlled and 32 patients had (100%) dyslipidemia. **CONCLUSION:** The present study suggests that dyslipidemia was more prevalent in diabetics and was associated with poor glycemic status. It was also found that dyslipidemia was more prevalent in over weight and obese patients with Type-2 DM than non-obese patients and Type-1 Diabetics. In Type 2 DM, dyslipidemia was associated with an abnormal WHR than normal WHR.

KEYWORDS: Diabetes Mellitus (DM), Dyslipidemia, Obesity, Waist Hip Ratio (WHR), Body Mass Index (BMI).

INTRODUCTION: Diabetes is rapid gaining the status of a impending epidemic in India with more than 62 million diabetic persons presently diagnosed with the disease.⁽¹⁻²⁾ The incidence of diabetes is rising among young adults.⁽³⁾ Obesity is one of the major risk factors for diabetes, yet there has been modest research focusing on this possibility factor across India.⁽⁴⁾ an anthropometrical measurements like BMI and WHR were used to rule out obesity and are more practical both in the

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clinical practice and epidemiological studies.⁽⁵⁻⁷⁾ Diabetes is often associated with dyslipidemia and enhanced percentages of glycosylated hemoglobin. It has been reported that WHR showed important association with myocardial infarction as compared to BMI.⁽⁸⁾ Dyslipidemia is a risk factor for coronary artery disease, an important cause of morbidity and mortality in patients with diabetes mellitus. Dyslipidemia remains largely under diagnosed and neglected in high risk populations in both Type-1 and Type-2 diabetes.⁽⁹⁾ Obesity and Poor blood glucose control are the vital factors causing dyslipidemias in diabetics particularly in young.⁽¹⁰⁾ To this purpose we have evaluated the lipid profiles in young diabetic patients (Type-1 and Type-2) to correlate them with their glycemic status, body mass index and waist-hip ratio in comparison with control subjects.

METHODS: This comparative study was conducted in 65 diabetic and 30 non-diabetic patients, who had attended either as inpatients or outpatients to medicine or endocrinology departments of King George Hospital, Andhra Medical College, Visakhapatnam during the period from December 2006 to October 2008. All the patients between 18-39 yrs. including both sex were included and Patients below 18yrs and above 39yrs; Pregnant females, Patients on lipid modifying drugs, like statins, fibrates, steroids, beta blockers, thiazides, phenytoin; Patients with Chronic alcoholism and Patients with renal, hepatic and thyroid disorders were excluded from the study. Ethical committee approved the study and patient information consent was obtained prior to the study.

Complete history was obtained from all these patients and a thorough physical examination was done. Their height, weight, waist and hip circumferences were measured. Fasting blood samples were taken after an overnight fasting of 10-12 hrs. from every patient. FBS, HbA1c and lipid profile were analyzed. Other investigations like Hb, TC, DC, ESR, serum creatinine, LFT, thyroid profile and urine analysis were done as and when necessary. BMI was calculated as weight (kg) divided by height (in meters) squared as per W.H.O.⁽¹¹⁾

The circumference of the waist at the navel was measured while the patient stood relaxed and then the circumference around the hip at the point where buttocks protrude the most was measured. Waist measure was divided by hip to get the W-H Ratio. WHR>0.8 in females and >1 in males were considered abnormal. Patients were diagnosed as diabetics if they meet the ADA Criteria.

Patients were categorized as to the quality of diabetes control using standard American Diabetes Association criteria.⁽¹²⁾ For serum lipids, we referred to National Cholesterol Education Program-Adult Treatment Panel III (NCEP-ATP III) guidelines.⁽¹³⁾ HbA_{1c} was estimated by ion exchange resin method.⁽¹⁴⁾ Total Cholesterol (TC), Triglycerides (TG), High density lipoprotein cholesterol (HDL-C) were analyzed by enzymatic method using Hitachi 902 analyzer.

STATISTICAL ANALYSIS: The data was analyzed statistically and expressed results in mean, standard deviation, unpaired t test, chi-square test.

RESULTS: Total number of patients studied: 65 Number of patients with Type 1 DM: 15 Number of patients with Type 2 DM: 50; Number of controls were: 30 in number. All the patients with Type 1 diabetes had a normal W/H ratio with 60% were males and 40% were females where as in Type 2 diabetes, females were common constituting 66% and males only 34%. In Type-1 BMI of <18.5 (mean=16.60 ± 0.91), whereas in Type 2, 56% of patients had a BMI of ≥25 with a mean of 25.44±4.23. Out of 15 patients, 10 patients (66.66%) were poorly controlled and 5(33.33%) patients were under good glycemic control.

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In Type 2 DM, out of 50 patients, 32(64%) patients had poor glycemic control and 18(36%) patients had good glycemic control. 6(66.66%) out of 9 males had dyslipidemia and 5(83.33%) out of 6 females had dyslipidemia. In Type 1 DM ↑ TC, ↑ LDL-C were common in males and ↑ TG, ↓HDL were common in females but were not statistically significant ($p>0.05$). 5 well controlled patients 1(20%) had dyslipidemia and among 10 poorly controlled patients 8(80%) had dyslipidemia. In Type-1 the TC, TG, LDL-C was statistically significantly elevated and HDL was significantly reduced when compared to non-diabetics. All patients with or without dyslipidemia had normal BMI. In Type 2 DM, among 22 patients with BMI < 25, 17(77.27%) had dyslipidemia and among 28 patients with BMI >25, 28(100%) had dyslipidemia. According to these findings dyslipidemia was more prevalent in obese patients than non – obese, which was statistically significant ($p<0.05$).

In Type 2 DM, out of 50 patients 32 (64%) patients had high W/H ratio and 18(36%) patients had normal W/H ratio. The TC, TG, LDL-C were significantly elevated and HDL was significantly reduced in poorly controlled diabetics when compared to non-diabetics. 14(82.35) out of 17 males had dyslipidemia and 31 out of 33 females had dyslipidemia. TG, LDL-C, were significantly elevated and HDL-C was significantly reduced in Type 1 patients compared to controls. TC was elevated but was not significant statistically. In Type-2 DM TC, TG, LDL-C, were elevated and HDL-C was reduced in Type 2 compared to controls which were statistically significant.

In Type 2 DM ↑TC, ↑TG, ↓HDL, ↑LDL-C were more prevalent in males but there was no statistical significance. Out of 18 well controlled patients 13(72.22%) had dyslipidemia and among 32 poorly controlled patients 32(100%) had dyslipidemia. Patients with abnormal WHR had elevated levels of T.C, TG, and LDL-C which were statistically significant when compared to patients with normal WHR. HDL was reduced but not statistically significant. In the present study, vascular complications were common in Type-2 than Type 1 diabetics.

Type of DM	No. of patients (%)		Total
	Male	Female	
Type 1	9 (60%)	6 (40%)	15
Type 2	17 (34%)	33 (66%)	50
Controls	10 (33.33%)	20 (66.66%)	30

Table 1: (Gender Distribution)

Age(yrs.)	No. of patients (%)		
	Type 1 (n=15)	Type 2 (n=50)	Controls(n=30)
15-19	4 (26.66)	nil	1(3)
20-24	8 (53.33)	1 (2)	3(10)
25-29	2 (13.33)	4 (8)	3(10)
30-34	1 (6.66)	14 (28)	6 (20)
35-39	nil	31 (62)	17(56)

Table 2: (Age Distribution)

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BMI	No. of patients (%)		
	Type-1	Type-2	Controls
<18.5	15(100)	3 (6)	2(6)
18.5-24.9	–	19 (38)	22(73.33)
25-29.9	–	22 (44)	5(16.67)
>30	–	6 (12)	1(3)

Table 3: (Body Mass Index)

Type of DM	No. of patients (%)	
	WHR Normal	WHR Abnormal
Type 1	15 (100)	NIL
Type 2	18 (36)	32 (64)
controls	26(86.66)	4(13.33)

Table 4: (Waist- Hip Ratio) WHR

Type of DM	No. of patients (%)	
	Dyslipidemia	Total
Type 1	10 (60)	15
Type 2	45 (90)	50
controls	7(23.33)	30

Table 5: (No. of patients with Dyslipidemia)

Lipid moiety	No. of patients (%)		P value
	Type 1	Type 2	
↑ TC	3 (20)	23 (46)	<0.05
↑ TG	5 (33)	35 (70)	<0.05
↓ HDL	6 (40)	20 (40)	0
↑ LDL-C	8 (53.33)	35 (70)	>0.05
Combined dyslipidemia	8 (53.33)	40 (80)	>0.05

Table 6: (Comparison of dyslipidemia between Type 1 and Type 2 DM)

Type of DM	No. of patients (%)		P value
	Dyslipidemia in Well controlled	Dyslipidemia in poorly controlled	
Type 1	1(20)	8 80)	<0.05
Type 2	13(72.22)	32(100)	<0.05

Table 7: (Dyslipidemia and glycemic status)

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Lipid moiety	Well controlled (mean)	poorly controlled (mean)	P value	Non-diabetics (mean)	P value (in comparison with poorly controlled)
TC	162±6.28	192.2±20.22	0.0068	166.73±19.3	0.0013
TG	129.2±10.3	155.3±19.3	0.015	117.47±25.9	0.0001
HDL	43.2±4.97	37.5±6.10	0.0948	47.2±6.34	0.0001
LDL-C	94.6±6.19	122.4±22.1	0.0174	96.63±19.81	0.0023

Table 8: (Dyslipidemia in correlation with glycemic status in Type1 DM)

Lipid moiety	Well controlled (mean)	poorly controlled (mean)	P value	Non-diabetics (mean)	P value(in comparison with poorly controlled)
TC	184.2±22.5	215.4±33.96	0.001	166.73±19.3	<0.0001
TG	149.4±31.3	193.4±47.38	0.009	117.47±25.9	<0.0001
HDL	47.77±10.9	42.6±10.11	0.1	47.2±6.34	0.038
LDL-C	106.3±24.1	134.6±39.69	0.008	96.63±19.81	<0.0001

Table 9: (Dyslipidemia in correlation with glycemic status in Type2 DM)

BMI	TOTAL	dyslipidemia
		No. of patients (%)
<25	22	17 (77.27)
>25	28	28 (100)

Table 10: (Dyslipidemia and BMI)

P<0.05

Lipid moiety	Normal WHR (mean)	Abnormal WHR (mean)	P value
TC	181.27±22.59	223.13±36.71	<0.0001
TG	159.22±37.15	192.25±49.36	0.017
HDL	46.17±11.08	44.13±9.54	0.4
LDL-C	104.69±27.59	139.98±38.31	0.0012

Table 11: (Dyslipidemia in correlation with WHR in Type 2 DM)

DISCUSSION: Atherosclerotic complications are the leading cause of death in people with diabetes.⁽¹⁵⁾ and dyslipidemia is a major modifiable risk factor for these complications. Younger diabetics have an increased likelihood of developing complications as they are exposed for a longer duration to

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hyperglycemia and other diabetes related abnormalities. So, recognition and treatment of these abnormalities at an early age will reduce the incidence of complications.⁽¹⁶⁾

The present study was done in 65 young diabetics. In this age group, Type 2 diabetes was more common than Type 1 (76.9 Vs. 23.1%), which was comparable with the study done by Aguilar-Salinas et al.⁽¹⁷⁾

In the present study there was a male preponderance (60%) in Type 1 and female preponderance (66%) in Type 2 diabetes mellitus which were comparable with Aguilar-Salinas et al.⁽¹⁷⁾ (52%) and Antonio perez et al.⁽¹⁸⁾ (54%) and studies respectively.

Dyslipidemia was more prevalent in Type 2 DM (90%) compared to Type 1 (60%) which was statistically significant ($p < 0.05$) and similar to Ann K. Kershner et al study (20) and also there was a statistically significant difference when compared to non-diabetics, which was similar to Aguilar-Salinas et al and Antonio perez et al.⁽¹⁷⁻¹⁸⁾ studies.

In both Type 1 and Type 2 diabetics, dyslipidemia was more prevalent in poorly controlled diabetics (HbA1c of $\geq 7\%$) than non-diabetics, with a statistically significant difference. In Type 1 DM 80% of poorly controlled diabetics had dyslipidemia compared to well controlled (20%) patients, which was statistically significant ($p < 0.05$) and similar to Antonio perez et al. In Type 2 Diabetes all the poorly controlled diabetics had dyslipidemia, when compared to well controlled (72.22%) patients which was also statistically significant ($P < 0.05$).

The present study suggests that dyslipidemia was more prevalent in diabetics and was associated with poor glycemic status. According to Al-Adsani et al.⁽¹⁹⁾ TC, TG, LDL-C levels were strongly associated with glycaemic control. All the Type 1 diabetics had a normal WHR in our study. In Type 2 DM, dyslipidemia was associated with an abnormal WHR than normal WHR (100% Vs 72.2%) which was statistically significant ($P < 0.05$). Our study results were similar to Hardev singh Sandhu et al.⁽²⁰⁾ where there was a positive correlation between WHR and TC, TG, LDL-C. In a study by Sunil Gupta et al.⁽²¹⁾ $\uparrow$ TC, $\uparrow$ TG, $\uparrow$ LDL-C was associated with a high WHR.

CONCLUSION: The present study suggests that dyslipidemia was more prevalent in diabetics and was associated with poor glycemic status. It was also found that dyslipidemia was more prevalent in over weight and obese patients with Type 2 DM than non-obese patients and Type-1 Diabetics. In Type-2 DM, dyslipidemia and vascular complications was more associated with an abnormal WHR than Type-1 and control population.

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