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STUDY OF DYSLIPIDEMIAS IN YOUNG DIABETES MELLITUS PATIENTS IN CORRELATION WITH GLYCEMIC STATUS & OBESITY

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ABSTRACT: AIM: To study the lipid profile in young diabetes mellitus patients and to correlate them with their glycemic status & obesity. **MATERIALS & METHODS:** 65 young diabetic patients (of age 18-39 years) and 30 healthy controls of same age group who had attended to medicine & endocrinology departments of K.G.H, Visakhapatnam, were included in this study. **RESULTS & OBSERVATIONS:** Among 65 cases, 15 are Type1 DM & 50 cases are of Type 2 DM. In Type1 DM, 66.6% had poor glycemic status. Dyslipidemia was more in poorly controlled than well controlled (80% vs. 20% $p < 0.05$). In Type 2 DM, 32 had poor glycemic control & 18 had good control (64% vs. 36%). In Type2 DM, 13 out of 18 well controlled had dyslipidemia & all the 32 poorly controlled, had dyslipidemia (72% vs 100%, $p < 0.05$). In Type 2DM, 64% of patients had high W/H ratio. Dyslipidemia seen more in over weight and obese than non-obese (100% vs. 77.2%, $p < 0.05$) in Type 2 DM. Over all among 65 cases of DM, 54 had dyslipidemia & out of 30 controls 7 had dyslipidemia. This prevalence of dyslipidemia in diabetics was statistically found to be significant ($p < 0.05$). **DISCUSSION:** The present study suggests that dyslipidemia was more prevalent in diabetics when compared to non-diabetics. In both Type 1 & Type 2 DM, dyslipidemia was more prevalent in poorly controlled than well controlled patients. Dyslipidemia was more prevalent in obese than non-obese. Glycemic status and obesity are important determinants of dyslipidemia in diabetics. So good glycemic control, treatment of obesity reduces the incidence of dyslipidemia and its associated complications, particularly coronary artery diseases.¹

KEYWORDS: Dyslipidemias, Diabetes Mellitus (DM) Glycemic status, Central obesity.

INTRODUCTION: The prevalence of diabetes is increasing in young adults.² Diabetes and dyslipidemia are important risk factors for CHD in Indians.³ Poor blood glucose control and obesity are the important factors causing dyslipidemias in diabetics, in young adult group.

MATERIALS & METHODS: 65 young diabetic patients (of age 18-39 years) and 30 healthy controls of same age group who had attended to medicine & endocrinology departments of K.G.H, Visakhapatnam, were included in this study. In all the above, Fasting blood glucose, HbA1c, lipid profile were estimated. In all Height, Weight, Waist and Hip ratio were measured. The lipid profile values were compared between cases & controls, well & poorly controlled, obese & non obese among cases in both Type 1 and Type 2 DM patients.

Body Mass Index (BMI): BMI was calculated as weight (in kgs) divided by height (in meters) squared as per W.H.O.⁴ As large scale epidemiological studies suggest that metabolic and cardiovascular morbidity begins to rise when BMI's are > 25 , a BMI of > 25 was taken as the cut-off value for comparison.⁵

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Waist- Hip Ratio (WHR): Waist measurement was taken as abdominal circumference at midpoint between the costal margin and the iliac crest. Hip measurement taken as maximum diameter at the greater trochanter.⁶ Waist measure was divided by hip measure to get the W-H Ratio. WHR>0.8 in females and >1 in males were considered abnormal.⁷

Glycated Hb (Hb A1c): Glycosylated Hb was estimated by ion exchange resin method. Patients categorised as good and poor diabetes control using ADA criteria.⁸

Lipid Profile: Total Cholesterol (TC), Triglycerides (TG), High density lipoprotein cholesterol (HDL-C) were analysed by enzymatic method using Hitachi 902 analyser. Low density lipoprotein cholesterol (LDL-C) was calculated by Friedewald formula i.e. $LDL-C = TC - TG/5 - HDL$. Very low density lipoproteins were calculated by the formula, $VLDL = TG/5$.

Diagnostic Criteria for Dyslipidemia: The diagnostic criteria for dyslipidemia were taken as per NCEP, ATP III guidelines.⁹

Dyslipidemia is said to be present in the presence of any of the following:

Total cholesterol ≥ 200 mg/dl

Triglycerides ≥ 150 mg/dl

HDL-C < 40 mg/dl

LDL-C ≥ 100 mg/dl

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: 30.

BODY MASS INDEX: In Type 1 DM all patients had a 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 .

WAIST- HIP RATIO: (WHR): 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

GLYCEMIC STATUS: In Type 1 DM, out of 15 patients, 10 patients (66.66%) were poorly controlled and 5(33.33%) patients were under good glycemic control. In Type 2 DM, out of 50 patients, 32 (64%) patients had poor glycemic control and 18 (36%) patients had good glycemic control.

DYSLIPIDEMIA: In Type 1 DM among 15 patients 9 (60%) patients had dyslipidemia where as in Type 2 DM among 50 patients 45 (90%) patients had dyslipidemia.

Dyslipidemia and Glycemic Status: In both Type 1DM and Type 2DM dyslipidemia was more prevalent in poorly controlled compared to well controlled patients which were statistically significant.

Dyslipidemia in Correlation with Glycemic Status in Type1 DM: In Type 1 DM TC, TG, LDL-C were statistically significantly elevated and HDL was significantly reduced when compared to non-

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diabetics. Poorly controlled diabetics had elevated levels of TC, TG, and LDL-C which were statistically significant.

Dyslipidemia in Correlation with Glycemic Status in Type2 DM: In Type 2 DM TC, TG, LDL-C were significantly elevated and HDL was significantly reduced in poorly controlled diabetics when compared to non-diabetics. Poorly controlled diabetics had significantly elevated TC, TG, and LDL-C when compared with well controlled diabetics.

Dyslipidemia and 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 ($p<0.05$).

Effect of BMI on Lipid Moiety in Type 2 DM: Means of TC, TG, LDL-C were elevated to statistically significant levels and HDL was reduced to statistically significant levels in obese diabetics when compared to non-obese diabetics.¹⁰

Dyslipidemia and WHR: In Type 1DM, all of the patients with or without dyslipidemia had a normal WHR. In Type 2 DM patients, out of 18 patients with normal WHR 13(72.22%) had dyslipidemia and among 32 with abnormal WHR 32(100%) had dyslipidemia.¹¹ Dyslipidemia was significantly prevalent in patients with abnormal WHR ($P<0.05$).

Dyslipidemia in Correlation with WHR in Type2 DM: 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.

DISCUSSION: Atherosclerotic complications are the leading cause of death in people with diabetes¹² 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 hyperglycemia and other diabetes related abnormalities. So, recognition and treatment of these abnormalities at an early age will reduce the incidence of complications.¹³ The present study was done in 65 young diabetics aged between 18-39yrs years and 30 healthy controls of same age group.

OBESITY: In Type 1 DM all patients had a BMI of <18.5 whereas in Type 2 DM, 56% of patients had a BMI of ≥25 with a mean of 25.44 ± 4.21 , In Aguilar- Salinas et al¹⁴ study 78% had a BMI of ≥25 with a mean of 29 ± 6 . The difference could be due to difference in diet and economic status of the study population. 64% of the type 2 diabetics had central obesity (increased waist hip ratio) where- as all the Type1 diabetics had a normal WHR.

Dyslipidemia: 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,¹⁵ and also there was a statistically significant difference when compared to non-diabetics, which were similar to Aguilar-Salinas et al and Antonio perez et al¹⁶ studies respectively.

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Dyslipidemia and Glycemic Status: In both Type1 and Type 2 diabetics, dyslipidemia was more prevalent in poorly controlled diabetics (HbA1c of $\geq 7\%$) than in 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 DM all the poorly controlled diabetics had dyslipidemia when compared to well controlled (72.22%) patients which was also statistically significant ($P < 0.05$).

In Type 1 diabetics TC, TG, LDL-C were significantly elevated in poorly controlled when compared to well controlled and non-diabetics where-as there was no significant difference between well controlled diabetics and nondiabetics. So, good glycemic control can prevent dyslipidemias.

TC (215.4 ± 33.96 Vs. 184.2 ± 22.5 , $P = 0.001$; Vs. 166.73 ± 19.3 , $P < 0.0001$), TG (193.4 ± 47.38 Vs. 149.4 ± 31.3 , $P = 0.009$; Vs. 117.47 ± 25.9 , $P < 0.0001$) and LDL-C (134.6 ± 39.69 Vs. 106.3 ± 24.1 , $P = 0.008$; Vs. 96.63 ± 19.81 , $p < 0.0001$) were significantly elevated in poorly controlled diabetics when compared to well controlled diabetics and non-diabetics respectively. HDL-C (42.6 ± 10.11 Vs. 47.77 ± 10.9 , $P = 0.1$; Vs. 47.2 ± 6.34 $P = 0.038$) was significantly reduced in poorly controlled diabetics when compared to well controlled diabetics and non-diabetics respectively.

When compared with non-diabetics, well controlled diabetics had significantly elevated levels of TC, TG and LDL-C, but there was no statistically significant difference in HDL-C levels.

The present study suggests that dyslipidemia was more prevalent in diabetics and was associated with poor glycemic status. According to A.Al-Adsani et al,¹⁷ TC, TG, LDL-C levels were strongly associated with glycaemic control. In Ismail et al¹⁸ glycemic status was an important determinant of TC, TG, and LDL-C.

Dyslipidemia and BMI: Dyslipidemia was more prevalent in over weight and obese patients (100%) with type 2 DM than non-obese patients (77.27%), which is statistically significant ($P < 0.05$). Where-as, all the type1 diabetics had a BMI of < 18.5 .

TC (221 ± 38.01 Vs. 182.86 ± 20.79 , $P = 0.001$), TG (193.39 ± 46.16 Vs. 157 ± 40.9 , $P = 0.006$), LDL-C (141.55 ± 38.41 Vs. 103.84 ± 25.55 $P = 0.0002$) were significantly elevated where-as HDL-C (41 ± 9.43 Vs. 47.55 ± 10.19 , $P = 0.022$) was significantly reduced in patients with BMI ≥ 25 than non-obese patients. Present study shows that obese patients had significantly elevated TC, TG, LDL-C and significantly reduced HDL-C than non-obese, In Aguilar- Salinas et al study, HDL was significantly reduced in obese than non-obese (34 ± 8 Vs. 30 ± 3 , $P < 0.01$).

In a study by Sunil Gupta et al, higher BMI was associated with $\uparrow$ TC, $\uparrow$ TG, and $\uparrow$ LDL-C. These studies also suggest that $\uparrow$ BMI was associated with increasing dyslipidemias.

Dyslipidemia and WHR: All the Type1 diabetics had a normal WHR in our study. In Type 2 DM, dyslipidemia was associated with an abnormal WHR than with normal WHR (100% Vs 72.2%) which was statistically significant ($P < 0.05$).

TC (223.13 ± 36.7 Vs 181.27 ± 22.59 , $P < 0.0001$) TG (192.25 ± 49.36 Vs 159.22 ± 37.15 , $P = 0.017$), LDL-C (139.98 ± 38.31 Vs 104.69 ± 27.59 , $P = 0.0012$) were significantly elevated in patients with abnormal WHR than with normal WHR. HDL-C (44.13 ± 9.54 Vs 46.17 ± 11.08 , $P = 0.4$) was reduced in patients with abnormal WHR but was not significant.

In the present study truncal obesity was associated with dyslipidemia with an increase in TC, TG and LDL-C. These results were similar to Hardev singh Sandhu et al where there was a positive

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correlation between WHR and TC, TG, LDL-C. In a study by Sunil Gupta et al ↑TC, ↑TG, ↑LDL-C were associated with a high WHR.

SUMMARY AND CONCLUSIONS: Among 65 young diabetics studied, Type2 diabetes was more prevalent than Type 1. In Type1 DM all the patients were underweight; where as in Type 2 DM 56% of patients had BMI ≥ 25 . Central obesity was present in 64% of Type 2 diabetics, when measured by WHR, and central obesity was more common than generalized obesity.

Though dyslipidemia was present in both Type 1 and Type 2 DM, it was more prevalent in Type 2 than Type 1 DM. Elevated levels of TC, TG, LDL-C and reduced levels of HDL-C were seen in both Type 1 and Type 2 diabetics compared to non-diabetics.

Dyslipidemia was correlated with glycemic status, in our study. TC, TG, LDL-C were significantly elevated in poorly controlled when compared to well controlled patients. Dyslipidemia was more prevalent in obese than nonobese. There was a significant increase in TC, TG, LDL-C and significant reduction in HDL-C in obese diabetics. Abnormal WHR was significantly associated with dyslipidemia. TC, TG, LDL-C levels were significantly elevated in patients with central obesity.

These observations suggest that glycemic status; BMI and WHR were important determinants of dyslipidemias in diabetics. So, glycemic control and treatment of obesity would reduce dyslipidemias and its associated complications.

BMI	No. of patients (%)		
	TYPE 1 (n=15)	TYPE 2 (n=50)	Controls (n=30)
<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%)

In Type 1 DM all patients had a 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 .

Type of DM	No. of patients (%)	
	WHR NORMAL	WHR ABNORMAL
Type 1 (n=15)	15 (100%)	NIL
Type 2 (n=50)	18 (36%)	32 (64%)
Controls (n=30)	26(86.66%)	4(13.33%)

WAIST- HIP RATIO: (WHR): 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

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DYSLIPIDEMIA: In Type 1 DM among 15 patients 9 (60%) patients had dyslipidemia where as in Type 2 DM among 50 patients 45 (90%) patients had dyslipidemia.

Type of DM	No. of patients (%)		P value
	Dyslipidemia in Well controlled	Dyslipidemia in poorly controlled	
Type 1 (n=15)	1 (20%)	8 (80%)	<0.05
Type 2 (n=15)	13 (72.22%)	32 (100%)	<0.05

In both Type 1 and Type 2DM dyslipidemia was more prevalent in poorly controlled compared to well controlled patients which were statistically significant.

According to these findings dyslipidemia was more prevalent in obese patients than non – obese, which was statistically significant ($p < 0.05$).

Effect of BMI on lipid moiety in Type 2 DM:

Lipid moiety	BMI <25 (mean)	BMI ≥25 (mean)	P VALUE
TC	182.86±20.79	221±38.01	0.001
TG	193.39±46.16	157±40.9	0.006
HDL	41±9.43	47.55±10.19	0.022
LDL-C	141.55±38.41	103.84±25.55	0.0002

Means of TC, TG, and LDL-C were elevated to statistically significant levels and HDL was reduced to statistically significant levels in obese diabetics when compared to non-obese diabetics.

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Dyslipidemia and WHR: Dyslipidemia was significantly prevalent in with abnormal WHR ($P < 0.05$).

WHR (Type2 DM)	Total	No. of patients (%) with dyslipidemia
Abnormal	32	32 (100%)
normal	18	13 (72.22%)

Comparison of Dyslipidemia with other Studies:

Lipid moiety	Type 1 DM		Type 2 DM		
	Present study (type1)	Antonio perez et al	Present study (type2)	Aguilar-Salinas et al	Mathura K C et al ⁴⁸
↑ TC	20	15.6	46%	34%	46.7%
↑ TG	33	5	70%	66%	73.3%
↓ HDL	40	20	40%	60%	66.7%
↑ LDL-C	53.33	16	70%	62%	66.7%

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