

# LIPID PROFILE ABNORMALITIES IN NIDDM WOMEN OF NORTH WEST INDIA: A CASE-CONTROL STUDY

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## ABSTRACT

Defect in insulin action or irregularity in insulin secretion or both due to disruption in body's Lipid metabolism, the major leading cause of NIDDM/T2DM worldwide. The present case control study was conducted on a total of 175 female subjects in which 93 women were NIDDM (cases) and 82 were non- NIDDM (controls), aged from 40-70 years. The patients with any other chronic disease were excluded from the study. Age and biochemical measurements viz., Total serum Cholesterol, Triglycerides, LDL, VLDL and HDL were obtained from their serum. The blood samples from NIDDM patients were obtained in their fasting state. The study disclosed that more abnormalities in all lipid variables i.e. (Triglycerides, Total Cholesterol, HDL, LDL and VLDL) had been seen in NIDDM women's serum as compared to non- NIDDM women's serum. The study revealed the pattern of Diabetic Dyslipidemia in NIDDM women which is Low HDL and higher TG- level. The study also concluded that the Triglyceride and Cholesterol were significantly correlated with VLDL and with LDL, respectively and no significant correlation was observed between age and Lipid Variables in the study. Furthermore, as in recent decades, the prevalence of NIDDM has increased; therefore, nowadays it becomes vital to maintain the lipid metabolism in patients with NIDDM for reducing the prevalence of cardiovascular events as well.

**Keyword:** T2DM, Lipid Profile, NIDDM, Women, South Punjab.

## 1. INTRODUCTION

Diabetes Mellitus (DM) is a common metabolic disorder [1] or life long condition which is caused by either defect in insulin action or irregularity in insulin secretion or both, due to disruption in body's Lipid metabolism [2]. Many studies had clearly established chronic hyperglycemia as a major complication in Type 2 Diabetes Mellitus patients which affects health through various mechanisms including platelet activation, endothelial metabolism and Dyslipidemia [3]. Generally, Diabetes is of two main types, 90% of diabetic patients account for Type 2 Diabetes Mellitus (T2DM), this condition is also defined as insulin resistance due to lack of response to insulin. This chronic condition is also known as Non Insulin Dependent Diabetes Mellitus (NIDDM). Instantaneous increase in glucose plasma levels is a major characterized feature of Diabetes Mellitus development [4]. Diabetic Dyslipidemia patients have a greater risk for cardiovascular diseases (CVD) [5]. In NIDDM, chronic hyperglycemia causes many vascular complications including CVD, nephropathy, retinopathy, neuropathy etc [6-7]. Body fat in obese category is mainly answerable for increase in prevalence of this chronic disease and leads to abnormality in Lipid levels [8].

The aim of the present case-control study was to find out the association, if any, of age with lipid profile or lipid parameters in both NIDDM (Type 2 Diabetes Mellitus) and non-NIDDM in women of South (Malwa region) Punjab, North West India.

## 2. MATERIAL AND METHODS

In the present study, the cross-sectional analysis had been conducted on a total of 175 female subjects aged from 40-70 years, of which 93 were NIDDM cases and 82 were non-NIDDM controls. The data were collected from January 20, 2018 to the end of May, 2018 by taking a written consent from each subject. Blood samples were collected by a hired trained technician from the subjects inhabiting South Punjab. 2-3 ml of blood samples were drawn from the subjects and poured in 5 ml plain vials. The blood samples from NIDDM patients were obtained in their fasting state. Serum was extracted from the blood samples for biochemical analysis by centrifugation. Age and various biochemical measurements such as Total serum Cholesterol (CHOL), Triglycerides (TG), Low Density Lipoproteins (LDL), Very Low Density Lipoproteins (VLDL) and High Density Lipoproteins (HDL) were taken on each subject. The study was done in the Department of Human Genetics, Punjabi University, Patiala, India.

### 2.1 Selection criteria for both NIDDM and non-NIDDM subjects.

Subjects were selected on the basis of following inclusion and exclusion criteria:

#### 2.1.1 Inclusion criteria

Only female subjects were included in the present study. Both in the cases and the controls subjects aged from 40-70 years were included.

#### 2.1.2 Exclusion criteria

In the cases, patients with any other chronic disease or serious surgery were excluded. Pregnant women were also excluded from the study.

Age (in years) of each subject was noticed on the proforma prior to blood sampling. For biochemical measurements (in mg/dL), GPO-POD method was used for the estimation of Triglyceride (TG) and CHOD-POD or Phosphotungstate method was used for estimation of Total Cholesterol (CHOL) and High Density Lipoprotein (HDL). By using Friedewald Formula (FF), Low Density Lipoprotein (LDL) and Very Low Density Lipoprotein (VLDL) values were obtained.

### 2.2 Statistical Analysis

The SPSS software 16.0 version was used to interpret the results. The mean, Standard Deviation (SD), Standard Error of Mean (SEM), Chi-square test with their p-value and Pearson's correlation test were applied to the present data. For lipid profile,  $p < 0.01$  had been considered statistically significant. Single star (\*) revealed the significant correlation at 0.05 level and double star (\*\*) at 0.01 level.

## 3. RESULTS

In the study, mean age (in years) was found  $50.23 \pm 7.47$  for non-NIDDM women and  $55.09 \pm 8.78$  for NIDDM women. Out of the five, four Lipid variables Triglyceride (TG), Cholesterol (CHOL), Low Density Lipoproteins (LDL) and Very Low Density Lipoproteins (VLDL) had shown statistically significant differences between NIDDM and non-NIDDM women in the present study ( $p < 0.01$ ) (Table 1). Table 1 showed that 56.34% of type 2 diabetic women had shown very high level of LDL (Low Density Lipoprotein) i.e.  $> 190$  mg/dl and it was found to be higher as compared to 19.57% non-diabetic women. More women from cases (11.27%) were at borderline risk as compared to non-diabetic women (8.7%). Normal level of LDL was higher in non-diabetics (54.35%) as compared to diabetics (16.90%).

Table 2 revealed that the percentage of high risk was higher in diabetic women (59.77%) than non-diabetic women (10.98%). The table also revealed that diabetic women were at higher risk of developing Cholesterol complication

than non-diabetic women (Table 2). Table 3 showed that the percentage of high risk of HDL (16.9%) was found to be higher in Type 2 diabetics than non-diabetics. The table further revealed that Type 2 diabetics women showed higher fluctuations in their HDL (High Density Lipoprotein) level than non-diabetics. Table 4 showed that the percentage of high risk of Triglycerides was higher in Type 2 diabetic women (27.27%) than non-diabetic women (7.41%). On the other hand, the percentage of normal triglyceride level was higher in non-diabetic women (70.37%) than diabetic women (62.5%). This analysis gave highly statistically significant differences between the cases and controls ( $p < 0.001$ ). Type 2 diabetic women were at higher risk of TG (Triglyceride) level complication than non-diabetic women (Table 4). Table 5 showed that the percentage of normal risk was higher in non-diabetic women (93.48%) than diabetic women (45.07%) but percentage of high risk of VLDL (Very Low Density Lipoprotein) was higher in Type 2 diabetic women (36.62%) than non-diabetic women (4.35%). Even percentage of cases (18.31) at borderline risk was also higher than control women (4.35%). The table further revealed that Type 2 diabetic women showed greater level of VLDL than non-diabetic women. Table 6 showed that Type 2 diabetic women were at greater risk of LDL complication than non-diabetic women. Table 8 showed that TG had positive correlation with VLDL at 0.01 level and with Cholesterol at 0.05 level. In addition, cholesterol had shown positive correlation with LDL at 0.01 level. Age had shown no such correlation with any of the Lipid variables in the study. HDL, LDL and VLDL also showed no significant correlation with any other variable (Table 8).

#### 4. DISCUSSION

There was more frequency of NIDDM women (53.14%) than non-NIDDM women (46.86%) in the present study. Mean age of NIDDM patients was found to be  $55.09 \pm 8.78$  year which was close to that reported by Ozder (2014) ( $55.5 \pm 9.2$  year) [19]. Sanjeevaiah *et al.* (2019) conducted a case-control study on diabetic and non-diabetic patients in which statistically significant results for TG and TC had been reported [9], similar to the present study (Table 1). Furthermore, the present study also revealed the same characteristic feature of diabetics' women. Like the present study, Sultania *et al.* (2017) [2] showed high Triglyceride value ( $159.37 \pm 107.81$ ) and low HDL value ( $43.79 \pm 13.92$ ) in NIDDM cases. Adams (2010) found higher level of Cholesterol in Type 2 diabetic cases than non-diabetic controls [10]. Mooradian (2009) found Dyslipidemia (high Cholesterol or high lipid profile) condition in cases with T2DM [11] and the present study showed similar results with prior studies.

Gordon *et al.* (2008) studied biochemical measurement HDL in type 2 diabetic and non-diabetic patients. It was concluded that higher level of HDL was found in Type 2 diabetic patients than non-diabetics [12]. Adams (2010) also found higher level of HDL in T2DM patients than non-diabetic. The present study showed similar findings. Abrams *et al.* (1982) also worked on plasma TG-level in T2DM patients and it was found to be higher in NIDDM cases than non-NIDDM controls [13]. Jokl *et al.* (1997) reported abnormal VLDL level in T2DM patients [14]. It was identified that T2DM patients were having greater value of VLDL. Noticeable fluctuations were seen in VLDL level by Abrams *et al.* (1982) in T2DM females. The results of the earlier studies were similar to the present results. Taskinen (2003) found higher LDL level in T2DM patients as compared to non-diabetic controls [15]. Howard *et al.* (1987) examined Lipoprotein metabolism in T2DM women and established that LDL level were present in T2DM patients at higher level [16]. Results of earlier study are mostly similar with the present study. This study had shown a big difference during comparison between normal ranges and the present results of three Lipid variables TG, TC and LDL. Statistically significant higher mean serum values of these three Lipid variables were noticed in Type 2 Diabetes Mellitus patients which collectively were at a higher risk of atherosclerosis and Coronary Artery Disease (CAD) as reported by Kumar *et al.* (2018) and Ladeia *et al.* (1994) [17-18]. A study on T2DM patients by Ozder (2014) had shown the significant correlation of Total Cholesterol with LDL at 0.01 levels [19] and the present study also revealed the similar significant results in their correlation of TC with LDL. A study by Gadi *et al.* (2007) reported that Diabetic Dyslipidemia was characterized by hypertriglyceridemia, hypercholesterolemia, low HDL and elevated levels of LDL [20] and the present study also revealed similar findings. Like the present study, a study by Haffner *et al.* (1998) on NIDDM patients revealed elevated levels of Triglycerides and LDL-C; and decreased level of HDL-C [21].

## 5. CONCLUSION

Thus the present study revealed that abnormalities in various lipid variables (CHOL, TG, HDL, LDL, VLDL) were observed more in NIDDM women as compared to non- NIDDM women in North West Indian state of Punjab. The study also revealed the pattern of Diabetic Dyslipidemia in NIDDM women i.e. low HDL and higher TG- level. This study also concluded that TG and CHOL were positively correlated with VLDL and LDL, respectively and no significant correlation was observed between age and lipid variables investigated. Since the prevalence of NIDDM has been increasing in India in recent years, it becomes vital to maintain the lipid metabolism in NIDDM patients for reducing the prevalence of cardiovascular events as well.

## 6. ACKNOWLEDGEMENT

The author is grateful to Dr. Gijinder Kaur, Assistant Professor, Department of Human Genetics, Punjabi University, Patiala under whose guidance the present work was carried out.

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## BIOGRAPHY

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**Table 1:** Mean difference among lipid variables in the cases and controls.

Variable (mg/dl)		Cases	Controls	Mean difference	T-value	p-value
TG	Mean	159.37	119.32	40.04	2.94	<0.01**
	SD	107.81	65.74			
	SEM	11.49	7.30			
CHOL	Mean	319.09	164.78	154.31	7.79	<0.01**
	SD	162.59	85.15			
	SEM	17.43	9.40			
HDL	Mean	43.79	43.65	0.13	0.05	0.52
	SD	13.92	14.01			
	SEM	1.65	2.06			
LDL	Mean	244.41	126.14	118.26	4.85	<0.01**
	SD	156.49	107.19			
	SEM	18.57	15.80			
VLDL	Mean	34.92	16.38	18.54	6.53	<0.01**
	SD	22.01	7.54			
	SEM	2.6117876	1.1116620			

\*\* Statistically significant.

**TABLE 2:** Categorization on the basis of Cholesterol in NIDDM and non-NIDDM women along with Chi-square and p-values.

Category	Cholesterol (mg/dl)				Chi square value (p)
	Cases		Controls		
	Frequency	Percentage (%)	Frequency	Percentage (%)	
Normal (< 200)	28	32.18	67	81.71	46.29 (<0.001)**
Borderline(200 – 239)	7	8.05	6	7.32	
High Risk (> 240)	52	59.77	9	10.98	
Total	87	100.0	82	100.0	

\*\* Statistically significant.

**TABLE 3:** Categorization on the basis of HDL in NIDDM and non-NIDDM women along with Chi-square and p-values.

Category	HDL (mg/dl)				Chi square value (p)
	Cases		Controls		
	Frequency	Percentage (%)	Frequency	Percentage (%)	
Normal (< 40)	33	46.48	18	39.13	3.30 (0.19)
Borderline (41-59)	26	36.62	24	52.17	
High risk ( $\geq$ 60)	12	16.90	4	8.7	
Total	71	100.0	46	100.0	

**TABLE 4:** Categorization on the basis of Triglycerides in NIDDM and non-NIDDM women along with Chi-square and p-values.

Category	Triglycerides (mg/dl)				Chi square value (p)
	Cases		Control		
	Frequency	Percentage (%)	Frequency	Percentage (%)	
Normal (< 150)	55	62.5	57	70.37	13.57 ( $<0.001$ )**
Borderline (150 – 199)	9	10.23	18	22.22	
High Risk (200 – 499)	24	27.27	6	7.41	
Total	88	100.0	81	100.0	

\*\* Statistically significant.

**TABLE 5:** Categorization on the basis of VLDL in NIDDM and non-NIDDM women along with Chi-square and p-values.

Category	VLDL (mg/dl)				Chi square value (p)
	Cases		Controls		
	Frequency	Percentage (%)	Frequency	Percentage (%)	
Normal(< 25)	32	45.07	43	93.48	28.43 ( $< 0.001$ )**
Borderline (25 – 35)	13	18.31	1	2.17	
High Risk (> 35)	26	36.62	2	4.35	
Total	71	100.0	46	100.0	

\*\* Statistically significant.

**TABLE 6:** Categorization on the basis of LDL in NIDDM and non-NIDDM women along with Chi-square and p-values.

Category	LDL (mg/dl)				Chi square value (p)
	Cases		Controls		
	Frequency	Percentage (%)	Frequency	Percentage (%)	
Optimal (< 100)	12	16.90	25	54.35	22.53 (<0.001)**
Sub optimal (100 – 129)	10	14.08	6	13.04	
Borderline (130 – 159)	8	11.27	4	8.7	
High (160 – 189)	1	1.41	2	4.35	
Very high (> 190)	40	56.34	9	19.57	
Total	71	100.0	46	100.0	

\*\* Statistically significant.

**TABLE 7:** Results of various Lipid Variables in Type 2 Diabetic Patients.

Lipid variable	Normal range <sup>1</sup>	Study results
TG	<150	159.37±107.81
TC	<200	319.09±162.59
HDL	45-65	43.79±13.92
LDL	<100	244.41±156.49

<sup>1</sup>mg/dL.

**Table 8:** Correlation of age with various lipid variables (TG, CHOL, HDL, LDL, VLDL).

Variable		Age	TG	CHOL	HDL	LDL	VLDL
Age	Cases	1	-0.05	0.10	0.03	0.13	-0.06
	Controls	1	0.10	-0.03	0.22	0.03	0.05
TG	Cases		1	0.11	0.14	0.01	1.00**
	Controls		1	-0.23*	-0.20	-0.13	1.00**
CHOL	Cases			1	0.06	0.98**	0.16
	Controls			1	0.01	-0.99**	-0.08
HDL	Cases				1	-0.04	0.15
	Controls				1	-0.11	-0.21
LDL	Cases					1	0.15
	Controls					1	-0.12
VLDL	Cases						1
	Controls						1

\*Statistically significant at 0.05 level.

\*\*Statistically significant at 0.01 level.