



Original Article

A Cross-sectional Study of Profile Serum Lipid levels in off-springs of Diabetic patients in a Tertiary Care Hospital in Central India

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Abstract

Aims & Objective: To compare various serum lipid parameters in young healthy off-spring of diabetics (single or both parents) with offspring of non-diabetic parents.

Material and Methods: A cross sectional study with 120 subjects included, 60 normal healthy off-springs of diabetic parents (single parent diabetic 38 & both parent Diabetic 22) and 60 normal healthy off-springs of non-diabetic parents between age group of 18 to 30 years. All inclusion and exclusion criteria were applied after which subjects were enrolled and also informed written consent were taken. Serum lipid cholesterol level assay was done by Modified Roeschlaus's method (Dynamic extended stability CHOD-POD method) by Fully Automatic Analyzer.

Results: The mean value of Serum HDL was lower in off-springs of both diabetic parents than offspring of non-diabetic parent and the difference was statistical significant ($p=0.005^{**}$). We found Statistical significant difference in mean value of Serum HDL between offspring of single diabetic parent and offspring of non-diabetic parent ($p=0.042^{*}$) and mean value of Serum HDL was lower in offspring of both diabetic parents than offspring of single diabetic parent but the difference was not statistical significant ($p=0.522$).

Conclusion: Lipid profiles of off-springs were related to diabetic parent's history. When both parents are diabetic their offspring should always be kept in follow-up as they have high chances of developing hyperglycemia in future.

Keywords: Lipid profile, High Density lipoprotein, Cholesterol.

Introduction

Diabetes mellitus is a group of metabolic diseases characterized by increase in blood sugar levels resulting from alteration in insulin secretion and insulin effects or both. Various pathogenic mechanisms lead to development of diabetes, such

as autoimmune mechanism which causes beta cell destruction located in the pancreas with consequent insulin deficiency. Chronic hyperglycemia in diabetes is associated with long-term dysfunction of various organs e.g. eyes, kidneys, heart¹.

Long-term complications of diabetes include retinopathy with potential loss of vision; nephropathy leading to renal failure; peripheral neuropathy with risk of foot ulcers, amputations, and Charcot joints; and autonomic neuropathy causing gastrointestinal, genitourinary, and cardiovascular symptoms and sexual dysfunction. Patients with diabetes have an increased incidence of atherosclerotic cardiovascular, peripheral arterial and cerebrovascular disease. Hypertension and abnormalities of lipoprotein metabolism are often found in people with diabetes.¹

Family history of diabetes specially in type 2 diabetes is not only a risk factor for the disease but is also positively associated with risk awareness and risk-reducing behaviours. It may provide a useful screening tool for detection and prevention of diabetes type 2.

The risk of becoming a diabetic for an individual with a positive family history of diabetes increases by two- to fourfold. Offspring with a positive family history of diabetes have higher body mass index (BMI) than controls³. Obesity and body fat distribution⁴. lifestyle,⁵. impaired glucose tolerance (IGT), and a family history of type-2 Diabetes Mellitus^{6,7}. represent risk factors for type-2 Diabetes Mellitus. First-degree relatives of patients with type-2 Diabetes Mellitus frequently show abnormal glucose tolerance and share several metabolic abnormalities of the full blown disease and have a 30%–40% risk of developing type-2 Diabetes Mellitus themselves⁸.

Serum lipid profile is also altered in case of diabetes mellitus which is the collective term given to estimation of total cholesterol, high density lipoprotein cholesterol, low density lipoprotein cholesterol and triglycerides in fasting serum sample.

As number of studies has been conducted regarding association b/w Diabetes mellitus and lipid parameters, to our knowledge, relationships between lipid profile parameters and blood sugar have not been determined in off-springs of diabetics.

Therefore, the purpose of this study was to investigate any significant difference in the level of serum lipid profile parameters in offspring of diabetic parents and offspring of non diabetic parents.

If our hypothesis proves true in our study, these tests can be used routinely in young and healthy offspring of diabetic parents and preventive measures such as lifestyle modification can be suggested to ‘at risk- individuals’ and total incidence and burden of such a debilitating illness could be reduced.

Material and Methods

Study was carried out in the Department of Biochemistry at the People’s College of Medical Sciences & Research Centre Bhopal during 2013 to 2014. The Study protocol was approved by the Ethical Committee of our institute .Prior to enrolment in the study written informed consent was obtained from each subject.

Study Design: a.) The cross sectional study was carried out.

b.) We enrolled 120 subjects (comprises of 03 groups)

c.) age group of 18 to 30 years were enrolled

d.) All inclusion and exclusion criteria were applied and written informed consent were taken..

Participants were divided into three groups-

Group 1: control group (n=60) both male and female of age group 18-30 years, whose parents are non-diabetic..

Group 2: (n=38) both male and female age group 18 to 30 years, with one of their parents with history of diabetes.

Group 3: (n=22) both male and female of age group between 18 to 30 years with both parents having history of diabetes.

Selection of study subjects:

Inclusion criteria: 1.) Healthy off-springs of diabetic parents age group 18 to 30 years

2.) Healthy off-springs of non-diabetic parents in age group 18 to 30 years as controls.

Exclusion criteria:*Subjects not fulfilling the age criteria mentioned in inclusion criteria

*those with uncontrolled liver or thyroid diseases
 *any acute illnesses, such as infection, surgery, and hospital admission, recent bone fracture (<6 months)
 *on medications known to affect bone or glucose metabolism, such as glucocorticoids or bisphosphonates.

After overnight fast (8-12 hrs) blood sample for serum lipid was collected in plain vial between 8 am and 10 am. Samples were centrifuged at 3000 rpm for 10 minutes; serum separated and immediately stored in deep freezer at -20°C for further analysis. Serum lipid cholesterol level assay was done by Modified Roeschlaus’s

method (Dynamic extended stability CHOD-POD method) by Fully Automatic Analyser, serum TG and Serum HDL was done in fully auto analyzer “Biosystem A25”. LDL and VLDL were calculated by Friedwald’s formulae.

Results

We calculated the mean value and standard deviation of the parameters and with the help of ANOVA we saw if any significant difference is present between the groups in all the parameters included in our study and this was followed by post hoc test to see where the actual difference was present.

Table No.1 Mean Value of Serum Triglyceride

Variable		N	Mean	Std. Deviation	Std Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Triglycerides	Group 1	60	96.95	35.227	4.548	87.85	106.05	54	210
	Group 2	38	99.95	34.478	5.593	88.61	111.28	60	192
	Group 3	22	106.95	34.963	7.454	91.45	122.46	61	183
	Total	120	99.73	34.845	3.181	93.43	106.03	54	210

Table No.1 showing mean value of Serum Triglycerides in 3 different groups with standard deviation. The mean value of Serum Triglycerides in offspring of non-diabetic parents was 96.95(SD 35.227), in offspring of single diabetic parent was

99.95(34.478) and in offspring of both diabetic parents was 106.95 (SD 106.95). (Group 1- offspring of non-diabetic parents, Group 2- offspring of single diabetic parent, Group 3 - offspring of both diabetic parents)

Table No.2 Anova

Variable		Sum of Squares	df	Mean Square	F	Sig.
TG	Between Groups	1613.767	2	806.884	0.661	0.518
	Within Groups	142869.699	117	1221.109		
	Total	144483.467	119			

Table No.2 showing statistical analysis by Anova. There was no statistical significant difference in

mean value of Serum Triglycerides between 3 groups (p=0.518).

Table No.3 Post HOC Analysis

Variable	A	B	Mean Difference (A-B)	Std. Error	Sig.		
TG	Group 1	Group 2	-2.997	7.245	0.910	-20.20	14.20
		Group 3	-10.005	8.710	0.486	-30.68	10.67
	Group 2	Group 1	2.997	7.245	0.910	-14.20	20.20
		Group 3	-7.007	9.362	0.735	-29.23	15.22
	Group 3	Group 1	10.005	8.710	0.486	-10.67	30.68
		Group 2	7.007	9.362	0.735	-15.22	29.23

(Group 1- offspring of non-diabetic parents, Group 2- offspring of single diabetic parent, Group 3 - offspring of both diabetic parents)

Table no.3 Showing Post Hoc analysis of Anova test. Although the mean value of Serum Triglycerides was higher in offspring of both diabetic parents than offspring of single diabetic

parent (p=0.735) and offspring of non-diabetic parents (p=0.486), but the difference was not statistical significant. The Difference in the mean value of Serum Triglycerides between offspring of single diabetic parents and offspring of non-diabetic parents was also not found statistical significant (p=0.910).

Table No.4 Mean Value of HDL

Variable		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
HDL	Group 1	60	43.5750	3.91553	0.50549	42.5635	44.5865	35.20	51.20
	Group 2	38	41.5158	4.46085	0.72365	40.0495	42.9820	35.90	57.00
	Group 3	22	40.3273	3.76161	0.80198	38.6595	41.9951	36.00	51.00
	Total	120	42.3275	4.24502	0.38752	41.5602	43.0948	35.20	57.00

Table No.4 showing mean value of serum HDL in 3 different groups with standard deviation. The mean value of Serum HDL in offspring of non-diabetic parents was 43.5750(SD 3.91553), in

offspring of single diabetic parent was 41.5158(SD 4.46085) and in offspring of both diabetic parents was 40.3273(SD 3.76161).

Table No.4 ANOVA

Variable		Sum of Squares	df	Mean Square	F	Sig.
HDL	Between Groups	206.433	2	103.216	6.231	.003**
	Within Groups	1937.967	117	16.564		
	Total	2144.399	119			

[* p value <0.05(significant), ** p value <0.01 (highly significant)]

Table No.4 showing statistical analysis by Anova. There was statistical significant difference in

value of serum HDL between 3 groups (p=0.03**).

Table No.5 Post HOC Analysis

Variable	A	B	Mean Difference (A-B)	Std. Error	Sig.		
Serum HDL	Group 1	Group 2	2.05921*	0.84377	0.042*	0.0562	4.0623
		Group 3	3.24773*	1.01438	0.005**	0.8397	5.6558
	Group 2	Group 1	-2.05921*	0.84377	0.042*	-4.0623	-0.0562
		Group 3	1.18852	1.09032	0.522	-1.3998	3.7768
	Group 3	Group 1	-3.24773*	1.01438	0.005**	-5.6558	-0.8397
		Group 2	-1.18852	1.09032	0.522	-3.7768	1.3998

[*p value <0.05(significant), ** p value <0.01 (highly significant)]

(Group 1- offspring of non-diabetic parents, Group 2- offspring of single diabetic parent, Group 3 - offspring of both diabetic parents)

Table no.5 Showing Post Hoc analysis of Anova test .The mean value of Serum HDL was lower in offspring of both diabetic parents than offspring of non-diabetic parent and the difference was statistical significant (p=0.005**). There was

statistical significant difference in mean value of Serum HDL between offspring of single diabetic parent and offspring of non-diabetic parent (p= 0.042*).

The mean value of Serum HDL was lower in offspring of both diabetic parents than offspring of single diabetic parent but the difference was not statistical significant (p=0.522).

Table No.6 Mean Value of Serum Cholesterol

Variable		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Cholesterol	Group 1	60	167.50	12.729	1.643	164.21	170.79	130	194
	Group 2	38	165.53	17.991	2.918	159.61	171.44	120	196
	Group 3	22	175.09	18.726	3.992	166.79	183.39	141	207
	Total	120	168.27	15.942	1.455	165.39	171.15	120	207

Table No.6 showing mean value of serum Cholesterol in 3 different groups with standard deviation. The mean value of Serum Cholesterol in offspring of non-diabetic parents was 167.50(SD 12.729), in offspring of single diabetic

parent was 165.53(SD 17.991) and in offspring of both diabetic parents was 175.09(SD 18.726). (Group 1- offspring of non-diabetic parents, Group 2- offspring of single diabetic parent, Group 3 - offspring of both diabetic parents)

Table No.7 ANOVA

Variable		Sum of Squares	df	Mean Square	F	Sig.
Cholesterol	Between Groups	1345.175	2	672.587	2.723	0.070
	Within Groups	28898.292	117	246.994		
	Total	30243.467	119			

Table No.7 showing statistical analysis by Anova. There was no statistical significant difference in

value of serum Cholesterol between 3 groups (p=0.070).

Table No.8 Post HOC Analysis

Variable	A	B	Mean Difference (A-B)	Std. Error	Sig.		
Serum Cholesterol	Group 1	Group 2	1.974	3.258	0.817	-5.76	9.71
		Group 3	-7.591	3.917	0.133	-16.89	1.71
	Group 2	Group 1	-1.974	3.258	0.817	-9.71	5.76
		Group 3	-9.565	4.210	0.064	-19.56	0.43
	Group 3	Group 1	7.591	3.917	0.133	-1.71	16.89
		Group 2	9.565	4.210	0.064	-0.43	19.56

(Group 1- offspring of non-diabetic parents, Group 2- offspring of single diabetic parent, Group 3 - offspring of both diabetic parents)

Table no.8 Showing Post Hoc analysis of ANOVA test. Although the mean value of Serum Cholesterol was higher in offspring of both diabetic parents than offspring of single diabetic parent (p=0.064) and offspring of non-diabetic parents (p=0.133), but the difference was not statistical significant. The Difference in the mean value of Serum Cholesterol between offspring of single diabetic parents and offspring of non-diabetic parents was also not found statistical significant (p=0.817).

Discussion

Type 2 Diabetes mellitus is a metabolic syndrome which is relatively common in most countries including India which is now being referred to as “Diabetes Capital of the world” and risk of becoming diabetic for individual increases by two to four times if he has positive family history.

The present study in offspring of diabetic parents suggests the presence of certain risk factor of the disease at an early age.

We calculated the mean value and standard deviation of all the parameters and with the help of ANOVA we saw if any significant difference is present between the groups in all the parameters included in our study and this was followed by

post hoc test to see where the actual difference was present.

We found no significant difference in serum triglyceride level and serum cholesterol level between the 3 groups although the mean value was high in offspring of both diabetic parents compared to offspring of non-diabetic parents.

But we found significantly lower level of HDL cholesterol in offspring of both diabetic parents compared to offspring of non-diabetic parents and we also found significant difference in serum value of HDL in offspring of single diabetic parent compared to offspring of non-diabetic parent.

Benigno et al⁹ also found in his study lower HDL cholesterol levels in offspring of parents with T2DM compared with the offspring of non-diabetic parents.

A.Shahid et al¹⁰ also observed significantly low HDL cholesterol in offspring of single diabetic parent compared to non-diabetic parents.

Hirata et al¹¹ also found significantly lower level of HDL cholesterol in first degree relatives of diabetes mellitus.

Gerich et al¹² Steinberger et al¹³ further said that insulin resistance which may be a genetically inherited trait is also known to enhance lipolytic activity thereby increasing fatty acid levels thus bringing about these altered changes in lipid profile and can also cause dyslipidemia in individuals with normal glucose tolerance.

Rahim et al¹⁴ in his study found the mean values were markedly lower for HDL and higher for LDL in the groups (both diabetic parents and single diabetic parents) having family history of diabetes when compared to other group (non-diabetic parents).

Conclusion

The role of high density lipoprotein cholesterol (HDL) is elaborately explained in studies that have attempted to explain its role in residual cardiovascular risk. Various studies conclude that HDL levels are inversely associated with risk of

coronary heart disease and are a key component of predicting cardiovascular risk.

We found significantly lower level of HDL cholesterol in offspring of diabetic parents (both parents) as compared to the offspring of non-diabetic parents. We also found significant difference in serum value of HDL in offspring of single diabetic parent compared to offspring of non diabetic parent.

HDL and LDL are two of the four main groups of plasma lipoproteins that are involved in lipid metabolism and the exchange of cholesterol, cholesterol ester and triglycerides between tissues. It is evident that HDL protects against atherosclerosis. Some of these factors appear to have anti-oxidant and antiinflammatory effects which may obviate processes that initiate atherogenesis.

Therefore, the need for monitoring of lipid parameters among offspring of Diabetic patients that may prevent future cardiac events by eliminating risk factor in context to HDL on routine basis is advised.

References

1. Diagnosis and Classification of Diabetes Mellitus, DIABETES CARE, VOLUME 31, SUPPLEMENT 1, JANUARY 2008.
2. Hariri S, Yoon PW, Qureshi N, Valdez R, Scheuner MT, Khoury MJ. Family history of type 2 diabetes: A population-based screening tool for prevention? *Genet Med.* 2006;8:102–8.[PubMed]
3. Sande MV, Walraven GL, Milligan PM, Banya WS, Caesay S, Nyan O, et al. Family history: An opportunity for early interventions and improved control of hypertension, obesity and diabetes. *Bull World Health Organ.* 2001;79:321–8
4. Ohlson LO, Larsson B, Svardsudd K, Welin L, Eriksson H, Wilhelmsen L, et al. The influence of body fat distribution on the incidence of diabetes mellitus. 13.5 years of follow-up in the participants in the

- study of men born in 1913. Diabetes. 1985; 34:1055–8.
5. Helmrich SP, Ragland DR, Leung RW, Paffenbarger RS., Jr Physical activity and reduced occurrence of non-insulin dependent diabetes mellitus. N Engl J Med. 1991; 325:147–52.
 6. Barnett AH, Eff C, Leslie RD, Pyke DA. Diabetes in identical twins.A study of 200 pairs. Diabetologia. 1981;20:87–93
 7. Pierce M, Keen H, Bradley C. Risk of diabetes in offspring of parents with non-insulin dependent diabetes. Diabet Med. 1995; 12:6–13.
 8. Fukumoto S, Martin TJ. Bone as an endocrine organ. Trends Endocrinol metab 2009; 20:230-236
 9. Benigno Linares Segovia, Maximiliano Guti´errez Tinoco, Angeles Izquierdo Arrizon, Juan Manuel Gu´izar Mendoza and Norma Amador Licon. Long Term Consequences for Offspring of Paternal Diabetes and Metabolic Syndrome. Hindawi Publishing Corporation Experimental Diabetes Research Volume 2012, Article ID 684562, 5 pages
 10. Adeela Shahid, Khalid P. Lone, Sadia Saeed, Muhammad Arslan. Male offspring of both diabetic parents have higher insulin resistance and serum leptin levels compared to those with one diabetic parent. HORMONES 2008, 7(4):313-319
 11. Kumiko Hirata, Amudha Kadirvelu, Marco Di Tullio, Shunichi Homma, Anna Maria Choy. Coronary Vasomotor function is abnormal in first degree relatives of patients with type 2 Diabetes. Diabetes Care, Volume 30, number 1, January 2007: 150-153.
 12. Gerich JE (1998) the genetic basis of type 2 diabetes mellitus: impaired insulin secretion versus impaired insulin sensitivity. Endocr Rev 19: 491-503
 13. Steinberger J, Daniels SR; Atherosclerosis, Hypertension, and Obesity in the Young Committee (Council of Cardiovascular Disease in the Young); American Heart Association Diabetes Committee(Council on Nutrition, Physical Activity, et al. (2003) Obesity, insulin resistance, diabetes, and cardiovascular risk in children: an American Heart Association scientific statement from the Atherosclerosis, Hypertension, and Obesity in the Young Committee (Council on Cardiovascular Disease in the Young) and the Diabetes Committee (Council on Nutrition, Physical Activity, and Metabolism).Circulation 107: 1448-1453
 14. Meraj Rahim, Mariam Rahim, Masood Anwar Qureshi, ShaheenSharafat, Zaman Shaikh et al. LIPID Profile and Growth Indicators among Offspring’s of Diabetic Parents in Karachi J Diabetes Metab. 2014; 5:10.