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.
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.  

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 controls. Obesity and body fat distribution, lifestyle, impaired glucose tolerance (IGT), and a family history of type-2 Diabetes Mellitus 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 themselves.

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, whose parents are diabetic.

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 formula.

**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 |
|-----------|-----|------|----------------|-----------|---------------------------------|---------|---------|
| 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 35.227).

(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 | 2.997   | 7.245                | 0.910      | -14.20 | 20.20 |
|          | Group 3 | -7.007  | 9.362                | 0.735      | -29.23 | 15.22 |
|          | Group 3 | 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 parent (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 | Minimun | Maximum |
|----------|----|--------|----------------|------------|--------------------------------|---------|---------|
| HDL      |    |        |                |            | Lower Bound | Upper Bound |         |         |
| 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 | 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 | Group 1 | 1.18852                | 1.09032    | 0.522 | -1.3998 | 3.7768 |
|              | Group 3 | Group 2 | -3.24773               | 1.01438    | 0.005** | -5.6558 | -0.8397 |
|              | Group 2 | 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 |
|---------------|----|-------|----------------|------------|---------------------------------|---------|---------|
| Cholesterol   |    |       |                |            |                                 |         |         |
| Group 1       | 60 | 167.50| 12.729         | 1.643      | 164.21 to 170.79                 | 130     | 194     |
| Group 2       | 38 | 165.53| 17.991         | 2.918      | 159.61 to 171.44                 | 120     | 196     |
| Group 3       | 22 | 175.09| 18.726         | 3.992      | 166.79 to 183.39                 | 141     | 207     |
| Total         | 120| 168.27| 15.942         | 1.455      | 165.39 to 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).

Table No. 7 ANOVA

| Variable      | Sum of Squares | df       | Mean Square | F       | Sig. |
|---------------|----------------|----------|-------------|---------|------|
| Cholesterol   | 1345.175       | 2        | 672.587     | 2.723   | 0.070|
| Between Groups|                |          |             |         |      |
| 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 1   | Group 2   | -1.974                | 3.258      | 0.817| -9.71 | 5.76 |
|                | Group 3   |            | -9.565                | 4.210      | 0.064| -19.56 | 0.43 |
|                | Group 1   | Group 3   | 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 al 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 al also observed significantly low HDL cholesterol in offspring of single diabetic parent compared to non-diabetic parents. Hirata et al also found significantly lower level of HDL cholesterol in first degree relatives of diabetes mellitus. Gerich et al Steinberger et al 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 al 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.

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